Knowledge Co-creation in Design Games

Conversation Analysis of an Interorganizational Design Game Session

Otso Hannula
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Otso Hannula

The public defense on 4th May 2020 at 18:00 (6 p.m.) will be organized via remote technology.

Link: https://aalto.zoom.us/j/147394986


A doctoral dissertation completed for the degree of Doctor of Science (Technology) to be defended, with the permission of the Aalto University School of Science, at a public examination held at the lecture hall TU1 of the school on 4 May 2020 at 18.

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Aalto University publication series
DOCTORAL DISSERTATIONS 55/2020

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ISBN 978-952-60-3824-7 (printed)
ISSN 1799-4934 (printed)
ISSN 1799-4942 (pdf)

Ungrafia Oy
Helsinki 2020

Finland
Abstract

The development of organizations depends on their ability to create knowledge: the capabilities of organizations are tied to the knowledge of individuals and groups, but knowledge in organizations also takes the form of conceptual artefacts, such as the designs of products and services, and the organizations’ ways of working. Prior research has shown that new knowledge is often created at the boundaries between communities-of-practice such as professional disciplines or organizational departments. In knowledge co-creation, especially relevant conceptual artefacts are developed in interaction between members of various communities-of-practice.

However, there is a lack of research on how knowledge co-creation takes place in interpersonal interaction. To address the gap, this thesis brings together literature on knowledge co-creation, conversation analysis and design games. Design games are a methodology originating from participatory design in which knowledge co-creation takes place using a physical game. Knowledge co-creation is defined in this thesis as interaction between people from various communities-of-practice, where an interorganizational relevant conceptual artefact, i.e. an epistemic object, is developed. Development of an epistemic object takes place through distinctions, i.e. verbal statements that define the epistemic object in novel ways.

The empirical case of this thesis is a session where a group of professionals led by a facilitator played the design game ATLAS to create a plan for a joint project between two organizations. The session was recorded, and conversation analysis was applied to study knowledge co-creation at the level of turns-at-talk. The findings of this thesis identified a total of 156 knowledge co-creation sequences, each of which contained offering a distinction about the project plan, which was the epistemic object being developed. Each offer had a response that determined whether the offer resulted in a change in the epistemic object, and thus determined whether new knowledge was created. Based on the responses, the sequences were divided into productive dialogue where new knowledge was co-created, and non-productive dialogue in which knowledge was not co-created.

The results of this thesis 1) show how knowledge co-creation sequences lead to the creation of distinctions in design games, 2) show how a game structure guides the collective creation of distinctions and promotes productive dialogue by providing an overall sequential organization and game goals for the interaction. In addition, this thesis provides a framework for the effects of design games on knowledge co-creation: design games provide physical, social, conceptual and structural support. This work contributes to the literature by providing a model for understanding knowledge co-creation as productive dialogue consisting of individual turns-at-talk that prompt, offer and accept distinctions, and by describing how design games can support the creation of distinctions.

Keywords knowledge co-creation, knowledge creation, distinction, design games, conceptual artefacts, knowledge building, boundary objects, epistemic objects, facilitation, communities-of-practice, conversation analysis, institutional interaction

ISSN (printed) 1799-4934 ISSN (pdf) 1799-4942
Location of publisher Helsinki Location of printing Helsinki Year 2020
Pages 238
Tekijä
Otso Hannula

Väitöskirjan nimi
Tiedon yhteisluomisen muotoilupeleissä: muotoilulapelisession keskustelunanalyysi

Julkaisija
Perustieteiden korkeakoulu

Yksikkö
Tuotantotalouden laitos

Sarja
Aalto University publication series DOCTORAL DISSERTATIONS 55/2020

Tutkimusala
Tuotantotalous

Käsikirjoituksen pvm
21.11.2019

Väitöspäivä
04.05.2020

Väittelyluvan myöntämispäivä
25.03.2020

Kieli
Englanti

Monografia

Artikkeliväitöskirja

Esseeväitöskirja

Tiivistelmä
Organisaatioiden kyky kehittyä perustuu niiden kykyyn luoda uutta tietoa: organisations toiminta on sidottu yksiköiden ja ryhmiin tietämykseen, mutta myös käsittellelliset artefaktit kuten tuotteiden ja palveluiden suunnitelmat sekä organisaatioiden toimintamallit ovat luonteeltaan tietoa. Aikaisempi tutkimus on näyttänyt, että uutta tietoa syntyy erityisesti eri käytäntöyhteisöjen, kuten eri osastojen tai ammattikuntien välisessä vuorovaikutuksessa. Tiedon yhteisluomisessa eri käytäntöyhteisöjen jäseneet vuorovaikututtavat keskenään kehittääkseni yhteistyön kannalta tärkeitä käsittellellisiä artefakteja.

Tiedon yhteisluomisen tutkimus ei kuitenkaan ole toistaiseksi selvittänyt, miten tiedon yhteisluomisen organisatioinen välillä tapahtuu yksilöiden vuorovaikutuksen tasolla. Vastakseen tään tutkimusaukko, tämä väitöskirja tuo yhteen kirjallisuutta tiedon yhteisluomisesta ja keskustelunanalyysistä, sekä tutkimusta muotoilupeleistä. Muotoilulapelit ovat osallistavan muotoilun yhteiskunnalliset menetelmät, jossa tiedon yhteisluominen tapahtuu fyysisen pelin avulla. Tiedon yhteisluominen määritellään tässä työssä eri käytäntöyhteisöihin kuuluvien yksilöiden välisenä vuorovaikutuksena, jossa kehitetään organisaatioiden välisen yhteistyön kannalta merkityksellisiä käsittellellisiä artefakteja eli epistemeisiä objekteja.


Tämän työn tulokset kuvaavat 1) miten tiedon yhteisluomisen jakso jahtavat distinktioiden syntymiseen muotoilulopissa ja 2) miten pelirakeneen, joka koostuu vuorovaikutustilanteen kokonaisarkeenteesta ja pelitavoitteesta, ohjaa distinktioiden luomisen prosessia ja rohkaisee tuottavaan puhetta. Työ luo teoreettisen viitekehyn vuoropulapelien vaihtokeucta tiedon yhteisluomiselle: muotoilupeli tukee tiedon yhteisluomista fyysisesti, sosiaalisesti, käsittellellisti ja rakenteellisesti. Työn tieteellinen kontribuutio on tiedon yhteisluomisen empiirinen kuvaaminen tuottavana vuoropuheluna, jossa distinktoitui luodaan kehotus-, tarjous- ja vastausvuorojen avulla.

Avainsanat
tiedon yhteisluominen, tiedon luominen, distinktiot, muotoilulapelit, käsittellelliset artefaktit, tiedon rakentaminen, rajaelineet, epistemeiset objektit, fasilitointi, käytäntöyhteisöt, keskustelunanalyysi, institucionaalinen vuorovaikutus

ISBN (painettu) 978-952-60-3824-7
ISBN (pdf) 978-952-60-3827-8

ISSN (painettu) 1799-4934
ISSN (pdf) 1799-4942

Julkaisupaikka HelsinkI
Painoppaikka HelsinkI
Vuosi 2020

Sivumäärä 238

Acknowledgements

First, I must thank professor Riitta Smeds for opening the door to my unexpected academic career. My entire scientific output has been the direct result of being offered to do my Master’s thesis on the design game ATLAS in early 2013. I thank Riitta for challenging me to always reach higher, and for trusting my abilities much further than I thought wise.

I thank my wonderful instructors for giving me the tools to create this thesis and holding me together long enough to finish it. I thank Associate professor J. Tuomas Harviainen for seeing the potential in a young researcher with an unorthodox research interest, and for the endless emotional support that this journey has since required. I thank Dr. Antero Hirvensalo for mentoring me into the world of conversation analysis. I also thank Professor Olivier Irrmann for instructing me through the first steps of my graduate studies, and for co-authoring my first journal paper.

I thank my pre-examiners, professor Jacob Buur and professor Kristiina Kumpulainen, for their insightful comments on my work. Both their research has been instrumental for my work, and I was deeply humbled by their kind words about my research. Their feedback helped clarify this work significantly.

I owe my gratitude to the ALTAS project researchers for co-creating ATLAS and for taking me into a truly multidisciplinary research project. I thank especially Päivi Pöyry-Lassila, Anna Salmi and Miia Jaatinen for being my closest academic colleagues, Kirsikka Vaajakallio for writing a foundational dissertation on design games that I could build upon, Jung-Joo Lee, Juha Kronqvist and Tuuli Mattelmäki for introducing me to the world of design, and Mari Holopainen for raising the bar on societal impact.

I am grateful to our wonderful research group, SimLab. I thank Laura Kohonen-Aho for peer support in all aspects of our shared graduate studies and beyond. I thank my fellow Information Networks graduates for sharing my joys and tears: Elina Kosonen, Karoliina Liimatainen, Svante Suominen,
Laura Larmi and Mikko Latva-Käyrä. I also thank Anne Kokkonen, Rita Lavikka, Soile Pohjonen, Marika Nosito, Liina Hongell, Sara Viitala, and Manuel Bacso for being a part of our family.

I thank the Centre of Excellence in Game Culture Studies and the international community they have hosted in their inspiring Tampere seminars for showing that games are a part of human existence worthy of dedicated academic inquiry. I thank especially Jaakko Stenros and Sebastian Deterding for being the worthy idols of a junior academic, and for their interest in my research.

This thesis would not exist without funding from Tekes, the Finnish Funding Agency for Innovation, via the research projects ATLAS – a map for future service co-development and CECO – Creative Ecosystems and Collaborative Operators. Finishing this dissertation was made possible by generous grants from Heikki ja Hilma Honkasen säätiö and the Foundation for Aalto University Science and Technology.

I am grateful to my employer Nitor for financially supporting my dissertation and for providing me with the flexibility that I have required to balance work, dissertation, and some semblance of a social life. I also thank my colleagues, especially Dr. Maarit Laanti and the design team, for continued enthusiasm and emotional support over the years.

I thank my loving circle of academic friends for their support throughout the years. I am forever grateful to Eevert Novius for continuing to show me the great joys of sustained intellectual curiosity. I also thank Merituuli Melkko, Emil Virkki, Vesa Laakso, Aliisa Pietilä, and others for proofreading this dissertation.

I thank my parents Maija and Jorma for their endless interest, encouragement and financial support toward my dissertation. I always knew you would be there for me, no matter how dark things seemed. I thank my siblings Aarni and Onerva for enduring all those dinner conversations that my research ate up.

Finally, I thank Saila for countless days of sparring and proofreading, and for bringing our son Valo into the world. Thank you for being with me on a journey that has now come to an end.

Espoo, March 2020

Otso Hannula
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<td>Knowledge co-creation</td>
<td>The creation and development of conceptual artefacts in interaction between members of several communities-of-practice, such as organizational units of professional specialities.</td>
</tr>
<tr>
<td>Conceptual artefact</td>
<td>An intangible object created by people, such as a model or a scientific theory, that multiple people can have a knowledgeable relationship to and that can be developed further (Bereiter 2002).</td>
</tr>
<tr>
<td>Distinction</td>
<td>A novel claim about a conceptual artefact that, once accepted by at least one other participant of knowledge co-creation, becomes an accepted part of that conceptual artefact (Tsoukas 2009).</td>
</tr>
<tr>
<td>Epistemic object</td>
<td>A conceptual artefact that is the shared object of development in knowledge co-creation (Knorr Cetina 2001).</td>
</tr>
<tr>
<td>Boundary object</td>
<td>A physical artefact that is understandable to members of various communities-of-practice (Carlile 2002).</td>
</tr>
<tr>
<td>Institutional interaction</td>
<td>Interaction taking place within an institutional frame of interaction that gives additional meaning, roles and goals to the interaction (Drew and Heritage 1992).</td>
</tr>
<tr>
<td>Design games</td>
<td>A co-design methodology combining game elements with design goals and methods to support knowledge co-creation (Brandt and Messeter 2004; Vaajakallio and Mattelmäki 2014).</td>
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Statement of originality

The author is the sole creator of this manuscript. No parts of the text or analysis have been published elsewhere.
1 Introduction

1.1 Motivation of the thesis

For organizations to function and succeed, knowledge is everything. The ability of individuals and groups to perform is tied to their knowledge about people, tools and concepts. In a rapidly changing world, the organizations’ continued relevance depends on their ability to create knowledge, i.e. create new products and services, and renew organizations’ ways of working (Damanpour 1991). This has had profound effects in the global economy, where entire professions and organizations now exist to create knowledge in various forms (Blackler 1995).

In organization research, knowledge creation refers to how organizations create and define problems, and actively develop new knowledge to solve them (Nonaka 1994). This thesis studies knowledge co-creation, where knowledge is created in collaboration between organizations and their stakeholders such as customers, suppliers and competitors (Kazadi, Lievens, and Mahr 2016). Organizations with different knowledge can partner up to develop new knowledge beyond the reach of any of the individual organisations (Bathelt, Malmberg, and Maskell 2004). Likewise, organizations collaborate with customers and other stakeholders to innovate by gaining access to knowledge beyond the organisation, especially in product and service development (Kohlbacher 2008; Romero and Molina 2011).

Specifically, this thesis focuses on knowledge co-creation that crosses boundaries of specialization – not just organization – to provide a diversity of knowledge and interests required for successful knowledge co-creation (Alin, Taylor, and Smeds 2011). This type of cross-boundary collaboration between communities-of-practice (Lave and Wenger 1991; Orlikowski 2002), such as specializations, departments and organizations, can provoke new insights as knowledge from various sources and points of view are combined (Carlile 2002; 2004; Bechky 2003).

This thesis studies knowledge co-creation that takes place in knowledge co-creation sessions, where organizational representatives interact with each other (Kohlbacher 2008). These sessions are known in professional vernacular variably as workshops (Rixon 2013), meetings (Ewenstein and Whyte
Introduction

2009, 19), brainstorming sessions (Nielsen 2012), and design labs (Binder and Brandt 2008), among other names. Places where knowledge co-creation takes place are sometimes called “ba” – literally translated to “place” – after Ikujiro Nonaka and Hirotaka Takeuchi (1995). However, “ba” is much wider than any individual session, since ba “is a concept that unifies physical space such as an office space, virtual space such as e-mail, and mental space such as shared ideals” (Nonaka, Toyama, and Konno 2000, 14), whereas this thesis focuses on knowledge co-creation that takes place in physical social interaction.

The tension between the need to co-create knowledge across boundaries, and the challenges in collaborating with people who do not share the same background or assumptions, has created demand for new ways of supporting knowledge co-creation (Romero and Molina 2011; Ramaswamy and Ozcan 2014; Kazadi, Lievens, and Mahr 2016). Previously identified ways of supporting knowledge co-creation include the use of boundary objects (Star and Griesemer 1989; Carlile 2002; 2004), and representing abstract and complex concepts through architectural drawings (Ewenstein and Whyte 2009) and business process visualization (Smeds and Pöyry-Lassila 2011). These methods are often combined with roles and goals designed to support knowledge co-creation, such as dedicated facilitators (Hirvensalo 2015).

Knowledge creation is often presented as a process in which a set of stages results in new organizational capabilities, products or services. Examples include the SECI model (Nonaka and Takeuchi 1995), expansive learning (Engeström 1999a), knowledge-creation steps (von Krogh, Ichijo, and Nonaka 2000) and dialogical model for organizational knowledge creation (Tsoukas 2009). These process models almost universally feature a stage of interaction between experts that results in the creation of a concept or concepts, such as the “conceptualization” phase (Nonaka 1994), “creating a concept” phase (von Krogh, Ichijo, and Nonaka 2000), or “modelling solutions” phase (Engeström 2001). As such, this thesis defines knowledge co-creation as the creation and development of conceptual artefacts in interaction between members of various communities-of-practice. Examples of conceptual artefacts (Bereiter 2002) include experimental and scientific devices (Nicolini, Meginis, and Swan 2012; Knorr Cetina 2001), architectural buildings in the process of becoming (Ewenstein and Whyte 2009; Mondada 2012b), and design concepts (Nonaka, Toyama, and Konno 2000).

While interaction between individual people is seen as a necessary part of knowledge co-creation in the literature, there is an identified gap in understanding how interaction in knowledge co-creation sessions results in new and developed conceptual artefacts. For example, Teppo Felin and William Hesterly (2007) argue that further research is needed on the role of individual knowledge in organizations’ ability to create knowledge, Robert Grant
(1996, 121) suggests that further understanding of knowledge creation requires considering individuals as the primary actors in the creation of knowledge, and Haridimos Tsoukas (1996) argues that interactions between individuals are the basis for all organization-level novelty and coordination.

This thesis sets off from the notion that new knowledge emerges through productive dialogue between individuals (Tsoukas 2009). The literature on knowledge co-creation often emphasizes dialogue between members of different organizations or departments in contexts such as product development (Nonaka & Takeuchi 1995), vehicle engineering (Carlile 2004), machine design and assembly (Bechky 2003), healthcare (Engeström 1999b). However, it is exceedingly difficult to find research in which transcriptions of knowledge co-creation are presented, demonstrating the inability or unwillingness in the extant literature to describe knowledge co-creation as interaction. Instead, narrative accounts based on observation and video tapes are used (e.g. Engeström 1999a).

This thesis follows a growing interest in organization research to address the ability of games and game-like interaction to support knowledge co-creation (Clatworthy 2011; Hannula and Harviainen 2016; Klapztein and Cipolla 2016; van Amstel and Garde 2016) which is a part of the larger research interest towards games in organizations (Vesa et al. 2016; Hamari 2017). Most notably, this thesis builds on the emerging literature on the use of design games created to support knowledge co-creation (Hannula 2014; Hannula, Irrmann, and Smeds 2014; Hannula et al. 2014; Hannula and Harviainen 2016; 2018). Design games are a co-design methodology of combining game elements such as game material, rules and roles with design-driven goals and methods to create a shared understanding of users; to create, test and present design ideas; and to create visions of the future (Brandt and Messeter 2004; Vaajakallio and Mattelmäki 2014). In professional practice, design games have increasingly been used beyond the field of design for various organizational purposes, such as project planning (Hannula and Irrmann 2016) and business model creation (Gudiksen 2015; Ojasalo and Ojasalo 2015).

This thesis approaches design games as tools for supporting knowledge co-creation. Design games are conceptualized as a specific institutional context for knowledge co-creation, meaning that interaction in a design game involves different identities and constraints than other professional conduct. Design games support knowledge co-creation by providing elements from both design practice (e.g. collages and representations) and the cultural understanding of games (e.g. game rules, roles and cards) (Vaajakallio 2012). Within this setting, this thesis sets out to study knowledge co-creation in which conceptual artefacts are developed by playing a design game. The results of this
thesis contribute to understanding knowledge co-creation as interaction taking place in design games.

1.2 Delimitations

This thesis takes a qualitative view into knowledge by defining knowledge as the individual and collective capabilities that enable knowledgeable action in organizations (Polanyi [1966] 2009; Cook and Brown 1999). This view is contrasted with quantitative approaches that focus on knowledge creation as increasing an organization’s knowledge stock (McFadyen and Cannella 2004; Smith, Collins, and Clark 2005). This thesis does not address innovation research, since knowledge creation generally concerns the development of an organization’s capabilities, while innovation is concerned with how these new capabilities may be turned into products and services that have economic value in markets (Popadiuk and Choo 2006). Alternatively, knowledge creation can be seen as the organizational capability that results in innovations (Nonaka and Takeuchi 1995, 3), or innovation itself can be seen as a process of knowledge creation (Peschl and Fundneider 2008).

This thesis studies knowledge co-creation as a constructive process of creating and developing conceptual artefacts (Bereiter and Scardamalia 2014), in contrast to descriptions of knowledge co-creation as a process of transforming practices (e.g. Carlile 2004). The focus of this thesis is on the co-creation of conceptual artefacts, not on transforming the knowledge of participants at the boundary with the assumption that the transformed knowledge of individuals will result in new or improved practices. For example, Pauli Alin (2010) studies interactions that could be interpreted as knowledge co-creation, but focuses on cross-organizational knowledge transformation through the lens of changing the practices of the participants instead of the co-creation of conceptual artefacts. Neither does this thesis analyse knowledge co-creation as a political process involving the participating organizations’ interests and knowledge (Carlile 2002; Hirvensalo 2015).

Additionally, this thesis studies knowledge co-creation in contexts where the participants do not have an established working relationship, and therefore do not form a community-of-practice amongst themselves. For example in expansive learning (Engeström 1987), knowledge creation is conceptualized as a group activity in which an organizational unit develops its everyday work as a form of collective learning. Since the scope of this thesis is in the co-creation of knowledge between people that do not form a stable work community, expansive learning, innovative knowledge communities (Hakkarainen et al. 2010; Pöyry-Lassila 2015), practice-based learning (Kokkonen 2018), and similar community-driven approaches are not included.
1.3 Research problem and objectives

This thesis studies knowledge co-creation as the creation and development of conceptual artefacts in interaction between members of more than one community-of-practice. Knowledge co-creation is studied in the context of playing a design game, conceptualized as a tool for knowledge co-creation. The outcome of knowledge co-creation is the development of conceptual artefacts relevant to all participating organizations.

The research problem of this thesis is: “How can design games support knowledge co-creation?”

The theoretical objective of this thesis is to describe how knowledge co-creation takes place by developing conceptual artefacts in design games and how design games support knowledge co-creation.

The practical objective of this thesis is to provide better understanding of how knowledge is co-created in interaction between organizational representatives and how it can be supported with design games.

1.4 Research approach and method

The research approach of this study is qualitative to address the research problem of how design games can support co-creation. Qualitative research creates holistic understanding about the chosen phenomenon by interpreting diverse data to come to conclusions about human issues. The research process used in qualitative research is emergent, where research questions and even data may change during the research process as the researcher learns more and opportunities to gather additional data are found. The conclusions of qualitative research are always based on the interpretation of the researcher, and as such cannot be completely disconnected from the researcher’s persona and context. (Creswell 2009)

This thesis aims to produce new scientific knowledge by comparing a preliminary theoretical framework to empirical observations and proposing how theories of knowledge co-creation should be expanded to account for discrepancies between the two. This way of reasoning is called theoretical contextualization, a reasoning strategy based on abductive reasoning (Niiniluoto 1999), also known as inference to the best explanation (IBE). In theoretical contextualization, theoretical explanations of the observations are made simultaneously with the creation of new theoretical understanding, meaning that applying and expanding the theoretical framework are a single inseparable activity. In theoretical contextualization, there is no idealized normative research process that could be followed and used to justify the findings of this thesis. Instead, this thesis is based on the understanding that any inductive reasoning is always contingent on the
By grounding this thesis in abductive reasoning, this thesis is placed in the philosophical paradigm of *American Pragmatism*, following the work of Charles Sanders Peirce (1839–1914), William James (1842–1910) and John Dewey (1859–1952). Pragmatism has had an immense effect on organization research, and many of the foundational papers cited in this thesis explicitly call out pragmatism as a driving theoretical underpinning (e.g. Tsoukas 1996; Cook and Brown 1999; Carlile 2004; Nonaka and von Krogh 2009), or are closely aligned with pragmatist thinkers in goals and assumptions (e.g. Bereiter 2002).

The advantages of the theoretical contextualization strategy for this thesis are that it instructs the author to make the inference process transparent, demonstrate that the analysis is authentic to the empirical data, and to conserve theories (Ketokivi and Mantere 2010). The epistemic virtue of contextualization is *explanation*: the claims made in this thesis aim to be *simple, plausible, interesting*, and *novel*. The warrant for theoretical claims is sought by showing that explanations are consistent with the data, making the selection between multiple plausible explanations transparent, and being authentic to the actual research process. (Ketokivi and Mantere 2010) The evaluation of the inference and explanations of this thesis, as well as the potential challenges to the warrants sought in this thesis, are addressed in Section 9.3: Evaluation and limitations.

Figure 1 illustrates the reasoning model of this thesis. New knowledge co-creation theory is proposed as *explanations* for discrepancies between current literature and observations in the empirical data. The *grounds* for new theory consist of the video data of this thesis, and the theoretical framework formed based on the current literature. The *warrant* for the proposed new theory is sought with a theoretical contextualization strategy, meaning that this thesis presents inference and explanation as a single activity in which theoretical concerns, such as the preservation of existing theory, are used to justify a particular explanation over others (Ketokivi and Mantere 2010, 323–25).
Figure 1: The inductive reasoning model of the empirical analysis, adapted from Ketokivi and Mantere (2010).

This thesis contributes to the literature on knowledge co-creation by elaborating the already existing theory. Theory elaboration is an approach to plan and execute empirical research in a way that starts off with an existing theoretical framework and compares it to empirical observations to generate new insight (Fisher and Aguinis 2017, 441). The theory elaboration approach is used in this thesis to differentiate the approach from theory generation studies that create formal and testable research propositions, and theory testing studies are determined by the formal hypotheses or theories being tested (Fisher and Aguinis 2017; Ketokivi and Choi 2014). In this thesis, the theoretical framework being elaborated is knowledge co-creation as interaction, which is compared to the empirical observations from a design game session.

The empirical context for this study is a design game session in which two organizations, an IT service platform supplier and a higher education institution customer, played the design game ATLAS to co-create a project plan, conceptualized as an organizationally relevant conceptual artefact. In addition to the Customer and Supplier representatives, the game session was attended by a student of service design, a market research professional, and a facilitator. The data for this study consists of a video recording of the game session. The empirical context is described in detail in Chapter 6: Data collection and analysis.

The object of analysis in this thesis is the observable interaction between the participants of a design game session, which includes speech, gestures and the use of physical artefacts. The participants of the design game session were oriented to their roles as representatives of different organizations, and therefore their interaction in the design game session was institutional interaction where the participants oriented to their organizational identities. Because the line of argumentation in this thesis is not based on generalizability of inference but on authenticity, this thesis focuses on the detailed analysis of knowledge co-creation taking place in the single session of playing a design game to provide a rich, authentic description of the empirical data. The
results of this thesis are therefore generalizable to theory, not directly to other instances of playing the design game ATLAS or other design games.

Interaction research is uniquely positioned to observe knowledge co-creation since it studies the public interpersonal interaction where we can expect conceptual the development of artefacts to take place. Recent empirical work on knowledge transformation by analysing interaction on the speech act level (Alin 2010) and the conversation analysis of facilitation in the presence of political conflicts in knowledge co-creation sessions (Hirvensalo 2015) has been able to show that specific sequences of interaction lead to the creation of new knowledge. However, these studies have not addressed how new conceptual knowledge is created.

This thesis applies conversation analysis (Sacks, Schegloff, and Jefferson 1974) as a method of interaction research and as a theory of social interaction. Conversation analysis is applied in this thesis as a research method for qualitative analysis of interaction to inform the analysis steps and interpret the data. Compared to speech act theory where each utterance is coded by comparing an emerging theoretical framework with each utterance in isolation (Alin 2010; Alin, Taylor, and Smeds 2011), conversation analysis focuses on collaborative formation of meaning by observing each turn-at-talk in the context of preceding and following talk (Schegloff 2007). More specifically, this thesis draws on the conversation analysis of institutional interaction, interaction that takes place in institutional contexts such as workplaces (Drew and Heritage 1992).

1.5 Structure of the thesis

While the reasoning process behind this thesis is abductive, meaning that the theoretical framework and the observations from the data have been developed concurrently, this thesis is constructed around the classical structure of introduction, theory, method, findings, and conclusions.

Chapter 1 introduces the research motivation and the research problem alongside an overall research approach. Chapters 2 and 3 present literature relevant to the case, which is then used to construct a theoretical framework in Chapter 4. Chapter 5 presents the research questions of the empirical study based on the theoretical framework. Chapter 6 describes the empirical case, the data, the research method and the analysis process used to answer the research questions. Chapter 7 presents the findings of the empirical study and answers the research questions using the theoretical framework. Finally, the research problem is answered in Chapter 8 and the discussion and evaluation of the results are presented in Chapter 9 along with future research directions.
This chapter reviews literature on knowledge co-creation. In this thesis, knowledge is defined as the tool of knowing, and knowledge creation as interaction where shared knowledge is created and developed in the form of organizationally relevant conceptual artefacts such as plans or models. Building on this definition, knowledge co-creation is defined as knowledge creation between members of different communities-of-practice. Boundary objects and epistemic objects are described as two types of objects used to support knowledge co-creation. Finally, distinctions are defined as the way conceptual artefact are developed in knowledge co-creation.

### 2.1 Observable knowledge and knowing

This thesis defines knowledge co-creation as the creation and development of conceptual artefacts in interaction between members to various communities-of-practice. For knowledge co-creation to be studied on the level of interaction, a theory of knowledge must conceptualize and operationalize knowledge in a way that makes knowledge observable in interaction with other people.

The most common use of the word “knowledge” is to describe a person or their mental possessions. Oxford Dictionary defines knowledge as “facts, information, and skills acquired through experience or education; the theoretical or practical understanding of a subject” with examples of use “a thirst for knowledge” and “her considerable knowledge of antiques”.¹ These examples show that a person can be said to have knowledge and be knowledgeable about a subject.

However, an often-overlooked aspect of knowledge and knowledgeableability is that expertise is observed through action, since knowledge as a mental possession is unobservable. Instead, a person is said to have knowledge or be

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knowledgeable because their actions demonstrate knowing when they describe things in detail and interact expertly with tools to reach desired outcomes. Also, the knowledgeability of a person never appears out of thin air or leaps fully formed from the mind of an individual: knowing is practiced and developed over time, and cannot at any point be reduced to possessing facts and rules (Polanyi [1966] 2009).

This thesis addresses knowledge demonstrated through actions, as opposed to the traditional Western definition of knowledge as “a justified true belief” which remains widely used in knowledge creation literature (Nonaka 1994; Nonaka, Toyama, and Konno 2000; von Krogh, Ichijo, and Nonaka 2000; von Krogh and Grand 2000). This thesis aligns with the traditional definition’s criticism, which argues that knowledgeable action is not declarative but adaptive (Cook and Brown 1999) and as such cannot be formulated into beliefs that could then be true or even justified. As such, this thesis aims to develop a theoretical framework for knowledge in interaction in which the postulation of beliefs is unnecessary.

Following researchers of design knowledge (Schön 1983; Cross 2001; 1982), organization researchers Scott Cook and John Brown (1999) propose that knowledge and knowing are two different things that we should approach as two different but mutually compatible epistemologies, i.e. theories of knowledge. The first epistemology, the epistemology of possession, holds that knowledge can be possessed by people and organizations, and although it might be largely intangible, knowledge can in principle be inventoried. Cook and Brown (1999) categorize different types of knowledge along the widely used axes of explicit versus implicit knowledge and individual versus group knowledge (Polanyi [1966] 2009; Nonaka 1994). The resulting four types, shown in Figure 2, are then treated as four distinct and coequal forms of knowledge, each doing work the others cannot (Cook and Brown 1999, 381).

Figure 2: Four forms of knowledge in the epistemology of possession (Cook and Brown 1999).

Cook and Brown (1999) describe the four forms of knowledge as follows. *Explicit individual knowledge* consists of things an individual can know, learn,
and most importantly, express explicitly. This includes, but is not limited to, “concepts, rules, and equations that typically are presented explicitly and are typically known and used by individuals” (Cook and Brown 1999, 391). *Explicit group knowledge* includes things that are expressed and shared explicitly within a group, such as stories of success, or metaphors that have a useful meaning within the group. *Tacit individual knowledge* includes individual abilities that are not expressible explicitly, such as skills, the feel for using certain tools or keeping a bike upright. Finally, *tacit group knowledge* includes the shared ways of interpreting communication and action by the group, which Brown and Cook (1999, 391) refer to as “genres”.

An example Cook and Brown (1999) use to illustrate the explicit/tacit dimension is the ability to ride a bicycle. People who can ride a bicycle possess some of that knowledge explicitly in the form of descriptions – constituting explicit personal knowledge – but cannot fully explicate how they manage to stay upright on the bicycle, how to press the pedals in a continuous motion, and so on – constituting tacit personal knowledge. Both are required, since while a novice can use their explicit knowledge when attempting to ride a bicycle, the explicit knowledge will not suffice alone without acquiring the required tacit knowledge as well.

Similarly, Cook and Brown (1999) describe photocopier technicians as an example where the group knowledge does epistemic work that the individuals cannot do by themselves. Only an individual technician can repair a broken copier machine, but the collective professional group possesses a wider set of explicit knowledge in so-called ‘war stories’ about what odd noises coming from copiers can mean. Individual technicians possess some knowledge but the ‘body of knowledge’ is only held by all the technicians collectively. Similarly, it is only in the context of the wider group that an individual technician can understand how a story told in the break room is interpreted differently from the same story told in a formal training session – constituting tacit knowledge about the genres of communication within the group.

This categorization largely corresponds to the four representations of knowledge proposed by Nonaka (1994), since both feature explicit and individual and group knowledge. However, whereas Nonaka argues that knowledge is created by converting one type of knowledge into another, and that routines and practices of individuals are themselves tacit knowledge (Nonaka and Toyama 2003), Cook and Brown argue that knowledge – even tacit knowledge – is a possession that is *used to know*, and that one type of knowledge can never be turned into another type of knowledge.

Since *knowing* is action and therefore cannot be possessed like knowledge, a second epistemology is required to account for knowing: the *epistemology*
of practice. In the epistemology of practice, knowing is an aspect of individual and group action which both utilizes and contributes to the four types of knowledge described above (Cook and Brown 1999; cf. “knowledge of experience” in Nonaka 1994, 22). In this view, knowledge and knowing are considered separate because of their underlying assumptions: knowledge is a possession of individuals and groups but knowing is action. Figure 3 visualizes the combination of knowledge, something that can be possessed, with knowing, something is known through action, and superimposes knowing as a bridge between the different forms of knowledge.

In the bridging epistemologies, each form of knowledge is seen as “a tool of knowing” where “knowing is an aspect of our interaction with the social and physical world” (Cook and Brown 1999, 381). Knowledge must therefore be seen as “a tool at the service of knowing, not as something that, once possessed, is all that is needed to enable action or practice” (Cook and Brown 1999, 387–88 emphasis in original). The possession of knowledge does not imply that one is able to act on the knowledge – rather, knowledgeable action must be practiced. In the bicycle example, riding the bicycle is the interaction with a physical bicycle that is made possible by explicit and tacit knowledge. For a novice, the act of attempting to ride a bicycle would be the knowing that would allow them to generate the required tacit knowledge for successful bicycle-riding.

This thesis focuses on the creation of knowledge in collaborative interaction between people, which Cook and Brown (1999) describe as generative dance: interaction between individuals and the world in practice that draws on different types of knowledge that creates new knowledge and new ways of

Figure 3: Knowledge and knowing (Cook and Brown 1999).

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2 Cook and Brown (1999) use the phrase “tool of knowing” in referring to how knowledge as a mental possession gives shape and meaning to the world and how a knower uses knowledge when knowing. While using the phrasing “tool for knowing” would be more grammatically accurate, “tool of knowing” is used in this thesis to maintain consistency with sources.
knowing. Cook and Brown (1999) therefore argue that the creation of new knowledge – knowledge creation – consists of action (knowing) that draws upon earlier knowledge and results in both the creation of tools for knowing (possession) and ways of knowing (practice). For example, a dance troupe following a choreographer’s instructions and examples draws upon their individual and group knowledge in trying out the moves, but also generate new tacit group knowledge about performing together, and create new ways of practicing the dance (Cook and Brown 1999).

The generative dance represents a key step in forming a theoretical foundation for knowledge co-creation as the creation of knowledge through collaborative interaction. The generative dance focuses on the generation of new knowledge by placing primary emphasis on interaction as the generative engine of knowledge creation. However, the generative dance is limited in at least two ways as a model of knowledge creation. First, the generative dance offers no insight into how knowledge is created, or what affects, supports or inhibits knowledge creation. Second, the generative dance focuses on a person or a group creating knowledge for themselves and therefore has very little to say about the creation of new concepts that can be used beyond the group that created them.

To build on the ideas presented in the bridging epistemologies, we turn to the second perspective to knowledge and knowing used in this thesis, the work of Carl Bereiter in his book Education and Mind in the Knowledge Age (Bereiter 2002). The starting point of Bereiter’s work is an objection to what he calls the “folk-theory of mind”, describing a commonly held but rarely scrutinized belief that the human mind acts as a “filing cabinet” for knowledge (Bereiter 2002, 135). Instead, Bereiter seeks to establish a sociocultural view that some knowledge can exist beyond individuals in the form of theories and other conceptual artefacts (Bereiter 2002).

Like Cook and Brown (1999), Bereiter (2002) is interested in making knowledge observable in action and taking into account knowledge beyond explicitly expressible facts and rules. To replace the possession-oriented folk-theory of mind, Bereiter (2002) proposes a connectionist metaphor of the mind, where the mind does not contain knowledge, just like it does not contain abilities, attitudes or interests. Instead, knowledge is the relationship between a knowing person and an object of knowing, such as a tool, a person or an idea. This view of relational knowing (referred to by Bereiter as ”connectionism”) emphasizes that knowledge is not a set of rules applied from a mental container but instead knowledge is that which enables a person to make sense of their situation and make intelligent decisions based on prior experience, established routines, and social norms (Bereiter 2002; also in line with Polanyi [1966] 2009; Tsoukas 2003).
Bereiter (2002) argues that a person can be said to have knowledge only in as much as a person can be said to have a taste in art or an appreciation for woodwork – that is to say, to describe someone as having knowledge is an evaluation of their relationship to objects of knowing. If one would say that there is knowledge to possess, knowledge would be a relationship that both enables action and makes itself relevant in action. Figure 4 presents an illustration of knowledge as a relationship (dashed arrow) between a knower and objects of knowing, including physical artefacts such as tools, and people such as customers, colleagues and friends. (Bereiter 2002).

![Figure 4: Knowledge as relationship between a knower and objects of knowing](image.png)

Bereiter (2002, 137–48) illustrates the breadth and variety of knowledge that often gets reduced to descriptions of explicit and tacit knowledge by presenting different kinds of knowledge a person can have as a part of their relationship to an object of knowing:

- **Stateable knowledge** – knowledge that can form statements, such as the knowledge of a student about a historical event.
- **Implicit understanding** – unstatable understanding about the function and behaviour of objects and persons, such as the understanding of a glassblower about glass, or a salesperson’s understanding about a client.
- **Episodic knowledge** – memories of episodes that can be returned to for different purposes, for example the episodic knowledge of a scientific demonstration: the steps taken, the tone of the situation, the attitude of the demonstrator and so on.
- **Impressionistic knowledge** – ability to make intelligent decisions based on emotional responses, such as having an eye for good layout or evaluating the taste of a dish (see also “aesthetic knowledge” in Ewenstein and Whyte 2007).
- **Skill** – sub-cognitive physical actions learned by rote and implemented without recall, such as the use of precision tools or a golf swing.
- **Regulative knowledge** – ability to form and regulate mental routines, such as a writer’s ability to get into a writing flow, but also other components of knowledge that regulate the conduct inquiry, such as truth and objectivity.
For example, a dentist might be able to describe the function and history of their tools (stateable knowledge), but they will also have tacit understanding about when to apply different tools, impressionistic knowledge on whether a tool is in working order, and skill in holding and moving the tools while working. Because many of the categories are close to each other and edge cases can be tricky, Bereiter (2002, 149) notes that “the more fully developed and well-rounded a person’s knowledge is, the more artificial seem the distinctions among its components or aspects. This is universal characteristic of competence and has nothing to do with the particular categories”.

Compared to the four types of knowledge proposed by Cook and Brown (1999), Bereiter’s (2002) categories of knowledge provide further refinement of what kinds of tacit personal knowledge a person might have (tacit understanding, impressionistic knowledge, embodied knowledge and regulative knowledge) in addition to explicit personal knowledge, i.e. “stateable knowledge” (Bereiter 2002, 137). As such, Bereiter’s underlying assumptions are in line with Cook and Brown, with an additional emphasis on the object of knowing. Compared to Cook and Brown’s epistemologies of possession and practice, Bereiter’s point of view combines both knowledge and knowing into a relationship which makes knowing possible. Bereiter also places group knowledge as secondary to individual knowledge, although he writes that research on communities-of-practice and situated cognition can benefit from the relational view of knowledge by taking a critical look at what knowledge is not situated and can be transferred outside of the relations between one community and their material tools (Bereiter 2002, 204–5).

To present a working definition of knowledge in interaction that can account for both knowledge and knowing, this thesis takes the pluralistic view of knowledge as a tool of knowing that exists in coequal forms of explicit, tacit, individual and group knowledge (Cook and Brown 1999). Knowledge is defined as a relationship between a knower and an object of knowing. This relationship acts as the tool of knowing and involves tacit and explicit individual and group knowledge. Knowing is defined as knowledgeable interaction with the world, which draws from and can contribute to multiple types of knowledge.

### 2.2 Developing knowledge as conceptual artefacts

The creation of new products, services, and ways of working is often presented as an activity in which a concept or concepts is created, such as “conceptualization” (Nonaka 1994), “creating a concept” (von Krogh, Ichijo, and Nonaka 2000) or “modelling solutions” (Engeström 2001). Similarly, several descriptions of knowledge creation practices emphasize the role of conceptual or abstract objects that are developed in knowledge creation (e.g.
Knorr Cetina 2001; Miettinen and Virkkunen 2005; Ewenstein and Whyte 2009).

Against the aforementioned background, this section is largely based on a single monograph by Bereiter, *Mind Education in the Knowledge Age* (Bereiter 2002), because it provides the most detailed description of the interaction in which conceptual artefacts are created based on earlier knowledge. Bereiter’s work has been noticed as a contribution to knowledge creation literature (Paavola, Lipponen, and Hakkarainen 2004), but most of the later work utilizing conceptual artefacts and knowledge building has so far remained in computer-supported collaborative learning research which is not addressed in this thesis. This thesis takes Bereiter (2002) as the main source which is complemented by other authors presenting similar ideas about the role of conceptual knowledge.

Bereiter (2002, 62–64) describes knowledge work using the example of a research organization that carries out polls and interviews about the opinions of the public, utilizing knowledge about the world to create their reports. As a result, two kinds of knowledge are created. First, the knowledge of the organization and the individual working there is expanded as they become better at researching and compiling reports, but this knowledge cannot be separated from the work and workers themselves and cannot be sold at a market. A second type of knowledge is created in the form of reports that are used elsewhere are considered valuable as intellectual property.

To solve this conceptual challenge, Bereiter (2002) proposes that knowledge workers engage in knowledge creation which he calls knowledge building. Knowledge creation as knowledge building can be thought of as analogous to the work craftsmen do when they refine materials using specific tools and techniques to produce physical artefacts. By analogy, knowledge workers work with knowledge to create and develop conceptual artefacts such as models, theories and forecasts. Conceptual artefacts do not just appear like individual thoughts – they are crafted and developed over time through work. A conceptual artefact, such as a model, has qualities of its own that are separate from how it is viewed by any one person, and as such can be used by the people receiving the products of a knowledge worker. A great model may be understood poorly and a person may have false beliefs about the model, but the model itself should be considered as an independent object. (Bereiter 2002, 64–68).

When considered from a relational knowing standpoint, conceptual artefacts form a distinct group of knowable objects in addition to people and physical artefacts. Bereiter (2002) argues that to appreciate how conceptual artefacts differ from other knowable things one has to consider Carl Popper’s (1972) epistemology of three worlds: World 1 of physical objects, World 2 of mental states and World 3 of concepts and ideas (Bereiter 2002,
Knowledge co-creation

68–71). For now, let us consider the three worlds epistemology in the case of a single knowing person.

- World 1 consists of the physical artefacts such as natural objects, human-made artefacts and increasingly complicated information systems and infrastructures. In the context of this thesis, relationships of people towards objects in World 1 are characterized as tools, and changes in World 1 are the result of physical interactions. (Bereiter 2002).
- World 2 consists of social actors. The relationships to objects in World 2 are relationships between people: friends, colleagues, customers, patients, and so on. Changes in World 2 are learning, as people’s opinions and understanding changes. (Bereiter 2002).
- World 3 consists of conceptual artefacts. An important feature of conceptual artefacts is that they are shared, like a recipe or a joke, and that even though someone might express a recipe or joke using different words or remember parts of it, individuals still have a relationship to the same conceptual artefact. Changes in World 3 are knowledge creation. (Bereiter 2002).

The idea of conceptual artefacts helps frame ideas and concepts as something that can be discussed, altered and improved upon, and Bereiter (2002) argues that they should be taken as existing independent\(^3\) of any person holding them. This naturalization, Bereiter argues, enables a more nuanced view about knowledge as understanding, and especially as the understanding of conceptual artefacts such as Newton’s laws of physics. (Bereiter 2002). More importantly for this thesis, conceptual artefacts form the category of objects that are developed in knowledge co-creation.

Thinking about conceptual artefacts (Bereiter 2002) improves the bridging epistemologies (Cook and Brown 1999) by highlighting that some things that at first appear as explicit individual knowledge, e.g. concepts, rules and equations, are not reducible to stateable knowledge. When these conceptual artefacts are no longer considered personal knowledge but instead objects of knowing in their own right, the bridging epistemologies allow for there to be explicit and tacit, individual and group knowledge about conceptual artefacts.

\(^3\) It should be noted that the idea of seeing conceptual artefacts as independent from any one person should not be taken literally to imply a Platonic level of existence where conceptual artefacts would live on in the absence of the entire human species. Rather, the point is that when discussing a conceptual artefact, such as a recipe or equation, it cannot be tracked down to a single person within whom the conceptual artefact exists, just like it a recipe is not located at a single place when it is written down.
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artefacts, such as stateable knowledge, implicit understanding, impressionistic knowledge, embodied knowledge and regulative knowledge (Bereiter 2002, 137).

Figure 5 presents a visualization of Bereiter’s (2002) theory of relational knowledge created by the author of this thesis for visualizing knowledge. Figure 5 depicts the knowledge of an actor (in the middle) as relationships to physical artefacts in World 1, to social actors in World 2 and to conceptual artefacts in World 3. Each arrow represents knowledge as a relationship: social actors are knowledgeable about the objects of their knowing, i.e. their physical artefacts, other social actors, and conceptual artefacts.

Figure 5: Knowledge as a relationship between a knower and a set of physical artefacts, social actors, and conceptual artefacts.

The categorization visualized in Figure 5 helps identify the objects of knowing, places conceptual artefacts alongside other objects of knowing, and creates a clear parallel between the creation of artefacts in the physical and conceptual worlds. Each arrow in the visualization implies both knowledge and knowing (Cook and Brown 1999), as each relationship is laden with explicit, tacit, individual and group knowledge that a person uses as tools of knowing when they interact with that object. In the figure, learning is the development of knowledge about objects of knowing, and knowledge creation is the creation of and development of conceptual artefacts in World 3. Knowledge creation can lead to learning but the two are separate: “Learning is personal (World 2); knowledge-building is public (World 3).” (Goodyear and Zenios 2007, 359)

This thesis defines knowledge creation as the interaction where development of organizationally relevant conceptual artefacts. Conceptual artefacts provide theoretical constructs for describing the results of knowledge co-creation not as collaborative learning or transformed practices, but as a co-creative activity that results in conceptual artefacts that are independent
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from their creators. Bereiter’s (2002) model of three worlds provides a new way of describing different kinds of knowledge and allows for articulation about the knowledge that is the source of knowledge co-creation (knowledge about various objects of knowing) and the knowledge that is created in knowledge co-creation (new and developed conceptual artefacts).

2.3 Practice knowledge and communities-of-practice

Practice theory, also referred to as practice-based standpoint (Brown and Duguid 1991), practice-based approach (Carlile 2002) and practice lens (Orlikowski 2000), describes the social mechanisms of producing and organizing socially accepted knowledge and ways of knowing in a field, and how individuals become knowledgeable in a field by participating in a community-of-practice. This thesis draws from the literature on communities-of-practice (Lave and Wenger 1991; Brown and Duguid 2001) for two motivations. First, practice theory provides an understanding of how knowledge and knowing of individuals originates from membership in professions, departments, and disciplines. Second, communities-of-practice provide a theoretical foundation for the differences in knowledge that arise from different organizational backgrounds.

In practice theory, emphasis is placed on the stable but continuously evolving ways of working in communities rather than on the individual and the cognitive origins of competence (Brown and Duguid 1991). For example, the collective knowledge on how to repair photocopiers does not exist anywhere among a team of repairmen, but instead a practice of how to repair photocopiers exists in the routines, attitudes and assumptions of the members of the community. As new people learn to repair photocopiers by being instructed and by working alongside more experienced repairmen, they become members in that community-of-practice. (Lave and Wenger 1991). However, as this thesis focuses on how individuals participating in knowledge co-creation draw from their different practices, learning within one community is not addressed in this thesis.

Practice knowledge is localized, embedded, and invested in practice. This means that the knowledge of practitioners is localized around problems that are typically addressed in their practice; their ability to solve problems is embedded in methods, tools and rules of thumb used in the practice; and their practice has been developed further based on successful application of practice knowledge that previous successes had been built on, which makes practitioners invested in the practice. All three characteristics have significant benefits for practitioners: when using their practice knowledge, a practitioner is able to understand a problem they are facing from the perspective of their practice, draw from the knowledge embedded in the tools of their
practice, and contribute to their evolving practice by successfully using it. (Carlile 2002)

One of the professional groups described by Carlile (2002) is the design engineering department at an automobile fuel valve manufacturer. The practice knowledge involved in the design engineering practice is localized around producing prototypes according to specifications negotiated by the sales team together with the car manufacturers and the company’s own upper management. The knowledge is embedded in the tools and materials used by the design engineers, such as sketches, prototypes, epoxy tools, technical drawing systems and testing equipment. The design engineers are invested in their practice knowledge. They have to understand and agree with the benefits of changing the production process if this affects their already functioning ways of working.

Figure 6 presents a model of practice knowledge proposed by the author. It is based on Bereiter’s (2002) model of three worlds, but introduces multiple knowing practitioners. Each person’s practice knowledge consists of relationships to tools, other people and conceptual artefacts within the domain of the community-of-practice. For example, a practitioner’s knowledge regarding a tool is a relationship between the practitioner and that tool: the total a sum of all the experience, impressions, declarative information and so on that the practitioner has had about that tool as a member of the community-of-practice. A similar relationship exists between individuals and other people within that practice, and the conceptual artefacts in the practice. However, each practitioner in a community-of-practice has their own relationship to each object of knowing, and as such there are differences in their knowledge even though they originate from the same practice.

![Figure 6: Practice knowledge as relational knowledge.](image-url)
To explain Figure 6 using a practical example of a researcher, World 1 refers to the material tools and infrastructure that makes performance possible: computers, software, and buildings (Orlikowski 2006). World 2 refers to the world of social actors including colleagues, students and friends. World 3 refers to conceptual artefacts including all the different theories that are in the realm of that community-of-practice but also shared ideas how the research group is and ought to be organized, different research projects they work on and so on. The relationships between a tool in World 1 or a theory in World 3 (i.e. objects of knowing) and the researchers (i.e. knowers) is not identical: even though the knowledge is organized within the same practice, one researcher might have a tacit understanding of the application of the theory while another researcher might be more familiar with the stateable details and history of the same theory. The relationship of different practitioners to a shared object of knowing can be different even though they are members of the same community-of-practice: some practitioners have more knowledge of one kind while other members have different kinds of knowledge related to shared objects of knowing.

Two things bear to be reiterated: First, Figure 6 presents one practice and its components; each practitioner is also a member of other communities-of-practice and is knowledgeable about tools and conceptual artefacts that are not in the domain of this one single practice. Second, when knowing in action, each practitioner will draw on the relationships to all relevant tools, actors and conceptual artefacts: Figure 6 represents all the knowledge the practitioners can draw upon when acting within the domain of the community-of-practice, e.g. when acting as researchers. This is exemplified by Cook and Brown as they describe the relationship between a physician and the practice of nephrology: “while only individual physicians know how to diagnose nephritis using palpation (groups do not have hands), the knowledge of what constitutes acceptable and unacceptable practice in nephrology is possessed by nephrologists as a group” (Cook and Brown 1999, 386). Practice is therefore the active knowing of the practitioner made possible by the membership in the living community-of-practice.

In summary, the key qualities of practice knowledge are that a practice is a way of organizing knowledge in the context of a domain, that practices are social, and that knowledge signifies membership in a community-of-practice such as a profession or an organization that is knowledgeable about a domain. As members of communities-of-practice, individuals are knowledgeable about objects in their domain through their practices.
2.4 Interorganizational knowledge creation

In this thesis, knowledge creation is defined as interaction in which organizationally relevant conceptual artefacts are created and developed. Similarly, knowledge co-creation is defined as knowledge creation taking place between members of different communities-of-practice acting as representatives of their respective organizations. Conceptual artefacts developed in knowledge co-creation are thus not only organizationally relevant, but interorganizationally relevant, i.e. relevant to all the organizations represented by the participants.

Knowledge co-creation is rife with conflicts of interest and lack of common ground arising from differences in background knowledge (Carlile 2002, 2004). Examples of knowledge co-creation include collaboration between members of different organizational units, departments and organizations, including multidisciplinary teams consisting of people with different organizational backgrounds (Carlile 2002). However, overcoming the challenges involved in crossing boundaries is motivated by innovation: creating marketable innovations often involves building coherent systems of complementary knowledge that is available in different functions and professional groups within formal organizations (Brown and Duguid 2001). As the available knowledge increases globally, more areas of specialization are required to push the envelope and create better solutions.

According to Paul Carlile (2002), communication at the boundary of communities-of-practice needs to cross knowledge boundaries which form “both a source of and a barrier to innovation” (Carlile 2002, 442). Cross-boundary collaboration is fraught with challenges that arise from different vocabularies, meanings and underlying assumptions which organizations have to overcome since these challenges “are not only a critical challenge, but a perpetual necessity because much of what organizations produce has a foundation in the specialization of different kinds of knowledge” (Carlile 2002, 442).

Carlile (2004) describes knowledge boundaries as having varying relative complexity consisting of difference, dependence, and novelty. Difference in knowledge means that the collaborators have diverse levels and fields of expertise, with the implication that each field has different practices that they are invested in. As the difference between practices increases, so does the effort needed to share and assess each other’s knowledge. Dependence refers to how dependent collaborators are on their cross-boundary collaborators – for example, car engine design and chassis design are distinct fields but are highly dependent on each other as decisions made in one affect the other. As the number and impact of dependencies across the boundary increases, the complexity and the amount of effort needed to share and assess
knowledge at a boundary also increases. Novelty refers to the how novel the circumstances of collaboration are to the collaborators. Novelty decreases the amount of common knowledge between the collaborators, for example because of new customer needs, technology, or collaborators. As a result it becomes harder for the collaborators to effectively use common knowledge to represent all the differences and dependencies involved in the collaboration (Carlile 2004, 557).

In addition to the relative complexity of knowledge boundaries, Carlile (2002) proposes that there are three levels of knowledge boundaries related to communication: syntactic, semantic and pragmatic boundaries. Syntactic boundaries are a result of lacking a shared vocabulary which results in individuals not being able to share their knowledge or access the other party’s knowledge. Semantic boundaries are boundaries created by different meanings or interpretations of shared words. Semantic boundaries highlight the importance of conveying meaning in cross-boundary collaboration. Pragmatic boundaries are created by the consequences of accepting knowledge from outside one’s own community of practice. (Carlile 2002).

While overcoming challenges in syntax and semantics are far from trivial, the challenges of pragmatic knowledge boundaries provide a window to why collaboration across knowledge boundaries is both challenging and rewarding. When overcoming pragmatic knowledge boundaries so that new ways of working may be implemented, practice knowledge must be given up or renegotiated, including the goals and what is “at stake” in the practice, such as fulfilling domain-specific requirements. (Carlile 2002). This process of knowledge transformation often involves a political aspect where one department or professional group is at a stronger position to negotiate how their current practices will be changed (Carlile 2004; Hirvensalo 2015). Although this thesis does not address how practices are changed, as in Carlile’s (2002; 2004) research, the political dimensions may still affect the development of conceptual artefacts as participants may be unequal position to affect the outcome of knowledge co-creation.

Successful collaboration across practice boundaries requires that knowledge expressed by members of one community-of-practice is made relevant for the other participants: “an individual’s understanding of the product, process, or organization [is] expanded, not merely by the introduction of new knowledge, but by placing that knowledge within her own locus of practice in such a way that it enhances the individual’s understanding of her work world, enabling her to see that world in a new light” (Becky 2003, 321). Negotiation between individuals at the boundaries of communities-of-practice enables figuring out new ways of working instead of solidifying into progressively more isolated compartments (Brown and Duguid 2001). Different communities-of-practice can even drive each other to reconsider
their underlying assumptions through coordinated collaboration at the community level (Brown and Duguid 2001).

Based on the cited literature, Figure 7 presents a model of knowledge in knowledge co-creation created by the author. Two communities-of-practice, Practice A and Practice B, are shown in orange and blue respectively. In each relationship, shown as a bidirectional arrow, knowledge dynamically affords perceiving the object of knowing based on one’s own practices, meaning that Participant A perceives Participant B based on their background knowledge and vice versa. In addition to the relational knowledge, each practice involves knowledge in the form of conceptual artefacts specific to the practice.

![Figure 7: Knowledge at the boundary between two communities-of-practice.](image-url)

In Figure 7, Participant A and Participant B are members of different communities-of-practice, visualized using orange and blue colours. At the boundary, the participants are knowledgeable about each other, represented as an orange arrow for the knowledge of Participant A about Participant B, and blue arrow for the knowledge of Participant B about Participant A. Each participant’s knowledge is based on the domain of their respective practices, represented by the conceptual artefacts, social actors and physical artefacts in their colour.

In this thesis, the differences in knowledge between members of various communities-of-practice are both opportunities and challenges for knowledge co-creation. In knowledge co-creation, participants can gain new insight by placing the other participants’ knowledge in the context of their
own knowledge. However, this contextualization requires effort in overcoming both differences in vocabulary and the meaning of words, and the political will to negotiate and compromise over existing knowledge.

2.5 Boundary objects

Interest in objects in organization research refers to the role of non-humans in organizational life. Current literature provides alternative ways of viewing these objects using different categories and axis of differentiating between objects and their roles in organizations. The most prominent ones embrace pluralistic notions that combine different kinds of objects originally described as features of specific types of activities (Nicolini, Mengis, and Swan 2012; Ewenstein and Whyte 2009).

In this thesis, objects relevant to knowledge co-creation are primarily categorized as either physical artefacts or conceptual artefacts to differentiate the type of interaction people have with the objects. Following Boris Ewenstein and Jennifer Whyte (2009), this thesis describes two roles that artefacts can be used in: boundary objects and epistemic objects. Conceptual artefacts and physical artefacts are seen as synonymous with abstract and concrete objects of Ewenstein and Whyte (2009).

One of the most influential descriptions of the role of objects in knowledge co-creation is boundary object, objects that support interaction between communities-of-practice. Multiple authors have proposed that boundary objects support the creation of new knowledge in collaboration between professional groups (Star and Griesemer 1989), across organizational functions (Carlile 2002), domains (Carlile 2004), occupational communities (Bechky 2003), and other communities-of-practice (Brown and Duguid 2001).

Boundary objects were originally introduced by Leigh Star (1988) to refer to an object that people act toward or with, which is used at the shared space between communities-of-practice (Star 2010). According to Star (2010), The word boundary refers to “a shared space, where exactly that sense of here and there are confounded” (Star 2010, 602–3), where the boundary object is used to identify the boundary between two groups by being of both worlds. The word object refers to “something people ... act toward and with. Its materiality derives from action, not from a sense of prefabricated stuff or ‘thing’-ness” (Star 2010, 603). A boundary object can be “abstract or concrete” (Star and Griesemer 1989, 393): for example, a theory is abstract but may be embodied, voiced, printed, and named even if it is not physically present like “a car that sits on four wheels” (Star 2010, 603). On the other
hand, the physical terrain of an area is very concrete in the sense that it exists out in the world, but it can also be accessed via representations such as maps.

According to Star (2010), the use of a boundary object is defined by three components related to their use: their interpretive flexibility, their ability to fulfil the work and information needs of different groups, and their ability to dynamically move between ill-structured and more tailored uses. Boundary objects have interpretive flexibility, meaning that boundary objects are defined by their use by two or more communities-of-practice (Star 2010). For example, a map of an area serves different purposes for diverse groups: hikers can use a trail map to find places of recreation, while a group of geologists might use the same map to catalogue mineral deposits. In such a case, the map can be used as a suitably ill-structured object that can sustain collaboration between the hikers and the geologists (Star and Griesemer 1989).

Through interpretive flexibility, boundary objects can fulfil the work and information needs of different groups, meaning that groups are able to achieve their own goals by collaborating with the other groups. Effective boundary objects allow different groups to work together without consensus (Star 2010, 602). The study of boundary objects shows “how practices structure, and language emerge, for doing things together” in the collaboration between diverse groups (Star 2010, 602).

By being both flexible and meaningful for multiple groups, boundary objects dynamically move between ill-structured and more tailored uses through a process in which the boundary object is worked. First, the boundary object exists between communities-of-practice, providing opportunities for communication and alignment. Second, members of each community-of-practice work on the boundary object, keeping the flexible nature of the boundary object while making it more relevant for use within their community-of-practice, i.e. useful for work that is not interdisciplinary. Third, communities-of-practice that are cooperating without consensus move back-and-forth between the first, shared, and the second, local, form of the boundary object. (Star 2010).

It is interesting to note that Star specifically includes the work-play continuum in defining work requirements: “‘Work’ is also a word that stretches, and should, to include cooperation around serious play endeavours such as skiing, surfing, and hiking” (Star 2010, 603), highlighting the fact that practices and communities-of-practice exist in all areas of life.
Since its conception, the concept of boundary object has been more tightly defined after Carlile (2002) proposed that boundary objects are used in coordinating across communities-of-practice. Based on his empirical research on new product development, Carlile (2002) lists categories of boundary objects based on their use in crossing a knowledge boundary: “repositories” are used for representing, “standardized forms and methods” are used for representing and learning, and “objects, models and maps” are used for representing, learning and transforming knowledge (Carlile 2002, 453). According to Carlile, the growing challenge in knowledge co-creation is not just in knowledge processing capacity, but also in the representational capacity of knowledge at a boundary (Carlile 2002, 454).

Carlile (2002) describes workers at the automobile fuel valve manufacturer collaborating between design engineering, manufacturing engineering and production work departments on a new complex type of valve. Each department has their own objects of daily work and their departmental ends they are trying to reach, so convincing them all that the whole production process would have to be changed to create this new type of valve was difficult. A breakthrough was reached when instead of a two-dimensional drawing, a mechanical engineer was able to show the problems of assembling the current valve design using a three-dimensional model that better represented the specifications, tolerances and locations of critical sealing surfaces that design engineering cared strongly about.

Based on this use-based definition, Carlile (2002) proposes that boundary objects support boundary-crossing knowledge creation based on their usefulness at a specific knowledge boundary, arguing that “paradoxically, a method or object that worked as a boundary object in one setting can become a boundary roadblock when taken to another setting.” (Carlile 2002, 451) Based on his observations, Carlile (2002) proposes that effective boundary objects have three characteristics that make them useful in joint problem solving at a given boundary, with each characteristic building on the previous one, for crossing the consecutive syntactic, semantic, and pragmatic boundaries of knowledge creation.

1. **Establishing a shared syntax or language for individuals to represent their knowledge at a boundary.** This means that boundary objects provide a shared terminology that can be used by all parties to correctly “search and store knowledge” (Carlile 2002, 451) across the syntactical boundary.

2. **Providing a concrete means for individuals to specify and learn about their differences and dependencies at a given boundary.** By interacting through the boundary object and tying concepts to it, collaborators reach shared meanings that are meaningful for all parties. The con-
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text of use determines the adequate level of concreteness of boundary objects that can bridge over the semantic boundaries for the creation of shared meanings: an engineering problem might require the presence of a physical component or machine, whereas a process map may be concrete enough for coordinating collaboration between two organizations (Carlile 2002, 451).

3. **Facilitating a process where individuals can jointly transform their knowledge at the pragmatic boundary.** To overcome the costs related to changing or giving up their earlier practice-based knowledge, participants can together alter, negotiate or change the boundary object, even if they rarely negotiate on equal terms (Star and Griesemer 1989). This knowledge co-creation at the pragmatic knowledge boundary requires that the participants to call into question their preconceived way of operating and propose new ways of working that accommodate requests made by the other parties (Hirvensalo 2015). An effective boundary object can be changed in a process of both applying knowledge and transforming current knowledge used at the boundary.

Carlile (2002) also argues that a boundary object must serve both practical and political purposes. The practical purpose of the boundary object is to set up a shared syntax or shared means for coming to an agreement on the meanings of shared language. The political purpose is helping a process of transforming current knowledge that local, embedded, and invested in practice. To resolve the tension between current ways of working that the participants are invested in, and the new perspectives that have arisen, new ways of working must be negotiated resulting in the creation of new knowledge. (Carlile 2002).

Carlile’s work has been commented by Ewenstein and Whyte (2009) on two topics: the role of knowledge boundaries, and the physicality of boundary objects. First, Ewenstein and Whyte (2009) argue that Carlile makes an undue assumption in that knowledge boundaries coincide with organizational boundaries. Whereas this might be true for new product development where professional disciplines are organized into different organizational units, Ewenstein and Whyte (2009) contrast this with their own research of an early phase construction project, where the architects, structural engineers and building services engineers engaged in shared practices involving diverse knowledge sets but no clear knowledge boundaries between participants. As such, they argue that boundary objects can serve coordination needs in what they call “trans-epistemic practices” where the work involves “diverse knowledge sets” (Ewenstein and Whyte 2009, 11).

In these settings, boundary objects are relatively stable sets physical artefacts with ‘co-incident boundaries’ (Star and Griesemer 1989: 392) such as
visual representations of a building that combine the professional perspectives of architects, structural engineers, and environmental engineers. In the trans-epistemic community, these boundary objects were used to elicit and integrate input from various stakeholders by revealing gaps, problems, or uncertainties to be resolved by specific actors or by directly inviting members of another epistemic community to contribute their knowledge. (Ewenstein and Whyte 2009).

Second, Ewenstein and Whyte (2009) highlight that Carlile’s examples are artefacts of one kind or another, i.e. they are the products of human action, but the only thing in common they have is that they provide an “infrastructure or process” for the transformation of knowledge into new shared knowledge at the boundary (Carlile 2002, 453). However, Ewenstein and Whyte (2009) also state that compared to Star and Griesemer (1989), Carlile (2002; 2004) sees both the objects and the boundaries as more concrete (i.e. physical) stable, objectified and reified. “Despite the mutability of boundary objects in relation to interpretations in the contexts of their use, there is no sense of unfolding or sequences of evolving representations.” (Ewenstein and Whyte 2009, 19)

Whereas Carlile (2002) defines boundary objects based on their use without taking a stance on whether they are physical or conceptual, Beth Bechky (2003) presents how “tangible definitions could serve as boundary objects” by describing the way physical machines and machine parts were used to communicate across engineers, technicians and assemblers. In Bechky’s (2003) case, boundary objects are limited to physical artefacts used in overcoming communication problems arising from the lack of shared background knowledge. Similar conceptualization of boundary object is used by Mark Bergman, Kalle Lyytinen and Gloria Mark (2007) to describe the capability of charts and project plans to promote shared representation, the capability to transform design knowledge, the capability to mobilize for design action, and the capability to legitimize design knowledge” (Bergman, Lyytinen, and Mark 2007, 562).

Based on this varied and often contradictory literature, this thesis defines boundary objects as physical artefacts meaningful for participants from various communities-of-practice that are used to represent knowledge and create a shared language. Boundary objects are characterized by their interpretive flexibility and ability to represent knowledge across communities-of-practice. Figure 8 illustrates the role of boundary objects in the theoretical framework.
In Figure 8, boundary objects are physical artefacts that both participants are knowledgeable about despite being members of different communities-of-practice. The asymmetrical knowledge about the boundary objects is represented by orange and blue arrows, respectively. The conditions for categorizing a physical artefact as a boundary object are that it is 1) physically present in knowledge co-creation, 2) relevant to all participants, and 3) used to represent knowledge and/or create a shared language across boundaries.

Because all participants are knowledgeable about boundary objects, they can be used to represent practice knowledge (visualized as coloured arrows in Figure 8) across the boundary. For example, boundary objects can be used to describe the use of other physical objects in a participant’s practice (representing spatial-temporal and processual knowledge of the assemblers through machine parts, in Bechky 2003, 318), or describing knowledge about a conceptual artefact relevant to a participant’s practice (describing the functionality of a “snap fit design” through assembly drawings, in Carlile 2002, 450).

2.6 Epistemic objects

*Epistemic objects* are conceptual artefacts that hold a central position in many forms of inquiry such as scientific research (Rheinberger 1997; Knorr Cetina 1999), conceptual design (Ewenstein and Whyte 2009) and organizational change (Miettinen and Virkkunen 2005). Epistemic objects motivate inquiry with their incompleteness, and inquiry is organised around epistemic objects in the process of becoming (Knorr Cetina 2001). Because of their incompleteness, epistemic objects are often overarching and future tense,
such as a building being designed (Ewenstein and Whyte 2009). In this thesis, many aspects of epistemic objects, such as abstractness and development through inquiry, have been combined to the idea of conceptual artefacts but epistemic object is still used as a separate concept to refer to the role some conceptual artefacts have in motivating knowledge co-creation.

The concept of epistemic object originates from Hans-Jörg Rheinberger (1997). In scientific research, epistemic objects are the subjects of research such as the concept of a molecule or a production system, and research is a process of modifying and developing the epistemic object (Rheinberger 1997). For Rheinberger (2005), an important part of science is making some objects epistemic, placing them at the centre of inquiry, while other objects are reduced to technical objects that are assumed to be stable and known.

Epistemic objects sustain attention by inspiring a desire to know more about them (Knorr Cetina 1997; 1999). Karin Knorr Cetina (1999; 2001) describes the relationship between the subject and the object as a desire to know more, and to complete that which is lacking. The epistemic object becomes like an actor that entices the subject to know more (Ewenstein and Whyte 2009). In a social setting, pursuing a shared object of desire drives collaboration by providing an object of desire or some other shared goal, and collaboration around epistemic objects is well captured in the description “collaboration as the organization of desire” (Nicolini, Mengis, and Swan 2012, 618). The existence of an epistemic objects can even affect the relationships between collaborators, creating a sense of responsibility towards the epistemic object resulting in a proto-community, colleagueship or a similar feeling of playing on the same team (Knorr Cetina 1999).

Nicolini et al. (2012) describe a project in which a cross-disciplinary group of scientists were attempting to develop a ‘bioreactor’, introducing engineering principles into the culture of stem cells. Various groups from electrical engineers to molecular biologists collaborated around the bioreactor to get it working, while also conducting their own disciplinary research around the reactor. This sense of community therefore provided a strong enough sense of belonging that collaborators would engage in knowledge transfer beyond the boundaries communities-of-practice (Nicolini, Mengis, and Swan 2012).

Finally, epistemic objects change over time, forever evolving and unfolding over time. Their value and desirability are rooted in their “lack in completeness of being” and their “capacity to unfold indefinitely” (Knorr Cetina 2001: 181). Pursuing avenues of inquiry to complete epistemic objects satisfies some questions but also creates new ones as knowledge about the epistemic object increases. Epistemic objects cannot yet be pointed at, and once inquiry progresses to the point where the incompleteness of epistemic objects is fulfilled, they cease to functions as epistemic objects (Rheinberger
“If we could point at them, they would already have lost their urgent and essential epistemic value to us.” (Rheinberger 2005, 407)

According to Rheinberger (2005), there are two possible resolutions to the essential tension of incompleteness in epistemic objects. One alternative is that the epistemic object is transformed into a technical object when the object is known, all the questions raised by it have been satisfied, and the object is no longer problematic for the participants. The experimental setup described by Rheinberger (1997) involves known technical objects, such as measurement instruments, and an epistemic object, which is the object of inquiry. Technical objects are assumed to function in a predefined way to see the behaviours of the epistemic parts of the system, so that new qualities can be discovered about them. However, the alternative result of resolving the tension of incompleteness is that the presumed solution itself becomes a problem and thus another epistemic object. As a result, scientific work can be said to turn epistemic objects into technical objects – or discover new epistemic objects for further inquiry. (Rheinberger 2005)

Ewenstein and Whyte (2009) apply the ideas of epistemic and technical objects to the use of visual representations in architectural design. They emphasize the transition from epistemic to technical object as a shift from open to closed, and unstable to stable. They remark that Carlile’s (2002) empirical data also features these transitions, such as the quote “tidiness is an insulting disguise to all of the late nights, pain and frustration of getting there” (Carlile 2002, 447). In the quote, the informant’s attitude toward his work is the result of the open and undefined epistemic object turning into a closed and defined technical object: “Suddenly it is no longer the source of passionate labour and inquiry, late nights, pain and frustration.” (Ewenstein and Whyte 2009, 13)

By applying the concepts of epistemic and technical objects to the use of visual representations, Ewenstein and Whyte (2009) argue that the use of representations as either epistemic or technical objects is a matter of choice by those using them. In any situation, some representations are left unquestioned and unproblematized as the technical objects that are assumed to be static so that inquiry can be directed to an epistemic object. Ewenstein and Whyte (2009) describe the use of two visual representations where the representation of a top floor is assumed to be static and defined so that the representation of the lower floor can be experimented with to find a suitable spacing of support beams. Like in Rheinberger’s (1997) experimental setups, the representation of the upper floor is used as a technical object so that knowledge can be co-created about the lower floor. (Ewenstein and Whyte 2009)

In this thesis, the epistemic object is defined as the incomplete, unfolding conceptual artefact that is the object of inquiry in knowledge co-creation.
The epistemic object motivates and unites the participants toward the shared goal of finding out more about it. The motivating agency of the epistemic object is based on its incompleteness – if an epistemic object ceases to generate more questions, it becomes a known technical object and ceases its epistemic significance. Likewise, the participants can choose to treat the epistemic object as a known technical object so that another conceptual artefact can be turned into the epistemic object. Figure 9 illustrates the role of epistemic objects in the theoretical framework.

In Figure 9, the epistemic object is a conceptual artefact that all participants are knowledgeable about. Like with boundary objects, each participant has their own knowledge about the epistemic object that defines their relationship to it, represented by orange and blue arrows, respectively. The conditions for categorizing a conceptual artefact as the epistemic object at a given point in time are that it is 1) addressed in the interaction, 2) a conceptual artefact currently being developed, and 3) used to motivate knowledge co-creation across boundaries.

### 2.7 Representation and instantiation

While this thesis categorizes all objects used to support knowledge co-creation as either physical or conceptual artefacts, physical and conceptual artefacts still affect each other through *representation* and *instantiation*. In their study of visual representations in architectural design, Ewenstein and Whyte (2009) highlight representation as a key relationship between conceptual and physical artefact as the way in which “the abstract is linked with the concrete” (Ewenstein and Whyte 2009, 12). The same idea can be found...
in Rheinberger (1997), who describes graphemes as the material traces that result from an experiment concerning an epistemic object. Conceptual artefacts, especially epistemic objects, can be partially *instantiated* in physical representations, making some part of the conceptual artefact visible and modifiable (Ewenstein and Whyte 2009).

Knorr Cetina (2001, 182) describes how epistemic objects exist in multiple forms and often multiple simultaneous instantiations, such as the collection of “partial simulations and calculations, technical design drawings, artistic renderings, photographs, test materials, prototypes, transparencies, written and verbal reports, and more” that make up a measuring device in the process of becoming. The epistemic object is developed further by developing these instantiations, and even if the device is built and thus ‘finished’, the researchers that built it are acutely aware of its faults and how the device could have been built otherwise. Even the finished device is an instantiation of the epistemic object which is the “possibly more complete ideal” of a measuring device (Knorr Cetina 2001, 183). Each instantiation is therefore itself a partial epistemic object, giving pointers how it could be further explored and thus driving knowledge co-creation forward through its incompleteness. (Knorr Cetina 2001).

According to Ewenstein and Whyte (2009), representations are used to manipulate epistemic objects by stabilizing some aspects of design and evolve others. While they do not specifically address how knowledge is co-created by interacting with representations, they conclude that by stabilizing some aspects of the work as technical objects and evolving other as epistemic objects, “the project knowledge develops and the concept of the building is defined and refined” (Ewenstein and Whyte 2009, 16). Core to their conceptualization of using representations to co-create knowledge is that “the epistemic object is developed and manipulated as the visual representations are changed” (Ewenstein and Whyte 2009, 11).

For example, Ewenstein and Whyte (2009) describe a hand-drawn, heavily marked-up sketch of a building. As layers of comments were added onto the original drawing, the sketch began to embody design knowledge. However, the sketch was not fully formed or defined, and as an epistemic object it actively drew attention to its own incompleteness, characterized as if asking the question: “Where, indeed, should that line be drawn?“ (Ewenstein and Whyte 2009, 22) When a ready answer was not at hand, the designers responded by trying a number of lines and assessing their impact on the design – and the epistemic object – once drawn. “Thus the important role visual representations play as knowledge objects is not just on account of their capacity to embed or inscribe knowledge, but on lacking, wanting and unfolding in uncharted directions.” (Ewenstein and Whyte 2009, 22)
Finally, Ewenstein and Whyte (2009) contrast the abstract and open nature of epistemic objects with descriptions of boundary objects, which they see as mediating knowledge work in at given boundaries. While boundary objects are stable and concrete, epistemic objects are dynamic and abstract, comprising of multiple unfolding instantiations. They characterize boundary objects as stable enough to act as shared points of reference, while the constantly unfolding epistemic objects motivate further exploration by finding out more. (Ewenstein and Whyte 2009) The role of representations is then to instantiate the epistemic object and support inquiry and unfolding that develops the epistemic object as a conceptual artefact.

The representation is also an important feature of physical artefacts used as boundary objects – in fact, part of their usefulness at boundaries arises from their ability to represent different conceptual artefacts for different participants (Carlile 2002, 451). Nicolini et al. (2012, 616) describe multiple types of representations used as boundary objects used in developing a bioreactor, such as “representations of results of the experiments (e.g., in PowerPoint slides)” but also “joint papers” i.e. physical artefacts representing conceptual artefacts such as scientific theories and “and the bioreactor itself with its constituent elements” i.e. physical artefacts with important roles in the practices of the participating communities-of-practice. However, some boundary objects may be used to represent knowledge without representing any conceptual artefact, such as the machine parts used to represent practices of assembly in Bechky (2003).

In this thesis, representation is defined as the mechanism with which epistemic objects and other conceptual artefacts are partially instantiated into physical artefacts. Aspects of conceptual artefacts can be instantiated into physical artefacts when the physical artefacts are used as representations, although conceptual artefacts can never be instantiated in their entirety. Instantiating aspects of conceptual artefacts allows conceptual artefacts to be physically interacted with, and changing the representations implies changes in the corresponding conceptual artefact. Boundary objects can be effective representations at knowledge boundaries since they are meaningful for all participating communities-of-practice.

2.8 Distinctions and productive dialogue

The literature on knowledge co-creation has repeatedly emphasized interaction between members of different organizations or departments such as product development teams (Nonaka & Takeuchi 1995), vehicle engineering (Carlile 2004), machine design and assembly (Bechky 2003), healthcare professionals (Engeström 1999b). However, very little has been said about how interaction between individuals results in new and improved conceptual artefacts relevant for the participating organizations.
This thesis sets off from a theoretical paper titled “A Dialogical Approach to the Creation of New Knowledge in Organizations” by Tsoukas (2009). He proposes that new organizationally relevant knowledge is created in productive dialogue, interaction “between at least two speech partners, in which a turn-taking sequence of verbal messages is exchanged between them, aiming to fulfil a collective goal” (Tsoukas 2009, 943).

In this productive dialogue, new knowledge is created when individuals “draw new distinctions concerning a task at hand” (Tsoukas 2009, 941 emphasis added). While Tsoukas (2009) does not put forward or cite an exact definition of ‘distinction’, he describes it as “splitting what was hitherto thought of as a unitary phenomenon in parts” (Tsoukas 2009, 942). The examples he cites are the distinguishing between ‘cold’ and ‘ice cold’ skin in nursing, between different ways of attaching subassemblies in design engineering, and between two mechanisms of causing an autoimmune disease in an immunology lab (Tsoukas 2009, 942).

For Tsoukas (2009), creating new distinctions is creating new knowledge, since the ability of individuals to act in any situation is dependent on the distinctions they can already draw about their situation. Thus, the creation of new distinctions changes and expands their knowledge. Tsoukas (2009, 950) cites just one empirical example of creating a distinction – an excerpt in which a nurse and a pharmacy assistant engage in dialogue and create distinction that defines a novel way of assigning the responsibility of giving medicine to a client. While there is no part in that exchange where one participant explicitly says that an alternative way of operating has been created, a conceptual change is inferred from the way the participants come to agree on a course of action that is novel in their context (Tsoukas 2009, 950–51).

In the author’s interpretation of Tsoukas (2009), a distinction is a verbal formulation that reflects a conceptual change, where conceptual change is understood in this thesis as a change in or the creation of a conceptual artefact. By combining, expanding or reframing the meaning of existing words, conceptual artefacts can be created and developed by using new words and meanings to refer to those conceptual artefacts. In the example of a nurse and a pharmacy assistant, the distinction can be summarized as the definition: ‘the role of drug dispensation is performed by the pharmacy and not the nurse’. The result of this distinction is a change in the conceptual artefact of drug dispensation at this hospital (Tsoukas 2009, 951).

In knowledge co-creation, participants rely on knowledge that has been inherited from their communities-of-practice (Brown and Duguid 1991) but lies outside of their immediate consciousness as a part of the unexamined ways things are done (Tsoukas 1996; 2003). This background knowledge of participants is not something of which a participant is simply unaware, but instead is focally unaware meaning that dialogue can bring background
knowledge into focal awareness where it can then be used to create new distinctions (Tsoukas 2009, 943).

Similarly, Cook and Brown (1999) claim that the creation of knowledge requires productive inquiry, defined as “that aspect of any activity where we are deliberately (though not always consciously) seeking what we need, in order to do what we want to do” (Cook and Brown 1999, 388). Through productive inquiry, new knowledge is created in through dialogue between participants on the meaning of a word or phrase. For Cook and Brown (1999), productive inquiry can be a part of any activity which is motivated by a problem, question, provocative insight, or troublesome situation (i.e. the activity is an inquiry), and which produces an answer, solution or resolution (i.e. the activity is productive) (Cook and Brown 1999). Productive inquiry is a good description of knowledge co-creation, since it features collaboration around an epistemic object (the activity is inquiry) and the goal is to develop the epistemic object as a conceptual artefact (the activity is productive).

To produce new or changed conceptual artefacts, participants of knowledge co-creation must create distinctions (Tsoukas 2009). This means that any productive dialogue depends on the productive difference of individual utterances. Utterances that just repeat the same information that has already been stated do not generate new meaning and therefore do not lead to new distinctions. Likewise, if the utterances are too different, destructively different, they invalidate earlier utterances and stop the dialogue from becoming productive (Gergen, Barrett, and Gergen 2004). The creation of distinctions therefore requires making claims that have not been made in that context before.

To illustrate what kinds of novelty distinctions may feature, Tsoukas (2009) proposes that new distinctions are created in productive dialogue through three processes of “reconceptualization” (Tsoukas 2009, 946 emphasis in original): conceptual combination, conceptual expansion, and conceptual reframing. Conceptual combination involves combining existing concepts such as “natural” and “selection” into a new concept “natural selection” which can have attributes not originating from either one of the comprising concepts. Conceptual expansion extends the use of a concept with an analogy into an area where it originally was not used, or to cover new topics that had not been thought to fall within the concept. Finally, conceptual reframing means reclassifying an on object or a relationship between objects, e.g. by using a metaphor, or shifting the emphasis in a relationship. (Tsoukas 2009).

However, merely uttering the distinction does not imply change in the background knowledge of the participants, but others must accept the distinction for it to constitute knowledge. Tsoukas (2009, 942–43) claims that “when new distinctions are made and accepted, new organizational
knowledge emerges; and when the new distinctions are developed into new products or processes, or are embodied in new actions, innovation and learning respectively occur.” Over time, new knowledge created in the dialogue “fades into accepted knowledge and forms part of the inherited background, thus providing the context for new organizational issues causing unsettledness to emerge, and the dialogical processes to be reactivated” (Tsoukas 2009, 941). In this way, the development of conceptual artefacts in knowledge co-creation enters the organizational background. If effect, this means that knowledge creation is a cycle of bringing knowledge into focal awareness for creating new distinctions, which in turn will return to the unexamined background that enables further knowing.

In this thesis, distinction is taken as the linguistic marker that a conceptual artefact is being changed. Distinctions are offered in interaction by making provisional claims that are accepted on the condition that they are agreed on by the other participants.

2.9 Summary

This thesis takes a three-pronged approach to defining knowledge, underpinned by an ontological categorization that there are three levels of objects: World 1 of physical artefacts, World 2 of social actors and their mental states, and World 3 of conceptual artefacts. The first prong is that knowledge is a tool of knowing which is either 1) the possession of an individual or a group, referred to in this thesis as knowledge, or 2) a continuous and practiced way of knowing, referred to in this thesis as a practice. Knowledge under the first definition includes four equal forms of explicit and tacit individual and group knowledge (section 2.1).

The second prong is that both knowledge and practice are relational, meaning that knowledge is conceptualized and observed in the relationships between a knowing subject and objects of knowing that combine one or more forms of knowledge and practice. The members of communities-of-practice share knowledge and practices in the community’s domain, such as a profession, organizational function, or other problem area (section 2.3).

The third prong is that conceptual knowledge is not approached as a mental possession but as conceptual artefacts, such as theories or models, that exist separate from but known by groups and individuals. Conceptual artefacts are World 3 objects that are created and developed by people through inquiry (section 2.2).

This thesis defines knowledge creation as the creation and development of conceptual artefacts relevant to an organization. In this thesis, the development of knowledge and practices do not constitute knowledge creation:
Knowledge co-creation is defined as the creation and development of conceptual artefacts in interaction between members to various communities-of-practice (contrasted with knowledge creation within a community-of-practice). The goal of knowledge co-creation is to create and develop conceptual artefacts relevant for all participating organizations (section 2.4).

This thesis categorizes objects used to support knowledge co-creation into physical artefacts in World 1, such as sticky notes, visualizations and design materials, and conceptual artefacts in World 3, such as models, theories and procedures. Physical artefacts can be used as representations of conceptual artefacts and thus allow the manipulation of conceptual artefacts for example through visual representations or tangible metaphors. Similarly, conceptual artefacts can be partially instantiated in physical artefacts such as visualizations, prototypes and test results, wherein that part of the conceptual artefact can be modified through its representation. In this thesis, representation and instantiation are defined as the same relationship between a conceptual artefact and one or more physical artefacts. Representation and instantiation do not exist in themselves, but instead they are the result of a person using a physical artefact as a representation in knowledge co-creation (section 2.7).

Two specific roles of objects in knowledge co-creation are also adopted for describing their use. First, boundary objects are defined as physical artefacts meaningful for participants from various communities-of-practice that are used to as representations to communicate across knowledge boundaries resulting from differences in participant knowledge. Boundary objects are characterized by their interpretive flexibility and ability to represent knowledge across communities-of-practice (section 2.5). Second, an epistemic object is defined as the incomplete, unfolding conceptual artefact that is the object of development in knowledge co-creation, and motivates and unites the participants toward the shared goal of finding out more about it. The motivating agency of the epistemic object is based on its incompleteness – if an epistemic object ceases to generate more questions, it becomes a known technical object and ceases its epistemic significance as an object of enquiry (section 2.6).

Productive dialogue has been identified as a source of new organizational knowledge when new distinctions are formed in response to organizational unsettledness. In this thesis, distinction is taken as the linguistic marker that a conceptual artefact is being changed. Distinctions are offered in interaction by making provisional claims that are accepted on the condition that they agreed on by the other participants (section 2.8).
However, further research is needed to empirically observe the development of conceptual artefacts in interaction and describe the effects of design games on knowledge co-creation. The following chapter will therefore delve into extant literature on interaction from the perspective of conversation analysis to understand knowledge co-creation that takes place in the interaction between the participants of a design game session.
The literature on knowledge co-creation has identified interaction between people to be a key mechanism through which new knowledge is co-created (Nonaka, Toyama, and Konno 2000; Carlile 2002; Bechky 2003). However, in research on productive dialogue and knowledge co-creation (Cook and Brown 1999; Tsoukas 2009), interaction has mostly remained a natural, undertheorized concept. To provide more theoretical granularity to the concept of interaction in knowledge co-creation, this chapter introduces conversation analysis, a powerful, theoretically grounded research tradition in interaction research. In addition, this thesis introduces extant literature on institutional interaction to study knowledge co-creation as interaction in institutional settings such as design games.

3.1 Interaction through the lens of conversation analysis

This thesis applies conversation analysis (Sacks, Schegloff, and Jefferson 1974) to theoretically describe and empirically analyse the interaction that takes place in knowledge co-creation in a design game session. Conversation analysis (hereafter CA) uses the concept of interaction to refer to all observable social interaction and behaviour in contact with other people, inasmuch as it is exhibited through verbal and bodily action (Scheglof 1996) in relation to the environment it takes place in (C. Goodwin 2000). These observable verbal and bodily actions are talk (or talk-in-interaction), which is recorded and transcribed for the study of “action, activity, and conduct in interaction” (Schegloff 1996, 162).

This thesis concerns applied CA in contrast to pure CA. The two kinds of research share a theoretical background and research methodology but have different areas of contribution. Pure CA contributes to the understanding of interaction that is shared across all interaction between peers, such as turn-taking and distribution of speaking rights (e.g. Heritage and Sorjonen 1994; Mondada 2016). Applied CA uses CA theory and methodology to study some other phenomenon than social interaction itself (Ten Have 2007), such as facilitation during conflicts of interest (Hirvensalo 2015), classroom participation (Kovalainen and Kumpulainen 2007) or social presence in vir-
tual environments (Kohonen-Aho 2017). In this thesis, CA is applied to understand knowledge co-creation as interaction by importing CA theory to understand what interaction is. As a result, this thesis provides new ways of thinking about the creation of knowledge in organizations from the foundational understanding of interaction between people.

This section describes four central features of conversation analysis that are applied in this thesis to the study of knowledge co-creation as interaction: turn-taking and sequential organization, assessments and agreement, resources for interaction, and the overall structural organization of occasions. Based on these four features, knowledge co-creation is conceptualized as interaction in which participants take turns and mobilize multimodal resources to make assessments, and agreement and disagreement about those assessments is established through the sequential organization of assessments.

3.1.1 Turn-taking and sequential organization

The foundational proposition of CA is that all interaction shares the same basic underlying structure of alternating turns-at-talk which consist of the utterances and/or actions a participant makes before a response takes place (Sacks, Schegloff, and Jefferson 1974). First, talk affects the production of following talk: when a participant speaks an utterance (the smallest unit of speech) or takes some other action, they expect that the person who speaks next will make a next action from a range of possible next actions determined by the first action. Second, speakers orient themselves to preceding talk, most commonly the immediately preceding talk. As speakers construct speech to take advantage of the previous talk, they provide context for interpreting preceding talk. Third, through the production of next actions the other speakers show their understanding of the speech on many levels. This can include showing that the speaker understands the previous turn-at-talk to be over, or that they understand the previous turn-at-talk to be a question, and so on. These understandings are then either tacitly accepted by the previous speaker, or the previous speaker can respond to repair the misunderstanding. (Heritage 2009).

In CA, interaction is studied from a structural perspective, identifying relative order in which actions and series of actions take place referred to as the sequential organization of interaction (Schegloff 2007, 2). For example, Figure 10 illustrates the back-and-forth organization of individual turns-at-talk between participants A and B, where the arrow a is A’s turn-at-talk (directed at B), b is B’s turn-at-talk (directed back at A), and a₁ is A’s response to B’s response b.
When looking at interaction in this way, one can see how each utterance is produced in the context of the prior utterance. In CA, a turn-at-talk is said to be in the first position if it is followed by a response in the second position. Likewise, after a reply in the second position, the speaker of the turn-at-talk in the first position can reply to the reply with a turn-at-talk in the third position. (Schegloff 2007, 168) In Figure 10, this means that if turn-at-talk $a$ is in the first position, $b$ is the second position, and $a_i$ is in the third position (e.g. “Do we have any spare time?” “Yes, about ten minutes” “Okay thanks”). The goal of a conversation analyst is then to use $b$ to understand what is being said in $a$, and both $a$ and $a_i$ to understand what is said in $b$, and so on.

A key feature of CA, in contrast to other approaches such as speech-act theory (e.g. Alin 2010), is that the meaning of any individual turn-at-talk is dependent on the preceding and following talk. For example, the phrase “do you mind?” can be a request, a scolding or an apology depending on who is saying it to whom, in what context, what was previously said, and how will it be responded to. Turns-at-talk follow each other, and in doing so constantly create and revise meanings in a double interactant structure (Weick 1979, 115), shown on Table 1.

**Table 1:** The structure of a double interactant (adapted from Weick 1979, 115).

<table>
<thead>
<tr>
<th>Position</th>
<th>Meaning</th>
<th>Example turn-at-talk</th>
</tr>
</thead>
<tbody>
<tr>
<td>First position</td>
<td>Action of a person</td>
<td>Select the subject of the review, put forward a new interpretation, specify the interpretation, etc.</td>
</tr>
<tr>
<td>Second position</td>
<td>Response of another person</td>
<td>Accept, reject, or modify the previous act</td>
</tr>
<tr>
<td>Third position</td>
<td>Re-evaluation by the first person</td>
<td>Abandon, re-evaluate or keep the original action</td>
</tr>
</tbody>
</table>
By applying the double interactant and other identified patterns of interaction, CA analysts can describe and explain the structural regularities of interaction that individuals use mostly unconsciously throughout their lives. In this thesis, the specific structural regularities such as the double interactant is used to study how knowledge co-creation takes place turn-of-talk at a time, and how talk is produced in collaboration between participants.

3.1.2 Assessments and agreement

To study the role of making claims in knowledge co-creation, this thesis turns to the analysis of assessments, a type of turn-at-talk in which participants make and take positions on claims about a referent, i.e. a thing that is being assessed. Assessments are a routine part of everyday conversations, such as participating in shared activities by making assessments (e.g. “Try the water.” “It’s wonderful!”), or when reporting about activities (e.g. “I tasted it, it was really horrible.”) (Pomerantz 1984). However, they are also a way for speakers to make claims, agree, disagree and come to shared conclusions about the state of things in activities such as knowledge co-creation.

Each assessment is a claim that the speaker has access to and knowledge of the thing they are talking about, i.e. the referent. This is displayed in cases where a speaker requests an assessment (e.g. “How are the dresses coming along?”) and the participant declines to answer by claiming that they do not have access to sufficient knowledge (e.g. “Well uh I haven’t been there...”). (Pomerantz 1984, 57). Claims of access or knowledge can also be disputed by other participants in the following talk (e.g. “The colours were really bad” “Did you see the version I sent you this morning?”).

In everyday conversation, assessments invite further assessments from other participants: a first assessment i.e. an assessment in the first position, invites a second assessment (e.g. “This cake is amazing” “It’s delicious”). Sometimes first assessments are formatted to specifically invite second assessments by using interrogatives such as “isn’t it” or “aren’t they” (e.g. “It’s a beautiful day, isn’t it?” “Yeah it’s just gorgeous.”). However, the recipient of the first assessment is always expected to turn their attention to what was just assessed and offer a second assessment of the referent regardless of whether an interrogative was used. (Pomerantz 1984)

Together, first and second assessments are referred to on this thesis as assessment pairs. The members of assessment pairs are not exclusive: in multiparticipant interaction, a first assessment may have multiple responses to it and so form multiple assessment pairs. Responses to the second assessment by the author of the first assessment that abandon, re-evaluate or
maintain the first assessment are considered *third assessments* in line with Weick (1979) above.

In interaction, first assessments are formulated by speakers to accomplish an action or multiple actions, such as praising, complaining, complimenting, insulting, bragging or self-deprecating. Like many other turns-at-talk, a first assessment is structured to invite some *preferred next action*, and so the second assessment must either take the preferred next action, or its alternative, the *dispreferred next action*. Most first assessments invite agreement (e.g. “This cake is amazing” “It’s delicious”), but some, such as self-deprecating assessments, invite disagreement (e.g. “I’m so dumb” “No, you’re not”). (Pomerantz 1984).

Second assessments take up a position in the assessment pair in relation to the first assessment, forming an *agreement* if the assessments align. The *type of agreement* depends on the relationship between the initial and the second assessments: *Upgrade type* agreements are second assessments that are aligned with but are stronger than their first assessments and occur as a part of agreement clusters or sequences of agreements. *Same type* agreements replicate the level of the first assessment, sometimes by repeating a part of the first assessment and adding “too” as in “I like it too” to appear as if a second in a list. *Downgrade type* agreements are second assessments of the same referent but using scaled-down or weakened evaluation terms. (Pomerantz 1984).

From the possible relationships between a first assessment and its second assessment, two levels of agreement sequences emerge. *Strong agreement* is characterized by the upgrade agreement and occurs in sequences of multiple agreements. *Weak agreement* includes same agreements or downgrade agreements, and can also be used as a part of a disagreeing response (e.g. “Isn’t it good?” “It’s good, but too sweet for my taste”) resulting in disagreement with an agreement component. (Pomerantz 1984).

Like agreements, disagreements come in two levels. *Weak disagreement* is a non-aligning second assessment that occurs with an agreement component, forming a partial agreement or a partial disagreement. Weak disagreement can also come with qualifications, exceptions, additions, and so on (e.g. “It’s a beautiful day” “It might actually be too hot, even”). *Strong disagreement*, on the other hand, is one where a speaker “utters an evaluation which is directly contrastive with prior evaluation” (Pomerantz 1984, 74) (e.g. “Alice hasn’t as much as shown her face here today” “She’s been here all day”). Additionally, a disagreement is strong only when the turn does not contain any agreement components. (Pomerantz 1984). The relative strengths of agreements and disagreements are summarized in Table 2.
Table 2: Construction and relative strengths of agreement and disagreement (Pomerantz 1984).

<table>
<thead>
<tr>
<th>Example first assessment</th>
<th>Example second assessment</th>
<th>Relationship to first assessment</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;It was good&quot;</td>
<td>&quot;It was the best!&quot;</td>
<td>Upgrade</td>
<td>Strong agreement</td>
</tr>
<tr>
<td>&quot;Yeah, it was good&quot;</td>
<td>Same</td>
<td></td>
<td>Weak agreement</td>
</tr>
<tr>
<td>&quot;It was okay&quot;</td>
<td>Downgrade</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;It was good, but a bit too sweet&quot;</td>
<td>Partial agreement</td>
<td></td>
<td>Weak disagreement</td>
</tr>
<tr>
<td>&quot;It wasn’t that good&quot;</td>
<td>Partial disagreement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;It was bad&quot;</td>
<td>Disagreement</td>
<td></td>
<td>Strong disagree-</td>
</tr>
</tbody>
</table>

The absence of a second assessment is usually taken as a potential disagreement, resulting in the first speaker making a backdown to avoid the disagreement (e.g. “It’s really warm here” [no reply] “Well, not that warm for a summer day”). The backdown can then allow the recipient to state the disagreement with the first assessment as agreement with the backdown (e.g. “Well, not that warm for a summer day” “Yeah, it’s sort of cloudy”). (Pomerantz 1984) By combining delays and withholding disagreement with the other speaker’s modifying their positions, the speakers allow stated disagreements to be minimized and stated agreements to be maximized: “It is not only that what would be a disagreement might not get said, but that what comes to be said may be said as an agreement.“ (Pomerantz 1984, 77)

For this thesis, assessments provide a bridge between the overall structural organization (i.e. in what order things are said) and the content of turns-at-talk (i.e. what is being said). Assessments provide a detailed view into how knowledge co-creation can be divided into individual turns-at-talk, and how the creation of knowledge emerges from assessments, agreements, disagreements and elaborations.

3.1.3 Resources for interaction

While organization research has been occupied with the role and nature of conceptual and physical artefacts as support for knowledge co-creation, CA has approached the use of objects from the opposite direction, highlighting embodiment and physical action as a part of interaction. In CA, interaction is considered multimodal, meaning that in takes place concurrently and in conjunction over multiple modalities such as speech, gesture and positioning. The use of different modalities by participants are intertwined in the production of interaction without clear hierarchy between modalities, for example that gesture is not an extension of speech but that co-occurring
speech and gesture form one action performed over multiple modalities. (Mondada 2016).

Interaction is produced with reoccurring elements, such as sentence structure, pointing, and positioning in space, that can be identified as resources for interaction (Mondada 2007a). Even rules and expectations can be resources if they have been established within the community they are used in (e.g. Nielsen 2012). Because interaction is by nature multimodal, multiple resources are often used simultaneously in multiple modalities, such as speech and gesture (Mondada 2007a). For example, a participant can express the same thing in two modalities to emphasize what they are communicating (e.g. showing four fingers and saying the word “four”), secure the attention of others (e.g. waving a hand and exclaiming “hey”), or make sure the use of resources is interpreted correctly (e.g. pointing at a written number four and saying “four”) (C. Goodwin 2000).

The study of interaction can be used to enumerate different kinds of resources used in a specific type of interaction. However, there is no way to exhaustively catalogue all the resources an interaction involves, so the concept of resource is used for highlighting a specific resource or a type of resource in the studied interaction, such as the resources used to play hopscotch (C. Goodwin 2000) or the use of turn-constructional-units as resources (Schegloff 2011). Physical artefacts, such as pens, playdough and Lego bricks, can be used as a resource in high-infinite ways as resources to perform various actions. Even when the physical attributes of artefacts impose some limits, embodied actions can expand those attributes, such as when a participant mimics squeezing a pen thinner with gesture when the pen can’t physically be made thinner with two fingers.

In this view, the action produced by the participant is viewed as primary, and any objects of knowledge co-creation are then identified resources for producing that action. Participants do not only use a pen as an interactional resource but (re)constitute and (re)negotiate it based on the context of action (Mondada 2016, 361). Artefacts become meaningful in the embodied practices that they are used in, and as such the conversation analytical study of artefacts means studying the use of artefacts (Mondada 2012b; C. Goodwin 2000). No claims about the use or role of objects can be made before the interaction occurs, and generalizations about the use of an object are subject to reconstitution and renegotiation by the users in each interaction (Mondada 2012b). For example, a pen is often used as a resource to write something, but its use can be reconstituted as a pointing instrument. The concept of resource is therefore very close to the idea of affordance (Norman 2013) except that the emphasis is placed on the use in interaction between participants, and not on the features of the artefact.
This thesis studies resources specific to design games by observing how they are deployed in making assessments. The purpose and meaning of physical artefacts, even elaborate ones such as architectural drawings, is produced in an embodied way by the participants who put them at the centre of focus, point at them, act with them and refer to them is speech. Physical and conceptual artefacts can be used as resources for the production of interaction, and so studying the use of physical artefacts as resources places primacy on the embodied, multimodal co-production of interaction in which physical artefacts such as pens and maps are mobilized as resources (Mondada 2016). For example, naming the game material of a design game as a resource means shining a light at what kinds of multimodal actions are produced using the game material, and how the game material is mobilized to produce those actions. This thesis therefore focuses on analysing interactional resources that are specific to design games such as game material and game rules, while omitting many conventional resources such as grammar or gestures not associated with the design game.

3.1.4 Overall structural organization of occasions

Interaction takes place in individual occasions of interaction such as phone calls, gift-giving, or talking about the weather (Heritage and Sorjonen 1994; Robinson 2013). These social activities involve normatively ordered sequences of actions that participants follow, such as the structure of ‘a single conversation’ (Schegloff 2007, 263) which begins with an opening, ends with closing, and has something in between the two (Robinson 2013). Depending on the context, an occasion of interaction may have a specific overall structural organization. Telling a trouble to a friend or family member involves “approaching, arriving at, delivering, working up, and exiting from the trouble in particular ways” (Robinson 2013, 258), while opening a birthday present in the presence of the gift giver involves “acknowledging the giver, reading the card, opening the gift, positively assessing the gift, thanking the giver and so on“ (Robinson 2013, 257–58).

Emanuel Schegloff (2007, xiv) describes overall structural organization as one of the six organizing practices of sequential organization without which interaction cannot proceed in an orderly fashion: turn-taking, action-formation, sequence-organizing, trouble-dealing, word-selection and overall structural organization. The study of overall structural organization therefore involves researching how occasions of interaction get structured, what structures occasions can take, and how does the positioning of turn-at-talk, sequences and other smaller structures change based on their position in the overall structure. (Schegloff 2007, xiv)

On a general level, occasions involve several activities – at least an opening, an ending, and ‘something in between’. The ‘in between’ of interaction may
be organized to one or more topics, often related to the reason for the interaction, including ‘no reason’ (Robinson 2013). For example, dealing with acute medical concerns during primary-care medical visits is organized into several topics that the participants produce and are oriented to, such as “presenting, gathering information about, diagnosing and treating the concern” (Robinson 2013, 258). Individual activities may vary in length and may not have clear boundaries, but they illustrate how the participants’ understanding of what is going on affects the moment-to-moment production of talk, and how participants are able to orient to the activities they are engaged in as something that can be departed from and returned to (Heritage and Sorjonen 1994).

In summary, this thesis applies CA to the study of knowledge co-creation as interaction in which participants take turns and mobilize multimodal resources to make assessments about shared referents, and agreement and disagreement about those assessments is established through the sequential organization of assessments. Talk is produced in relation to the overall structural organization of the occasion, and the overall structural organization of interaction is produced through the interaction itself. Each turn-at-talk is interpreted based on the preceding and following interaction, and relationship between turns-at-talk such as assessments is inferred from their positioning and content.

### 3.2 Institutional interaction

Following the research of Antero Hirvensalo (2015), this thesis studies knowledge co-creation as **institutional interaction**. In conversation analysis, institutional interaction refers to interaction between people that takes place in institutional or professional contexts, such as in courtrooms, classrooms and interviews (Drew and Sorjonen 1997). Institutional interaction is defined in opposition to **everyday interaction** between peers in non-institutional contexts, such as ‘at home’. According to Paul Drew and John Heritage (1992, 22), institutional interaction is defined by three characteristic traits, some or all of which may be present.

First, at least one participant of institutional interaction is oriented towards a goal, task or role conventionally associated with the institution in question. The interaction is therefore normatively informed by the goal orientations of the institutional context” (Drew and Heritage 1992) where the parties attribute their actions to their occupational position or situation-specific role (Arminen 2005). This can be the interaction between colleagues where both participants are in institutional work roles, or it can be the interaction between a police officer in the corresponding institutional role and another person not acting in any institutional capacity.
Second, the interaction includes constraints on “what one or both of the participants will treat as allowable contributions to the business at hand” (Drew and Heritage 1992, 22). For example, some kinds of interaction like yelling or cursing are not considered allowable contributions in a courtroom. Third, the interaction is associated with a special frame of inference specific to that institutional context, meaning that some actions that take place in institutional frames have a specific significance beyond the encounter at hand. Handing over money at a grocery store is interpreted as a business transaction, and not as giving a gift. In addition to taking place in institutional situations, it is important that the institutional identities of the participants are displayed and relevant when performing their institutional duties (Drew and Heritage 1992).

While all interaction in which people orient themselves to goals associated with organizational roles is institutional, this thesis studies the interaction in playing a design game. In this thesis, playing a design game is a part of a knowledge co-creation session. Knowledge co-creation sessions are social occasions with a predetermined programme, agenda, and a pre-established unfolding of phases guided by someone, with only specific people invited (Goffman 1963, 18–19). Examples of knowledge co-creation sessions vary in naming and format, but typical examples include workshops (Nielsen 2012), co-design gatherings (Vaajakallio 2012, 13), and process simulations (Smeds, Suominen, and Pöyry-Lassila 2014; Hirvensalo 2015).

The concept of a frame, developed by Erving Goffman (1974; see also Bateson 1972), has been very influential in studying contexts in sociology, which in turn influenced the study of institutional interaction within the field of conversation analysis (Drew and Heritage 1992). Goffman’s theories have also been highly influential in the study of games as social activities (e.g. Deterding 2013; Stenros 2015).

Frames are the way humans understand that objects, acts and situations have an altered meaning in a specific context. The existence of frames as discussed in this thesis is a phenomenon of human interaction: they are the result of how the participants themselves make sense of the situations they are in. A frame exists only when people orient themselves to it: A frame is created and identified through metacommunication, i.e. temporal or spatial markers that marks off the social activity from the surrounding world. These markers, such as the doors of courtrooms or the beginning and end of school days, are neither part of the thing being marked nor the world outside – they exist at the border. (Goffman 1974, 252).

The effect of frames is that participants make sense of things and actions in accordance with the frame (Goffman 1961). The participants only adhere to the meaning of objects provided by the frame, and construct interpretations of the objects using inferred rules of the institutional frame. Goffman (1961)
Interaction describes three features of frames by using games as an example: *rules of irrelevance*, such as ignoring the material value of game pieces; *realized resources* that signify game-relevant events and roles, such as capturing a piece in chess, or grounding out to third in baseball; and *transformation rules*, determining how external elements that affect the interaction are brought into the frame, such as letting the oldest player go first (Goffman 1961, 18–29). All three features likewise apply in other social encounters: people ignore coughs as not significant during a musical performance, motorists and pedestrians are roles that are meaningful only in the context of a street, and otherwise equally treated customers at a shop are addressed ‘sir’ or ‘miss’ based on their perceived gender (Goffman 1961, 18–29).

Institutional interaction also involves all the structures we expect from everyday interaction, such as turn-taking and assessments (section 3.1). However, some aspects of everyday interaction take on additional dimensions in institutional contexts: institutional contexts involve resources specific to that institutional context, such as the specific meaning placed on sticky notes in brainstorming sessions (Nielsen 2012), and occasions of institutional interaction may involve the production of and orientation to overall structural organization, such as doctor’s appointments (Robinson 2013), AA meetings (Arminen 2005) or claiming social security (Heritage and Sorjonen 1994). In this thesis, these institutionally relevant aspects of resources and overall structural organization are conceptualized as effects of institutional frames.

This thesis takes the presence of an *institutional frame* as the primary defining characteristic of institutional interaction from which other aspects are derived. Based on the institutional frame, participants:

1. take on institutional *roles*,
2. orient themselves to institutional *goals* tied to institutional roles,
3. accommodate institutional *constraints*,
4. involve *special inferences* specific to the institutional context, (Drew and Heritage 1992; Heritage 2004, 200),
5. have access to interactional *resources* specific to the institutional frame (Nielsen 2012; M. H. Goodwin 1995) and
6. have effects on the overall structural organization of interaction (Drew and Heritage 1992; Arminen 2005).

These six elements of an institutional frame are used in this thesis to characterize the frame an institutional interaction is taking place and describe its effects on the interaction. Later sections describe these elements in design games.
3.3 Institutional frames in design games

The institutional context studied in this thesis is a design game session as a locus for knowledge co-creation. While games and design games come in wildly different forms, this thesis focuses on the commonalities between games and design games instead of their differences (for a discussion on the “gameness” of design games, see Hannula and Harviainen 2016). Specifically, this thesis draws on game studies and design games literatures to construct a theoretical perspective for studying design games as institutional interaction. Playing a design game is defined as interaction in the institutional frame of a design game activity.

Games are a form of cultural interaction comparable to play, both of which are institutionalized forms of playfulness (Stenros 2015). According to Jaakko Stenros (2015), playfulness is an *brute fact* of human life which takes many socially constructed forms such as play and games, and many of these expressions of playfulness have become institutionalized parts of culture. Whereas playfulness is biological, institutions of play, such as individual games and even the category of games, are socially constructed (Montola 2012). This study concerns *social play* (play with others) in contrast to locomotor play (playing with the body) and object play (playing with objects such as toys), and the focus is on the *shared game activity* (Stenros 2015).

As a shared, culturally recognized activity, games form their own institutional frame of interaction. The study of what kinds of frames games imply and how game framing takes place has been a topic of interest in game studies (e.g. Deterding 2013; Stenros 2010), building on top of the work of Gregory Bateson and Erving Goffman. “In the frame of play, the participants need to recognize the actions of others and interpret them in a way that is fitting to the frame. By doing so, and acting in a manner that validates the actions of another, the shared frame is upheld.” (Stenros 2015, 145)

Research dating back to Goffman (1961) has shown that games actually involve three frames of interaction that are embedded in each other and marked by metacommunication about the existence of boundaries. The innermost frame is the “gamespace” in which the players of a game make formal moves that are interpreted as consequential within the logic of the

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5 The cooperation implied by the word “shared” is not unique to collaborative games but concerns all interactions where opponents have a shared framing of the situation, such as “we’re in a court of law”, “we’re playing chess” or “we’re in a fistfight”. Although situations do exist where participants have different framings of the situation, such as bullying, trolling or griefing (extensively described by Stenros 2015), this study focuses on the study of interaction as a collaborative undertaking.
game: game pieces are moved, turns are passed and squares are jumped (Stenros 2015, 147). This frame covers the narrowest definition of what playing a game means: in gamespace, interaction is reduced to changes in the discrete game states indicated by the position of game pieces, an electronic system, or other means. Metacommunication of the gamespace usually involves the orientation of the players’ bodies and attention toward a set of physical artefacts such as an electronic system (Mondada 2012a) or a playing field (M. H. Goodwin 1995) used to record the gamespace.

The formal moves take place within a second frame, the game activity, which contains the gamespace and other kinds interaction that can manifest between the players, such as play, reading someone’s poker face (i.e. telling whether someone is bluffing) and kingmaking (i.e. a player who cannot win deciding the winner of the game with their remaining moves) (Stenros 2015, 147). The boundaries of a game activity that separate it from the wider world are referred to as the magic circle of play which separates the time and place reserved for play or a game (e.g. Huizinga 1949; Montola 2012; Stenros 2012; see also “bracketing” in Goffman 1961). Within the magic circle, players, facilitators, referees and similar game participants engage in game interaction by making sense of things and actions through the game’s institutional frame, following the rules of irrelevance, realized resources and transformation rules. Metacommunication of the magic circle can involve a physically marked off area such as a playing field, or it can be communicated by the actions and intentions of the players (Stenros 2012).

Finally, the game activity is embedded within the third frame, the larger gaming encounter which includes the players of the game but also onlookers, commentators, hecklers and other participants of the social event within which the game is taking place (Stenros 2015, 147; Goffman 1961, 36). Metacommunication about a gaming encounter usually involves the presence of a game activity that the encounter takes place around, such as the small talk before a game formally begins, or spectators being oriented towards but not participating in a game. The three embedded frames are visualized in Figure 11.
Figure 11: Institutional frames in and around games.

This thesis focuses on playing the design game, defined as the interaction in the design game activity within the magic circle. A design game activity has participants, who may take on game roles such as that of a player or a facilitator. The institutional interaction that takes place within ‘the magic circle’ has a culturally recognized ability to resignify\(^6\), i.e. give a game-related meaning, to elements and interactions within it (Harviainen 2012; Waern 2012). Game rules support resignification by infusing meaning into otherwise meaningless activity, such as resignifying moving a game piece as a consequential action in the gamespace (Waern 2012). However, the resignification ability of games also creates completely new special inferences particular to games, such as scoring or winning (Waern 2012).

As a consequence, this thesis leaves out the rest of the design game session (analogous to a design gaming encounter in Goffman’s words) which includes interactions before, adjacent to, and after the design game activity, such as the briefing and debriefing of the design game (Vaajakallio 2012, 217). These interactions are considered to take place within a different institutional frame and are thus beyond the scope of this thesis.

The following sections will take a closer look at the elements of playing a design game as institutional interaction within the institutional frame of a game activity.

\(^6\) Stenros (2012) also notes the similarity between resignification and Goffman’s rules of transformation.
3.4 Facilitation in design games

In this thesis, design games are conceptualized as a method of supporting knowledge co-creation, and facilitator is conceptualized as an institutional role of supporting knowledge co-creation. However, the relationship between design games and facilitation is a complex one. This section opens the reciprocal relationship of a design game that features a facilitator role, and design game as a tool that a facilitator uses to support knowledge co-creation. Design games and facilitation are defined before a closer description of playing a design game as institutional interaction is provided.

In co-design practice, three roles related to using design games are generally conceived. The facilitator of the design game interacts with the players and supports interaction during the game; the design game designer has created the design game rules and material in advance so that a game can be played; and the designer using the results of the design game will integrate them into an ongoing design project or equivalent. However, all three roles can be just one or two people, resulting in overlapping roles. In such a context, the design game is a tool of the facilitator, constructed partly in advance and partly emerging in interaction between the facilitator and the players. (Vaajakallio 2012)

On the other hand, the research problem of this thesis emphasizes the design game’s ability to support knowledge co-creation, implying that facilitation is a feature of the design game that supports knowledge co-creation. This approach would suggest that the support provided by people taking on facilitator roles is just a part of design games. This section will explore the bidirectional relationship between design games and their facilitators by considering the purpose, neutrality and experience of facilitators.

The purpose of involving a facilitator, especially in group decision-making, is to leverage the assets of group problem-solving, such as access to a greater sum of total knowledge and information, more approaches to a problem, increased acceptance by participating in the problem-solving, and better comprehension of the decisions made; mitigate the liabilities, such as social pressure, valence of solutions, individual domination and the desire of participants to win arguments; and turn potential liabilities into assets, such as disagreement, conflicts of interest, increased tolerance for risk-taking, time-requirements of group decision-making, and the need for some participants to change. (Maier 1967) In co-design research, the presence of an organizer, researcher or designer in co-design gatherings is assumed, since co-design gatherings are as generally organized to serve a design or research purpose determined by the organizer (e.g. Mattelmäki and Sleeswijk Visser 2011).

The neutrality of facilitators is a topic of some controversy: should process facilitators contribute to the content of facilitated group activities? Mie
Nielsen (2012, 89) describes the facilitator role as “a ‘content-neutral’ party; an individual working to enable groups and organizations to collaborate, work more effectively and achieve synergy, or one who may assist a group in thinking deeper about its assumptions, beliefs, values, systemic processes, context, etc.” Lawrence Phillips and Maryann Phillips (1993) similarly argue that facilitators should keep themselves disinterested in the content of interaction and focus on designing and conducting the workshop processes because it is “difficult to think deeply about content and process at the same time, just as it is difficult to write and talk at the same time” and that if the participants see facilitator as an expert it can cause them to feel de-skilled and “find it difficult to mobilize their own expertise, and group work on the task may suffer” (Phillips and Phillips 1993, 534). This approach is sometimes called “process facilitation” or “process consultation” (e.g. Schein 1990).

To support the knowledge co-creation process of participants, process facilitators use several techniques depending on the practices of the facilitator in question. *Eliciting talk* from a participant can help to bring their individual knowledge into the knowledge co-creation process (Nielsen 2012). A facilitator can elicit talk by asking a direct, open-ended question to elicit talk (Pyser 2005, 216), but also with techniques such as creating openings for participants to fill their explanations, give the floor for participation, approve the participants' assessments without evaluating their contents, and manage speaker transition (Nielsen 2012, 103).

*Provoking reflection* is done by the facilitator to help participants create new meanings in the collective reflection of the group (Gergen, Barrett, and Gergen 2004; Heron 1999). Reflection can be provoked by summarizing a participant’s statement and following it up with open-ended, nondirective question (Kaner et al. 2007, 45; Weick 1979; Phillips and Phillips 1993), presenting assumptions and perspectives that the group has not dealt with (Pyser 2005), presenting alternative perspectives (Heron 1999, 117) or asking questions about task purpose, thereby stimulating the group to address its task, think through implications, make judgements and plan for action” (Phillips and Phillips 1993, 542). By using these techniques, a facilitator can encourage the participants to consider possible tensions and inconsistencies in their thinking.

*Managing the overall structural organization* means preparing and communicating an institutionally recognized form of interaction, such as a workshop or a brainstorming session to establish the desired the institutional frame. This thesis focuses on such actions where they take place during the game activity. Within an established frame, a session can be split into a series of phases, such as the generation of ideas, the presentation of ideas and the subsequent discussion and evaluation of ideas (Nielsen 2012). During the
session, the facilitator can influence the emergence of a frame for participation by repeating certain interaction patterns (C. Goodwin and Goodwin 1992). For example, if a facilitator repeatedly orients towards idea cards on a whiteboard as a pool of potential topics, the script of the interaction becomes recognizable for the participants who can fill their role as authors of ideas when they get the cue to speak about a topic (Nielsen 2012). Similarly, the facilitator can encourage a structure to emerge by repeating a sequence, such as giving floor to a participant, acknowledging the performance, possibly reacting to what was said and opening a subsequence, and then giving floor to the next participant (Cooren et al. 2006; Rixon 2013). As facilitated sequences become familiar, the facilitator establishes a local community-of-practice with its own practices for knowledge co-creation (Hirvensalo 2015, 25).

In addition to using more sophisticated techniques, a process facilitator can intervene in interaction to change or stop some aspect of the group’s work, or protect one or more individuals, “particularly when unpopular views or minority perspectives are in danger of being suppressed by the group” (Philips and Phillips 1993, 542). In all cases, facilitators only have as much power over a group as they are given, so facilitators usually achieve their goals using the other techniques described above.

The alternative view to process facilitation is what Chris Huxham and Steve Cropper (1994) call “input of substantive expertise” (Huxham and Cropper 1994, 5). In this view, facilitators support the process while also inputting their subject matter expertise by making contributions to the problem-solving or evaluating progress made by the participants (Huxham and Cropper 1994). The role of subject matter based expertise has also been highlighted in design research, where the design expertise of a facilitator can guide non-expert participants in making valuable contributions to the topic at hand (Lundberg and Arvola 2007).

Vaajakallio (2012) explicitly draws attention to both facilitation and subject matter skills required from design game facilitators by describing two roles of facilitation. In the first role, a facilitator becomes an active participant and makes their own perspective explicit while playing the game, while in the second the facilitator mainly builds bridges and makes connections without personal judgments (Vaajakallio 2012, 228). Because taking the two roles simultaneously results in contradicting demands for the facilitator (Phillips and Phillips 1993; Sleeswijk Visser et al. 2005), several authors have suggested dividing facilitation responsibilities to a ‘regular’ process facilitator responsible for the structure and guidance of the session, and a creative facilitator who has an active role in suggesting alternatives and encouraging the participants to explore the consequences further (Lundberg and Arvola 2007; Vaajakallio 2012, 76).
According to Vaajakallio (2012), using design games puts additional requirements on the facilitators, since expertise in facilitating design games is distinct from expertise in facilitating other forms of co-design. For example, it is often expected that design games should be modified every time they are used to fit the particularities of each case and the participants’ own process (Brandt and Messeter 2004). Similarly, Ehn and Sjögren (1991, 262–63) describe that becoming more experienced in facilitating their design games meant that they were better able to improve and change a game as they played, support the participants better, and to adopt to different kinds of situations, such as to skip parts of the game when appropriate.

While using design games puts additional requirements on the facilitator, it has also been suggested that using design games can also ease the role of the facilitator in some areas. According to Martin Johansson (2006), a design game facilitator does not need to be as active in ‘steering’ the collaboration and can instead takes the role of a secretary by taking notes and summarizing what had been said. “Handing over some of the facilitation responsibility to the design game may make it easier for the facilitator to contribute to the topic, while also not having to act with an ‘authoritarian’ facilitator role.” (Johansson 2006, 8) Johansson (2006) also suggests that once a facilitator has introduced the design game’s structure, they can take a more active role as a contributor.

Finally, it should be noted that the experience of the facilitator affects how facilitation is conducted. More experienced facilitators are better able to support group decision-making (Anson, Bostrom, and Wynne 1995) and participatory design (Luck 2007). Similarly, facilitators with different professional backgrounds such as theatre directors, industrial designers or ethnographers have different practices to facilitating design games (Vaajakallio 2012, 35). In design games where the roles of facilitator, designer and design game designer overlap, the facilitator of each design game session significantly affects the interaction in the design game (Vaajakallio 2012, 228).

Based on the research problem, this thesis defines facilitation as the actions that a person in the institutional role of a facilitator takes to support knowledge co-creation in a design game. This definition has three conceptual implications: First, the existence of the facilitator role is seen as a feature of the design game’s design. Regardless of who designed the design game, the design game has made the person a facilitator. Second, the facilitator role only exists in the design game activity, and anything done by the facilitator before the game is conceptualized as activities taken in some other role than as a facilitator. Third, even though research has shown that the conduct and effectiveness of facilitation is based on the experience and practices of individual facilitators, this thesis does not address to what extent the effects of facilitation vary between facilitators. Instead, all effects facilitators have on
the knowledge co-creation of participants are considered features of the design game.

### 3.5 Playing a design game as institutional interaction

This thesis focuses on the interaction between the players and facilitators of a design game that takes place within the institutional frame of the design game activity, conceptualized as *playing a design game*. Playing a design game includes the formal game moves such as drawing and placing cards, but also other interaction between the players, such as facilitation and discussing what moves to take. The rest of the design game session that is not part of the design game activity is left beyond the scope of this thesis to focus the analysis on interaction in one institutional frame. This section defines playing a design game as institutional interaction in the frame of a design game activity. The institutional nature of playing a design game is described using the five elements of institutional interaction described in the preceding sections: roles, goals, constraints, special inference, resources, and the overall structural organization.

During a design game, the participants of a design game take *institutional roles* according to the rules of the game, generally divided into *players* and *facilitators*. The role of the players can be defined in a way that gives them permission to act more creatively. For example, Vaajakallio (2012) describes a design game in which “everyone had mixed roles as a sourcer, producer and performer by being allowed and expected to make their own perspective explicit while playing the design game” (Vaajakallio 2012, 187). Different kinds of facilitator roles can be defined to support the interaction of the players. Examples of these supporting roles include “creative secretary” who actively suggests content, and “producer” who directs discussion and combines the other participants’ fragmented pieces into a narration (Vaajakallio 2012, 187).

However, playing a design game involves institutional expectations from within the game and beyond the game. Design games are played for organizational purposes which means that one or more participant is usually oriented toward a professional identity outside of the design game, such as that of an organizational representative. According to Hirvensalo (2015), the participants of knowledge co-creation sessions are often expected to take the role of an organisational representative that corresponds to their organizational identity and act in the interests of their organization. However, the role of organizational representatives is not automatically tied to the company they are employed by but can be the result of representing a managerial level or a specific sub-organization within the same organization (Hirvensalo 2015).
The institutional goals relevant for the institutional roles of the participants are likewise divided. For the players, the relevant institutional goal is to win the game, or because design games are rarely if ever competitive (Vaajakallio and Mattelmäki 2014), reaching a state specified by the game rules. The specified states can involve explicit game goals such as ‘form groups of cards’ (Buur and Soendergaard 2000), or more general design goals that the participants are trying to reach, such as ‘building a future landscape’ (Brandt, Mesters, and Binder 2008). Both game goals and design goals can be used simultaneously, and the design game session can be broken down into smaller tasks involving game goals that cumulate to reach the design goal of the game (e.g. the five steps of Video card game Buur and Soendergaard 2000). Simultaneously, the institutional goal of the organizational representatives is to solve practical problems in their interorganizational collaboration through knowledge co-creation and act in the interest of the organizations they represent (Hirvensalo 2015). The institutional goals relevant to the facilitators are maintaining the institutional frame of the design game activity, and supporting of the players in reaching their goals (Vaajakallio 2012).

In addition to goals, institutional frames create constraints for interaction that determine what actions are appropriate in that institutional frame (Drew and Heritage 1992). While the rules of design games are considered malleable in design games used in co-design, players are expected to follow some explicit game rules. According to Vaajakallio (2012), the underlying purpose of having game rules in the first place is to evoke a playful mindset in the participants. The rules are created and enforced to create the frame of a design game activity, meaning that the pursuit of the design goals is constrained by game rules that prohibit ways to reach the design goals in other means than those allowed by the game rules (Hannula and Harviainen 2016).

The rules of any game are seldom said out loud in their entirety at the beginning of a game. Instead, new players learn the rules through following examples and testing the limits of the rules, and the rules are then constituted when referees and other players enforce the rules (M. H. Goodwin 1995). Similarly, according to Vaajakallio (2012) the rules of design games are implicit when they are in the form of fixed elements that guide action, and explicit when they are written down and given to the participants in printouts.

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7 For example, philosopher Bernard Suits (1978, 36) concludes that “to play a game is to engage in activity directed towards bringing about a specific state of affairs, using only means permitted by rules, where the rules prohibit more efficient in favour of less efficient means, and where such rules are accepted just because they make possible such activity.”
In highly formal knowledge co-creation sessions with dozens of people speaking in turns, interaction is organized into sequences which consist of a facilitator’s question and the participants’ answers (Hirvensalo 2015) similar to how interaction is sequenced between teachers and students in classrooms, and between interviewer and interviewee in television interviews (Drew and Sorjonen 1997, 102). In these institutional frames, facilitators manage speaking rights to help the participants move from one topic to the next, and to encourage behaviour that is beneficial to the process while discouraging detrimental behaviour (Nielsen 2012). Even though all sequences of interaction are co-produced by the participants, a facilitator’s involvement by allocating speaking rights can be very effective in providing structure to the interaction (Cooren et al. 2006, 546; Hirvensalo 2015).

Institutional interaction may involve a special inference that gives a specific institutional significance to action performed within the institutional frame, such as how completing a wedding ceremony results in getting two people legally married (Heritage 2004) or how a court session can sentence people to prison (Drew and Heritage 1992). Similarly, when the participants of a game activity reach the specified goals of the design game and the facilitator acknowledges that the goal of the game is fulfilled, these actions have the special inference that the game has been ‘completed’. Additionally, unsanctioned breaking of the game rules or other disrespectful behaviour may warrant inferences about a participant’s attitudes toward either the design game, design games in general or the design goals of the game because of the professional identities involved in knowledge co-creation (Heritage 2004).

The game activity provides and is constructed in multimodal interaction using interactional resources (see section 3.1) such as culturally recognized game material and other physical artefacts that are used as metacommunication of the design game activity (Goffman 1961; M. H. Goodwin 1995). Game material include playing cards (Vaajakallio 2012, 92), game boards (Hannula, Irrmann, and Smeds 2014) and other artefacts that act as resources for framing the interaction as a game activity (M. H. Goodwin 1995) and separate the game activity from other kinds of knowledge co-creation activities. Similarly, rules of the design game are a resource used by the facilitator to frame the interaction as a game activity and not just designing with game material (Vaajakallio 2012, 224).

The facilitator role also provides the facilitators with culturally recognized forms of institutional talk, such as granting speaking rights, asking questions and provoking reflection. While the specific resources used by facilitators change depending on the practices of the facilitator and the available material environment (Hirvensalo 2015; Cooren et al. 2006), all facilitators use resources to pursue their institutional goal of supporting knowledge co-
creation. In this thesis, each technique described in section 3.4 is considered a resource available to the facilitator because of their institutional role as opposed to individual capabilities, since these techniques are dependent on the institutional frame the interaction takes place in.

Physical artefacts such as sticky notes and whiteboard can be prepared by the facilitators to act as resources for certain kinds of interactions like writing down ideas (Nielsen 2012). In design research, these are sometimes specified as design material that reflect the design context in different forms, such as service evidence (e.g. marketing brochures and contract forms), symbols (e.g. channels such as mobile phone, computer, office, letter, etc.), and pieces of user data in the form of printed stories (Kankainen et al. 2012, 228–29). Regardless of their origin, Vaajakallio (2012, 110) argues that the materials used in design games provide a common design language and opportunities for several interpretations, and provoke verbal and bodily expressions.

The overall structural organization of a design game activity is produced by the players and facilitators by using the game rules of a specific design game. This means that the overall structural organization of playing a design game is highly dependent on the design game in question. However, design games also have some structural similarities that have been alluded to as the “game structure” of playing a design game (Johansson 2006, 8; Vaajakallio 2012, 42; a preliminary definition proposed in Hannula 2014). For example, since all occasions of interaction have normative expectations of an opening and a closing (Robinson 2013), design games similarly use specific sequences of ‘beginning a game’ and ‘ending a game’ that act as metacommunication that a game activity has begun or ended.

The overall structural organization of an individual design game activity can be a result of explicit game rules, such as when the game rules divide the interaction into individual formal ‘moves’ or game turns that players take one after the other (e.g. the concept design games of Habraken and Gross 1988). In addition to explicit game rules, a design game can feature facilitator-defined stages, such as the five steps of Video Card Game, a design game for analysing video data described by Buur and Soendergaard (2000): “Dealing the cards”, “Reading your cards”, “Arranging your hand”, “Collecting card families”, and “Discussing the card families” (Buur and Soendergaard 2000, 3–4). The difference between moves and stages is that moves are short and controlled by the players, while phases are long and transitions between phases is controlled by a facilitator. A design game can also feature both game turns and phases. An example of this would be Topaasia, a game in which players first play a number of rounds in which they play cards from their hands, and then move to a crystallization phase in which there are less restrictions on the interaction (Hannula and Harviainen 2018).
Literature on facilitation has repeatedly highlighted that facilitators manage the overall structural organization of interaction by preparing and communicating an institutionally recognized form of interaction, such as a design game. During a design game activity, the facilitator can influence the emergence of a frame for participation by repeating certain interaction patterns (C. Goodwin and Goodwin 1992) such as drawing and playing cards. As the players recognize the overall structural organization of the interaction, they start to reproduce it themselves. After establishing the overall structural organization, the facilitator can let the participants follow it on their own so the facilitator can contribute to the topic at hand (Johansson 2006, 8). Table 3 summarizes the characteristics of the institutional frame of a design game activity.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>The institutional frame of a design game activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roles</td>
<td>Organizational representatives/players, facilitators</td>
</tr>
<tr>
<td>Goals</td>
<td>Completing the design game, reaching the design goals</td>
</tr>
<tr>
<td>Constraints</td>
<td>Players are expected to follow the explicit game rules. Facilitator may allocate speaking rights.</td>
</tr>
<tr>
<td>Special inferences</td>
<td>Continuing the interaction until the facilitator deems fit to end the game constitutes ‘completing the game’. Breaking the game rules or appearing uncooperative is interpreted by others as rejecting the design game or its design goals.</td>
</tr>
<tr>
<td>Resources</td>
<td>Game material, institutional talk by facilitators, other physical artefacts prepared by facilitators to promote certain kinds of activities, e.g. sticky notes, video cards</td>
</tr>
<tr>
<td>Overall structural organization</td>
<td>A single game activity consisting of an opening, a closing, and possibly several steps or phases in between. The ‘in between’ can be structure with game rules or facilitator-defined phases.</td>
</tr>
</tbody>
</table>

Design games provide a different kind of institutional frame from all other types of knowledge co-creation sessions, such as workshops (Nielsen 2012), co-design gatherings (Vaajakallio 2012, 13), and process simulations (Smeds, Suominen, and Pöyry-Lassila 2014; Hirvensalo 2015). The institutional frame of the design game activity, such as the institutional goals and roles, has been deliberately created by a design game designer (Vaajakallio 2012, 107) with the intention of supporting the knowledge co-creation of the participants through a design game. Whereas in other kinds of knowledge co-creation sessions facilitators can only affect the material environment by setting up sticky notes and other physical artefacts, design games can potentially provide game-specific roles and goals of the participants that support knowledge co-creation.
3.6 Summary

This thesis applies conversation analysis (CA) to expand the theoretical understanding knowledge co-creation as institutional interaction. In CA, interaction is considered as consisting of a sequence of turns-at-talk produced by the participants and interpreted in the context of preceding and following talk. In knowledge co-creation, participants take turns and mobilize multimodal resources to make assessments, and agreement and disagreement about those assessments is established through the sequential organization of assessments.

Compared to everyday interaction between peers, institutional interaction is defined by the presence of an institutional frame of interaction such as classrooms, doctor’s offices and courts of law, where the participants take on institutional roles, orient themselves to institutional goals relevant to their institutional roles, their interaction is constrained by the institutional context, and their actions are interpreted by a special frame of inference specific to that institutional context. The presence of an institutional frame is signalled by metacommunication, physical or spatial markers or acts that set the institutional interaction apart from everyday life.

This thesis defines playing a design game as interaction that takes place within the institutional frame of the design game activity, which is created by interacting according to the game rules and using the game material as resources for producing the design game. A design game activity includes the formal game moves such as drawing and placing cards, but also other interaction between the players, such as facilitation and discussing what moves to take. The rest of the design game session that is not part of the design game activity is left beyond the scope of this thesis to focus the analysis on interaction in one institutional frame.

While playing a design game, the participants take on institutional roles originating from the game rules, such as players and facilitators, and other relevant institutional identities such as organizational representatives, and orient themselves to institutional goals relevant to these identities. Each institutional role orients to different institutional goals: for example, the role of a player is oriented to the goal of completing the design game, and the role of an organizational representative is oriented toward reaching the design goal of the design game. However, the two roles do not rule out each other. A participant who takes on the roles of a player and an organizational representative must orient toward two goals: completing the game while also trying to reach the design goals of the game. If the two goals do not align, there is a potential for conflict. Similarly, a participant taking on a support-
ing role as a facilitator is oriented toward the goal of helping the other participants reach their goals regardless of whether the goals are relevant to their identities as players or representatives.

In a design game activity, the participants accommodate institutional *constraints* of being expected to follow explicit game rules and professional behaviour. Depending on the design game and the number of participants, additional constraints may apply, such as having the facilitators allocate speaking rights or only speaking in turns. Continuing the interaction until the facilitator deems fit to end the game constitutes ‘completing the game’ in the special inferential frame. Breaking the game rules or appearing uncooperative can be interpreted by the other participants as rejecting the design game or the design goals being pursued through the game.

In a design game, participants have access to interactional *resources* specific to the institutional frame. Resources of playing a design game originate from games, such as game rules and game material, and from other contexts, such as non-game-related design material, and the institutional talk of facilitators. Resources have a reciprocal relationship to the institutional frame: the institutional frame of a design game activity makes the resources specific to playing a design game available to the participants, and the participants use those resources that are as metacommunication that the interaction takes place in the institutional frame of a design game activity.

Finally, playing design game involves orientation to and production of an *overall structural organization* of interaction specific to that design game. A single game activity consists of an opening, a closing, and possibly several steps or phases in between. The ‘in between’ can be structured with game rules or facilitator-defined phases.

This chapter has synthesized literature on conversation analysis, institutional interaction, design games and facilitation to describe playing a design game as institutional interaction and to summarize how playing a design game affects interaction within the institutional frame. The next chapter presents a theoretical synthesis that will be applied in the empirical study.
4 Theoretical framework

Based on the literature laid out in the previous chapters, this chapter presents a theoretical framework for knowledge co-creation as a process of offering and accepting distinctions, and how playing a design game affects knowledge co-creation. As the three main areas of literature this thesis draws from – knowledge co-creation, conversation analysis and design games – have not been empirically studied together prior to this thesis, the theoretical framework is presented as a preliminary model preserving as much existing theory as possible while extrapolating the theory to provide theoretical language for the empirical study. The theoretical framework is then used in Chapter 5 to present research questions for the empirical study.

This thesis studies knowledge co-creation as interaction between participants of a design game. In conversation analysis (CA), interaction is considered as consisting of turns-at-talk. Each turn-at-talk is multimodally produced by a participant, and each turn-at-talk is both produced and interpreted in the context of both the preceding and following talk. Each turn-at-talk is interpreted based on the preceding and following interaction, and relationship between turns-at-talk such as assessments is inferred from their positioning and content. (Sacks, Schegloff, and Jefferson 1974).

Following Bereiter (2002), this thesis categorizes objects into three Worlds: World 1 of physical artefacts, World 2 of social actors and their mental states, and World 3 of conceptual artefacts. This thesis defines knowledge co-creation as the creation of distinctions that develop a conceptual artefact in interaction between members to various communities-of-practice. Objects used to support knowledge co-creation are categorized either as physical artefacts in World 1, such as sticky notes, visualizations and design materials, or conceptual artefacts in World 3, such as models, theories and procedures that can be represented using physical artefacts.

Epistemic objects are intangible objects that motivate inquiry across communities-of-practice by their incompleteness (Rheinberger 1997; Knorr Cetina 2001; Nicolini, Mengis, and Swan 2012). Following Bereiter (2002), this thesis defines inquiry as the development of conceptual artefacts, meaning that epistemic objects are a type of conceptual artefacts. Under the assumption that knowledge co-creation is motivated by an epistemic object, this
framework extrapolates that distinctions are made about the epistemic object, meaning the conceptual artefact that the participants want to develop.

According to Tsoukas (2009), distinctions are verbal claims made based on the speaker’s background knowledge. In CA, verbal claims are made with assessments, a type of turn-at-talk in which the participant makes a claim about a referent (Pomerantz 1984). Therefore, this thesis extrapolates that distinctions are created with assessments. Additionally, distinctions are created in interaction by making provisional claims on the condition that they are accepted by the other participants (Tsoukas 2009). As agreement is established by the relative positioning of assessments by different participants (Pomerantz 1984), this framework extrapolates that distinctions are first offered and then accepted by different speakers.

According to Mondada (2007a), interaction is multimodal, i.e. turns-at-talk are produced using multiple modalities such as speech, gesture and positioning, and participants use resources such as physical artefacts and sentence structure to produce talk. According to Pomerantz (1984), assessments are talk so this framework extrapolates that assessments are produced using multimodal resources.

This thesis defines boundary objects as physical artefacts that are meaningful for participants from various communities-of-practice and are used to represent knowledge and create a shared language. According to Carlile (2002; 2004), boundary objects are defined by their interpretive flexibility and ability to represent knowledge across communities-of-practice. According to Knorr Cetina (2001) and Ewenstein and Whyte (2009), aspects of an epistemic object can be instantiated into physical artefacts when they are used as representations, and physically modifying the representations implies changes in the corresponding epistemic object. Therefore, this framework extrapolates that boundary objects are used to offer and accept distinctions about the epistemic object by using them as representations.

Figure 12 visualizes the theoretical framework as a process. In Figure 12, the objects and relationships of the theoretical framework are presented as a process in which participants create distinctions by offering and accepting distinctions via assessments.
In Figure 12, each participant makes an assessment by using various resources for interaction, such as boundary objects, to first offer a distinction and then accept it. Based on the theoretical framework, the offering and accepting of a distinction leads to the creation of a distinction, and a corresponding change takes place in the epistemic object motivating the interaction. However, more understanding is required about how assessments are organized and produced in interaction while playing a design game.

This thesis defines a design game activity as institutional interaction, i.e. interaction in the presence of an institutional frame of interaction where the participants take on institutional roles, orient themselves to institutional goals, accommodate institutional constraints, undertake actions under special inference specific to that institutional context, and have access to interactional resources specific to that institutional frame (Drew and Heritage 1992; C. Goodwin and Goodwin 1992). In the institutional frame of a design game activity specifically, the institutional frame resignifies objects and actions in the interaction as significant for the design game (Waern 2012; Harviainen 2012). This thesis extrapolates that institutional frame design game activity affects the creation of distinctions.

According to Vaajakallio (2012), design games have player and facilitator roles originating from the game rules, and the goal relevant for these roles is the completion of the design game. Additionally, participants may also hold other relevant institutional identities such as organizational representatives (Hirvensalo 2015), and orient themselves to the goal of completing the design goals of the design game. The goal of the facilitators is to support the purpose of the interaction (Phillips and Phillips 1993), so this framework extrapolates that the facilitator role supports knowledge co-creation.
Participants of design games are expected to follow explicit game rules (Vaajakallio 2012). Depending on the design game and the number of participants, additional constraints may apply, such as having the facilitators allocate speaking rights or only speaking in turns (Hirvensalo 2015). The game rules can also be used to create a structure for the interaction (Johansson 2006; Vaajakallio 2012). In addition to the game rules, facilitators also provide structure for the interaction by preparing a recognizable form of interaction (Nielsen 2012). In CA, these structuring activities are described as the *overall structural organization* of interaction (Robinson 2013). Therefore, this framework extrapolates that the *game rules and facilitation together create the institutional frame of a design game activity*, and that the *frame of a design game activity provides an overall structural organization of interaction specific to that design game*.

In institutional interaction, participants have access to interactional *resources* specific to the institutional frame. In a design game activity, resources originate from games, such as game rules and game material, and from other contexts, such as non-game-related design material (Vaajakallio 2012) and the institutional talk of facilitators (Hirvensalo 2015). This framework extrapolates that in *design games, participants use the game material as boundary objects to offer and accept distinctions*.

Figure 13 visualizes the preceding theoretical framework as a *system* where interaction is a relationship between the participants, and the interaction is supported by physical artefacts, social actors, conceptual artefacts and the institutional frame.
In Figure 13, **four kinds of support for knowledge co-creation are extrapolated.** First, the facilitator participates in the interaction with institutional talk and prepares a recognizable overall structural organization to support knowledge co-creation. Second, the boundary objects are physical artefacts that are meaningful for both participants and can be representations of conceptual artefacts such as the epistemic object. Third, the epistemic object is a conceptual artefact that is shared by participants from different communities-of-practice. Fourth, the institutional frame of a design game activity is oriented to and produced by orienting to the roles, goals and constraints of the institutional fame, and the frame affects the interpretation of objects and actions within it.

The process and system perspectives on knowledge co-creation are complementary views to the same theoretical framework that emphasize different perspectives. The process perspective aims to describe how distinctions are created over time and through individual turns-at-talk, while the system perspective visualizes the full set of different actors and supporting elements of a design game in creating distinctions.
5 Research questions

The research problem of this thesis is: “How can design games support knowledge co-creation?”

This thesis defines knowledge co-creation as the development of an epistemic object by offering and accepting distinctions in interaction between members of various communities-of-practice. Knowledge co-creation is supported by boundary objects, facilitation and epistemic objects.

This thesis studies knowledge co-creation that takes place in a design game activity. In a design game activity, the interaction is affected by the participants’ orientation to the roles, goals, constraints, special inference, resources and overall structural organization that originates from the institutional frame of the design game activity. Interaction in the design game session before and after the design game activity, including the design and preparation of the design game, is not within the scope of this thesis.

Based on the theoretical framework, the research problem is reformulated as: “How do boundary objects, facilitation, epistemic object, and the institutional frame of the design game activity affect the offering and accepting of distinctions about an epistemic object in a design game activity?” To expand the theoretical framework and test the extrapolations highlighted in the theoretical framework, the following research questions are used to guide the empirical research:

RQ 1: How are distinctions offered and accepted?
RQ 2: What is the role of the facilitator in offering and accepting distinctions?
RQ 3: How are boundary objects used to offer and accept distinctions?
RQ 4: How does the epistemic object affect offering and accepting distinctions?
RQ 5: What is the effect of the institutional frame of a design game activity on offering and accepting distinctions?

The research questions are used to guide the research process described in Chapter 6. The research questions are answered at the end of Chapter 7.
This chapter describes the empirical study of this thesis. First, the design game ATLAS and the empirical case in which ATLAS is studied are introduced along with a description of how the empirical data was collected. Second, the application of conversation analysis to the empirical data is explained. Third, the analysis process is described as analysis rounds of increasing detailedness. Finally, the way the empirical data is presented.

6.1    Data collection

In this section, the design game ATLAS and the empirical case in which ATLAS is studied are introduced, and an overview of the data is presented. Finally, the presentation of data in this thesis is discussed.

6.1.1   Case: design game ATLAS

ATLAS is a design game that takes the form of a board game used as a tool for co-creating service co-design project plans. This section describes the background, purpose, material and use of ATLAS.

ATLAS has gone through multiple iterations and variations since its creation in 2012, and this section describes the version of the game that was used in gathering the empirical data. Other versions of the game include early phases of development (Hannula, Irrmann, and Smeds 2014; Hannula 2014), the released version of the game material and rules titled “The ATLAS game version 1.0” published online on April 22\textsuperscript{nd}, 2014\footnote{At the time of publication, the game material can be downloaded from http://otsohan-nula.com/atlas}, and other design games based on ATLAS that have since gone on to live their lives in the design practices of different individuals and organizations.

ATLAS the design game was developed in the research project ATLAS – a map for future service co-development from 2012 to 2014 at Aalto University in Finland, funded by Tekes the Finnish Funding Agency for Innovation (Lee et al.
The data for the design of ATLAS stemmed from 13 executed research projects in which co-design and co-creation methods had been used and took influences from other design games the researchers had been in contact with (Vaajakallio 2012). Originally created as a method of involving research project stakeholders in evaluating the findings of the research project, ATLAS was soon identified as a useful tool for co-creating project plans and not just making planning-related concepts tangible.

ATLAS was chosen as the case design game for this thesis because of the author’s familiarity with the game, the availability of appropriate video data for interaction analysis, and preliminary observations that the interaction taking place within sessions of ATLAS consistently featured knowledge co-creation. These preliminary observations were verified during the analysis process to ensure that ATLAS was a suitable design game for studying knowledge co-creation in design games.

The purpose of ATLAS is to help co-create a plan for a service co-design project, meaning a project in which future users and other stakeholders are going to be involved in designing a service using methods originating from design practice (Sanders and Stappers 2008). The project plan is co-created by following the game rules to draw and place ATLAS cards (Figure 14), where each card contains a question or a challenge regarding the project the players are planning. As the players collaboratively answer the questions, they share and create knowledge about the project. The goal is not to co-create the actual service – that will be done during the project – but instead the players choose the most appropriate goals, participants and service co-design methods for the project.

A typical use case for ATLAS is the very beginning of a project when the goals and constraints are not yet clear and a project team can use the game to both plan the project and create shared understanding about the project (Hannula and Irrmann 2016). ATLAS can also be used in design education by using a hypothetical or imaginary setting that the project will be planned in, as opposed to a real-life context where an actual project will be set in.
ATLAS is intended to be played with four to eight participants, of whom one takes the role of a facilitator and the rest take on the role of players. A single session of ATLAS takes from two to three hours in total and is divided into three phases: briefing, game turns, and debriefing. In the briefing, the project’s context is first reviewed and explained in case all participants are not familiar with the context, after which each participant introduces themselves using a set of introductory questions. Once the case and all participants have been introduced, the players take game turns. On each game turn, one card is drawn, answered and placed with the answer on the game board. After a specified time (typically 60 to 90 minutes), the game turns are finished, and debriefing begins. In the debriefing, the participants review the results of the game using four debriefing questions that help summarize the results of the game according to the four categories of cards used. After completing the debriefing, the game session is complete.

ATLAS is played with a set of game material consisting mostly of different kinds of cards, illustrated in Figure 15. In the briefing part of the game, players fill in blue travel tickets (bottom left in Figure 15) which also act as documentation of who participated in the game, what role they saw themselves in, and what their expectations for the game were. Each game turn, the players choose one category of hexagon card that presents the question the players must answer on that game turn (centre). The hexagon cards are either Objective cards used on the first turn to select and write down the goal of the project, or Question cards used to discuss some part of the future project. Both types of hexagon cards provide the players with a shared short-term goal to collaborate on in addition to the session-long goal of co-creating the project plan, and the questions printed on the Question cards provide perspectives informed by service co-design research. Some Question cards ask the players to draw additional cards, either method cards (centre left) or participant cards (top centre). These cards present service co-design methods and participants from which the players must choose the ones that best fit
their project. Finally, the Ending card (top right) is used at the debriefing phase of the session to answer the debriefing questions on it.

Figure 15: A complete set of ATLAS game material from a later iteration of the game.

The purpose of the game material is best explained by describing a streamlined example game turn, illustrated in Figure 16. At the beginning of the turn, the player in turn (i.e. the player whose turn it is) selects a category of hexagonal Question cards. The categories are Project Definition, Participants, Methods & Tools, and Lessons Learned, and the player can choose any category, including categories that were selected on previous turns. Each category is represented by a deck of hexagon cards, each category with their own colour. In the example, the player in turn selects the red Project Definition category and draws a card.
In the example turn of Figure 16, the player in turn selects the category of Project Definition and therefore draws a face-down card from the red Project Definition deck. However, the player does not know which question will be drawn or what questions each category contains so each game turn will have an element of surprise for all participants. After drawing a card, the player in turn reveals the card and reads the text on it aloud for all participants. Each hexagonal card has the same layout as the card in Figure 17: a question or a topic at the top of the card, and usually a brief description of the question or a list of possible answers in the centre. The participants then discuss the question and possible answers freely.
Once the card has been read aloud, the goal of each turn is to agree on an answer to the card. For example, a possible answer to the question “What are you aiming to create or improve?” on the card in Figure 17 might be just selecting one of the alternatives, such as “in this project, we are aiming to improve the service process”. On the other hand, the questions are open-ended, so another possible answer could be “we are going to develop the service process so that it better serves our partners and the general service ecosystem”. The final answer is the result of a dialogue where everyone is expected to tell their perspective, but the player in turn is responsible for writing down an answer that summarizes the discussion. This means that even if the discussion is not completed or there is no consensus on the answer, a summary of the discussion is still written, such as “on one hand we are trying to improve the service ecosystem, but on the other hand it exceeds our project scope”. Documented tensions and contradictions can be resolved later in the game through new insight, or they can remain unresolved at the end of the game, signalling that they need to be resolved outside of the game.

After the discussion on the card has finished and the answer has been written down, the player in turn attaches the answer to the hexagon card and places it on the game board next to a card with an answer that this answer is related to. This step forces the players to consider how the new answer is connected to the answers from previous game turns and helps the players find connections between decisions made on different turns. After the card has been placed, the next clockwise player begins the next game turn. Figure 18 shows what the ATLAS game board looks like at the end of a session in which eight game turns were played and a card placed on each one.

Figure 18: ATLAS game board at the end of a session.
While every game turn follows the same process, the exception is that on the first game turn the players will always take all the green Objective cards, go through them, and select the Objective card that best describes the project’s goals, such as “Embedding customer-oriented culture”. Once an Objective card has been selected, the intended outcome of the project is written on the card, such as “to redesign our hospital’s staff onboarding process”. The selected Objective card and the stated goal of the project are placed at the centre of the game board, and the second game turn begins by selecting the first Question card. The Objective cards are not used after the first game turn.

Once the allocated time has run out, typically after 60 and 90 minutes depending on available time, the game enters the debriefing phase. At the beginning of the debriefing phase, the facilitator takes out Ending card. Each of the questions of the Ending card asks the players to summarize all the answers to one category of Question cards (Project Definition, Participants, Methods & Tools and Lessons Learned) in written form so that the players have a chance to reflect on the answers and provide them with additional written documentation. The Ending card also includes bonus tasks that encourage the players to reflect on their learning during the game.

The debriefing questions presented on the Ending card are:

- What is the goal of the project?
- Who should be involved as participants?
- What methods and tools will be used?
- What lessons should be taken into account?

Two additional bonus tasks are also proposed to help the participants reflect on game experience:

- How has my role evolved through the game play?
- How could we develop today’s learnings further?

At the end of the debriefing, the players have created two physical artefacts that document the process of co-creating the service co-design project plan: the constellation of cards and answers (as seen in Figure 18) and the written answers to the Ending card summarizing the contents of the cards (in the session described in this study the participants used a separate flip chart for writing down the answers to the Ending card). Both can be used to communicate a vision of the future project in themselves, or they can be used as the basis of a more formal project plan.

While during the game the players all share the same goal of applying their knowledge to the best of their abilities to answer the cards and co-create the project plan, one participant takes the role of the facilitator. The facilitator
is responsible for maintaining the flow of the game and help the players have a productive session. If conflicts or disagreements arise within the game, the facilitator can act as a neutral mediator to resolve the situation. Even if the facilitator is more knowledgeable on the topic of service co-design, the facilitator is not supposed to give answers to the players but instead guide them to form their own answers. However, the facilitator can contribute knowledge by explaining concepts in the game material and asking questions that guide the discussion between players.

6.1.2 The studied design game session

The case analysed in this thesis is a single design game session from 2014, in which participants from multiple organizations and backgrounds co-create a project plan using ATLAS, a board game for co-creating service co-design project plans. This section introduces the case background and the participants of the design game session.

The studied design game session was selected as the empirical data of this thesis from seven available recorded sessions of ATLAS. The primary selection criterion for the session was the involvement of two organizations that had expressed interest in executing the project plan that would be created in the game session, whereas the other sessions that had been recorded were not similarly motivated by existing organizations. The secondary selection criteria consisted of sound and image quality of the data, orientation of the participants toward the camera, and the preliminary analysis on whether knowledge co-creation could be observed in the data. Only one session was selected for this thesis to allow for a detailed analysis of the moment-to-moment interaction between the participants, favouring depth of analysis over cross-case verification.

The background of the case was a potential collaboration between two organizations, referred to using pseudonyms Supplier and Customer in this thesis. The Supplier provides different kinds of ICT services including computation for public and private institutions and the Customer is a higher education institution in Finland with both educational and research responsibilities. The session had been organized at the request of company representative who wanted to use ATLAS to design a project with a representative from their customer. The game thus had a financial outcome in the form of a potential project, and all participants had institutional roles either as employees of the case companies or as a service industry professional participating in the game as a learning opportunity – a typical contextual feature separating instrumental gaming from gaming for entertainment or expression.
The motivation of the session was a future project in which the two organizations would collaborate to create a “cloud platform for business analytics education” for a course provided by the Customer based on the Supplier’s current offering. According to a summary presented by a representative of the Supplier at the beginning of the session, challenges for the project planning included selecting the tools and software the analysis platform should have, determining the cost of acquiring the tools and software or whether similar open source solution could be used, and how to customize the Supplier’s modular offering to fit the needs of a higher education course.

The design game session itself was organized as a part of an event organized by Tekes the Finnish Funding Agency for Innovation to promote service research they had funded to industry and academia, including the research project ATLAS. As a part of the event program, all participants of the event were organized into tables of five to seven players and a researcher acting as a facilitator. Each table at the event played a session of ATLAS with a hypothetical case, only the table with representatives of the Supplier and the Customer had a real case to play. The author of this thesis was present at the event to facilitate a table playing ATLAS but did not have any contact with the table studied in this thesis.

The goal of the session analysed in this study was to co-create a plan for the project in which the new cloud platform would be produced. Before the session, a representative of the Supplier organization had contacted the organizers if they could utilize the game to collaborate with the Customer organization, and an agreement was made that the Supplier organization could bring their case into one table at the event. The case had been decided in advance by a stakeholder in the collaboration, and four out of six players were either from the Customer or the Supplier.

In this thesis, project plan and planning a project are used repeatedly to refer to what the participants of the design game were doing. It is important to note that in this thesis the word ‘planning’ refers to the envisioning and debating done by the participants to come to a shared understanding how the service co-design project could be implemented. As such, the result of the planning is not a written project plan, but a shared, future-oriented understanding about the future project as a conceptual artefact shared by the participants.

The session had seven participants: one facilitator and six players (n=7). The three representatives of the Supplier were from the same department responsible for service development and customer interfaces and held positions as an IT team leader (Supplier 1), a senior IT expert (Supplier 2), an IT project manager (Supplier 3). The Customer representative was a senior lecturer in business analytics at the higher education institute (Customer).
Two participants of the event were not affiliated with either of the two organizations but joined the game as a part of the event programming: the CEO of a small local marketing company (Player 1) and a service design student (Player 2). The facilitator was a service design researcher who was a part of the ATLAS research project and one of the designers of the design game ATLAS. The facilitator had also been in contact with the Supplier representatives in arranging the case to be used at the event, and as such was aware of the case in advance but did not have a stake in the collaboration of the two organizations. The set-up of the participants is illustrated in Figure 19.

![Figure 19: Illustration of the game setup in the empirical data.](image)

None of the players had played ATLAS beforehand, which is normal for design games that are usually created for specific contexts. The players produced some design documentation during the design game activity, and time had been reserved at the end of the session to write more shared notes on the project plan. No formal project plan was written during the session, but the facilitator instructed the participants that using ATLAS in the session would help the participants discuss multiple aspects of the project.

### 6.1.3 Collecting the data

The empirical data of this thesis is a video recording of the single interorganizational design game session. The design game session was recorded using a fixed-point video camera pointed at the table, and a connected audio recorder on the table for better audio capture from all participants, including those who faced away from the camera. The complete video recording was 1 hour and 37 minutes in length. The recording began after the preceding piece of seminar programming ended, and continued until the end of the
event, including the debriefing of the game and the closing words of the seminar.

The author of this thesis was present at the site when the ATLAS session took place, participated in designing the design game ATLAS used in the session, participated in setting up the video and audio recording equipment and was aware of the organizations that participated in the session analysed in this thesis. However, the author did not have any contact with the organizations or individuals involved in the session, did not influence the selection of the facilitator, or otherwise affect the proceeding of the session. The author has not been in contact with the people featured in the video data or the organizations they represent to maintain impartiality in analysing the interaction featured in the data.

Informed consent of the participants was acquired in two steps. First, informed consent of the participating organizations by the researchers of the ATLAS project by agreeing with the participating organizations that they would be able to bring their case to the open industry event that the ALTAS sessions would be played at, in exchange for being video recorded for research purposes in a way that did not name the organizations or divulge trade secrets. Second, informed consent of all potential participants that elected to sit at the table was acquired by telling them that sitting at that table would result in them being video recorded, and that the recordings could be used by the research groups for research and teaching purposes in a way that maintained the anonymity of the participants. The potential participants were also provided with the option of sitting at a table that was not video recorded.

Written consent of the participants was not pursued because the researchers interpreted the event the session took place in to be a public space where implied consent was adequate after the potential participants were informed that recording would take place, that appearing in the recording was voluntary, and how the recording would be used. Once the verbal consent of all participants was acquired, the video recording was started.

In the analysis, identities of the participant were anonymized at all steps of transcription by using pseudonyms of the participants and organizations. The faces of all participants except the researcher facilitating the interaction were blurred as a part of the process of saving individual frames for publishing. Copies of the video recordings are kept on secure devices and are accessible only by those with permission to use the data in accordance with the original expression of consent.
6.2 Conversation analysis as a research method

This thesis applies conversation analysis (CA) as a research method for analysing interaction. CA is an approach to studying interaction as a process between two or more participants of a conversation, in which talk is produced by participants speaking in response to prior talk in an orderly and sequential fashion. While CA is not suitable for all research questions, it is well-suited for studying the orderliness of spontaneous naturally occurring social interaction among both laypeople and professionals. (Stivers and Sidnell 2013).

CA builds on theoretical assumptions regarding the phenomenon of human interaction. In CA, the practices and procedures used by participants to both produce and recognize actions are “ethnomethods” that are stable over time and can be a field of scientific research. Participants interpret what is happening in an interaction one step at a time while constantly updating their interpretations based on the reactions following any action. (Heritage 2009). Participants produce and understand social action holistically, simultaneously taking into consideration multiple types of context and orders of interaction, such as word selection, turn-taking, repair, preference organizations, sequence organizations and overall structural organizations (Robinson 2013).

Based on the foundational conception of how interaction is produced, CA aims to provide structural descriptions of interaction. Different contexts of interaction, such as games, can be understood by observing how a basic action-reaction-feedback structure is spontaneously performed by competent participants, and what different kinds of exceptions tell us about the interaction (Heritage 2009).

It is important that the specific interactions that are analysed by CA are examples of naturally occurring or spontaneous speech, i.e. the way that actual people interact with each other when unobserved and the interaction would have taken place even without the intervention of the researchers. The reason for excluding contrived interaction is that in these situations the participants are not following the naturally learned social order of interaction they use in everyday interactions, but instead follow specific structures of that contrived interaction. For example, a staged interaction between a researcher and the participant of a laboratory experiment measuring heart rate when talking to strangers is not spontaneous. However, the interaction between the same participant and the same researcher is spontaneous in the moments that are not part of the experiment and not written in advance, such as when greeting participants on arrival or when discussing the experiment with participants after it has ended. (Heritage 2009).
Data collection and analysis

CA uses detailed transcriptions as the object of analysis so that turns and order can be clearly observed from the data. By recognizing actions, reaction and feedback in the transcription, the structure of an interaction can be identified and compared to existing theory. (Stivers and Sidnell 2013) To discover the natural living order of social activities, CA researchers make audio and video recordings of interactions as they happen in favour of methods that are susceptible to after-the-fact reconstruction, such as introspection, interviews and field notes of participant observation (Mondada 2013).

Research using the CA method utilizes an inductive analysis process of noticing patterns in the data to understand a specific interaction. The findings of CA studies are generalizable to theory instead of making empirical generalizations about how often or with which likelihood an event will take place (Raevaara 2016).

This thesis applies CA in two ways. First, this thesis uses the CA theory of interaction in the theoretical framework to define interaction as the object of analysis (see Chapter 3). Second, conversation analytical practices of describing the data are used to analyze the empirical data and to justify the theoretical explanations. The author does not claim that all interpretations of the data made in this thesis are correct just because CA theory and research method has been used. Instead, this thesis clearly presents the data along with the author's theoretical explanation to convince the reader of the author's reasoning process (Ketokivi and Mantere 2010).

6.3 Data analysis

The analysis process of this thesis was informed by two complementary approaches to conducting interaction analysis. Primarily, the analysis of the data followed the research practices of conversation analysis, described in section 6.2. Secondarily, the analysis process was informed by the qualitative video analysis process described by Christian Heath, Jon Hindmarsh and Paul Luff (2010). The decision to use the video analysis process to inform the analysis process of this thesis was based on similar successful studies which combined the video analysis process with applying conversation analysis as a research method (Hirvensalo 2015; Kohonen-Aho 2017). This section uses the three analysis rounds of the video analysis process to narrate the analysis process: preliminary review, substantive review, and analytical review.

6.3.1 First round: Cataloguing the video data

The first round of analysis, the preliminary review, consisted of watching and making notes of the entire video data, and cataloguing the contents of the video to a content log (Heath, Hindmarsh, and Luff 2010, 62). The goal of the
preliminary review was to understand and document the structure of the design game session so that further rounds of analysis could focus on theoretically interesting sections of the data. In addition to the video data, the preliminary review was based on a pre-existing understanding of the intended structure of an ATLAS design game session, where playing the game would be preceded with an introductory part, after which the participant would play the game for a fixed amount of time before moving to a debriefing part. The content log is presented on Table 4.

Table 4: Content log of the video data.

<table>
<thead>
<tr>
<th>Time (h:mm:ss)</th>
<th>Duration (mm:ss)</th>
<th>Part</th>
<th>Step</th>
</tr>
</thead>
<tbody>
<tr>
<td>0:00:00</td>
<td>02:30</td>
<td>Briefing</td>
<td>Introducing the two case stakeholder organizations: a large ICT platform provider and a public educational institute</td>
</tr>
<tr>
<td>0:02:30</td>
<td>06:30</td>
<td></td>
<td>Reading the case aloud</td>
</tr>
<tr>
<td>0:09:00</td>
<td>03:28</td>
<td></td>
<td>Introducing ATLAS</td>
</tr>
<tr>
<td>0:12:28</td>
<td>01:55</td>
<td></td>
<td>Filling in the player sheets</td>
</tr>
<tr>
<td>0:14:23</td>
<td>08:27</td>
<td></td>
<td>Introducing the participants</td>
</tr>
<tr>
<td>0:22:50</td>
<td>06:14</td>
<td>Design game activity</td>
<td>Game turn 1 of selecting an Objective card and writing down the objective of the project</td>
</tr>
<tr>
<td>0:29:04</td>
<td>43:56</td>
<td></td>
<td>Game turns 2-7</td>
</tr>
<tr>
<td>1:13:00</td>
<td>15:51</td>
<td>Debriefing</td>
<td>Documenting begins</td>
</tr>
<tr>
<td>1:28:51</td>
<td>08:58</td>
<td></td>
<td>The game ends, each table shares some experiences from playing the game</td>
</tr>
<tr>
<td>1:37:49</td>
<td></td>
<td></td>
<td>Recording ends</td>
</tr>
</tbody>
</table>

The first part consisted of introducing the two organizations involved in the project being planned, the context for co-creating the project plan, ATLAS as a design game, and finally the participants and their respective backgrounds. This part, before starting to interact in accordance with the game rules, was named as briefing in the analysis as it laid out a shared basis for the participants to collaborate over.

After the participants were introduced, the facilitator declared that they would start playing, and the participants proceeded to take the first game turn. The first game turn was distinct from the other game turns that followed in that it consisted of selecting an Objective card from several available Objective cards and writing on it the objective of the project. On the other game turns, one player at a time chose a category of cards and drawing a card without knowing what the question on it would be. All game turns were grouped into a design game activity because the interaction during the
Data collection and analysis

game turns was regulated by the game rules of ATLAS, such as whose turn it was, and what question they were currently discussing.

After the design game activity, the facilitator declared that the time was running out and that they still had one more part of the design game session left in which they would collect and write down the collective understanding created during the game. While the design game had not explicitly ended, the interaction was no longer regulated by the game rules. The participants wrote documentation about the project they had planned on a large piece of paper while discussing some of the topics that arose during the game. The documentation continued until the master of ceremonies of the entire event called attention to have the different tables share their experiences playing ATLAS at the event. Each table shared some experiences from playing ATLAS, and the recording ended. This last part was named de-briefing because the interaction consisted of working on the results of the design game.

6.3.2 Second round: Overall structural organization

The second round of analysis, the substantive review, consisted of identifying events and phenomena that were of interest in the video (Heath, Hindmarsh, and Luff 2010, 64). The goal of the substantive review was to identify events that were relevant for the study of knowledge co-creation in the design game activity.

Guided by the research questions, the design game activity part of the video data (from 02:20 to 1:28:51) was selected for further analysis. The design game activity represented institutional interaction in accordance with the game rules and game material, and further analysis was focused on the design game activity.

In the design game activity, the participants selected an objective for their project and developed the project plan further from a different perspective on each game turn. However, because the participants discussed a different card on every game turn and therefore a different topic, each game turn was an independent encounter that had its own beginning, middle and end. Each game turn was first analysed independently to identify which cards were used, which topics were discussed, and what conclusions were reached on each game turn. Based on the analysis, a second content log named game turn log was created to provide additional granularity to the structure of the video data. The game turns are presented as a game turn log in Table 5.
Table 5: Game turn log of the video data.

<table>
<thead>
<tr>
<th>Game turn</th>
<th>Time (h:mm:ss)</th>
<th>Duration (mm:ss)</th>
<th>Card category and text</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0:22:50</td>
<td>06:14</td>
<td>Objective: Enabling a collaborative platform for various partners</td>
<td>“to create a platform with and for multiple partners”</td>
</tr>
<tr>
<td>2</td>
<td>0:29:04</td>
<td>08:36</td>
<td>Participants: What is the motivation of the participant?</td>
<td>“A lot of users who have easy access to the proper analysis environment with different data and needs.”</td>
</tr>
<tr>
<td>3</td>
<td>0:37:40</td>
<td>08:26</td>
<td>Methods and Tools: Take 5 method cards. How could those be employed in your project?</td>
<td>“[Customer journey] can be used to figure out where the story is to be focused because we can go through a larger field” “We can have the story which covers three [customer journeys]. Someone is studying, then goes to the University to work as a researcher, and then it goes to a company as a super researcher. You kind of have one story, but all the three [customer journeys]” (Personas, customer journey and storytelling)</td>
</tr>
<tr>
<td>4</td>
<td>0:46:06</td>
<td>03:09</td>
<td>Project definition: Where are you in the process?</td>
<td>We are making a prototype with real data and real students</td>
</tr>
<tr>
<td>5</td>
<td>0:49:15</td>
<td>05:25</td>
<td>Project definition: What level are you developing?</td>
<td>Service platform, even a service ecosystem. Platform by the service provider, users from the university, tools from companies. Nothing is stopping private companies from joining in.</td>
</tr>
<tr>
<td>6</td>
<td>0:54:40</td>
<td>11:59</td>
<td>Lessons learned: How do you analyse user data?</td>
<td>Course feedback, workshop, final seminar.</td>
</tr>
<tr>
<td>7</td>
<td>1:06:39</td>
<td>04:54</td>
<td>Methods and tools: What data gathering events are you planning?</td>
<td>Collaborative and single sessions. For example, three different user groups who will go through the service journey and think how it would ideally go. Complement with interviews. Students give good ideas. The courses cannot be too</td>
</tr>
</tbody>
</table>
The game turn log details the question on each Question card drawn and the answer the participants reached by the end of the game turn. Individual game turns were tied together into the single design game activity by moments of transition where a game turn ended, and a new game turn began. On game turn 7, near the end of the design game activity, the facilitator left the table for 1 minute 3 seconds ‘to check at which stage the other tables were’. During that time the players discussed what they thought of the game, not furthering the goals of the game or talking about the project they were planning, and the game turn was resumed after the pause. The pause was excluded from further analysis.

Each game turn followed a sequence of events implied in the game rules. First, one or more cards were selected, introduced and discussed. Second, an answer to the game material was agreed upon. Third, an answer was written down and placed with the card on the game board, and the relationship between the card and other cards from previous game turns was addressed. These three distinct phases had separate goals and focuses of attention, and they are referred to in this thesis as Setup, Collaborate and Materialize phases. The structure of the game activity including the phases and their durations is presented in Table 6.
Table 6: Game turn log with phases.

<table>
<thead>
<tr>
<th>Game turn</th>
<th>Phase</th>
<th>Time (h:mm:ss)</th>
<th>Duration (mm:ss)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Setup</td>
<td>0:22:50</td>
<td>02:02</td>
</tr>
<tr>
<td></td>
<td>Collaborate</td>
<td>0:24:52</td>
<td>02:00</td>
</tr>
<tr>
<td></td>
<td>Materialize</td>
<td>0:26:52</td>
<td>02:10</td>
</tr>
<tr>
<td>2</td>
<td>Setup</td>
<td>0:29:03</td>
<td>01:04</td>
</tr>
<tr>
<td></td>
<td>Collaborate</td>
<td>0:30:08</td>
<td>04:41</td>
</tr>
<tr>
<td></td>
<td>Materialize</td>
<td>0:34:49</td>
<td>02:37</td>
</tr>
<tr>
<td>3</td>
<td>Setup</td>
<td>0:37:38</td>
<td>03:04</td>
</tr>
<tr>
<td></td>
<td>Collaborate</td>
<td>0:40:42</td>
<td>04:11</td>
</tr>
<tr>
<td></td>
<td>Materialize</td>
<td>0:45:01</td>
<td>00:31</td>
</tr>
<tr>
<td>4</td>
<td>Setup</td>
<td>0:45:32</td>
<td>01:23</td>
</tr>
<tr>
<td></td>
<td>Collaborate</td>
<td>0:46:58</td>
<td>01:10</td>
</tr>
<tr>
<td></td>
<td>Materialize</td>
<td>0:48:10</td>
<td>01:00</td>
</tr>
<tr>
<td>5</td>
<td>Setup</td>
<td>0:49:15</td>
<td>01:08</td>
</tr>
<tr>
<td></td>
<td>Collaborate</td>
<td>0:50:03</td>
<td>01:54</td>
</tr>
<tr>
<td></td>
<td>Materialize</td>
<td>0:52:00</td>
<td>01:49</td>
</tr>
<tr>
<td>6</td>
<td>Setup</td>
<td>0:53:59</td>
<td>01:26</td>
</tr>
<tr>
<td></td>
<td>Collaborate</td>
<td>0:55:49</td>
<td>09:40</td>
</tr>
<tr>
<td></td>
<td>Materialize</td>
<td>1:05:30</td>
<td>01:04</td>
</tr>
<tr>
<td>7</td>
<td>Setup</td>
<td>1:06:36</td>
<td>00:29</td>
</tr>
<tr>
<td></td>
<td>Collaborate</td>
<td>1:07:30</td>
<td>02:32</td>
</tr>
<tr>
<td></td>
<td>Materialize</td>
<td>1:10:04</td>
<td>00:25</td>
</tr>
<tr>
<td></td>
<td>(Pause)</td>
<td>1:10:29</td>
<td>01:03</td>
</tr>
<tr>
<td></td>
<td>Materialize</td>
<td>1:11:32</td>
<td>01:15</td>
</tr>
</tbody>
</table>

At the end of the Materialize phase of game turn 7, the facilitator declared that the time was running out and guided the participants to the debriefing part of the design game session, and the design game activity ended.

The structure of the design game activity observed in the data corresponded to the concept of overall structural organization in CA, referring to the order of events and actions in a single interaction that divide it into distinct encounters (Robinson 2013). This means that the seven game turns formed the overall structural organization of the game activity, and that the three phases – Setup, Collaborate and Materialize – formed the overall structural organization of each game turn. In both cases, ‘overall structural organization’
means the order in which the interaction was expected to take place – on the levels of design game activity and game turn, respectively.

All seven game turns were analysed and transcribed at an approximate turn-at-talk level based on the multimodal contents (i.e. speech, bodily interaction and the use of physical artefacts) of the video data. This high-level transcription was used as a support for analysing the video data so that events relevant for more detailed analysis could be identified. The high-level transcription was improved over the course of the substantive review as the author gained more insight to the significance of different elements of interaction taking place on the video data. At the end of the empirical study, the high-level transcription consisted of 1310 lines of interaction, some lines consisting of multiple turns-at-talk in cases such as overlapping speech or interruptions.

Guided by the research questions, instances of participants making assessments (Pomerantz 1984) about the project they were planning were identified as significant for the knowledge co-creation taking place in the design game activity. With the help of the high-level transcription, 156 instances of participants making assessments were identified. Based on the theoretical framework, these instances were interpreted as participants offering distinctions. At the end of the substantive review, all 156 instances were selected for further analysis.

6.3.3 Third round: Detailed conversation analysis

In the third round of data analysis, the analytical review, relevant events were compared to each other to make observations on how events differed from one another (Heath, Hindmarsh, and Luff 2010, 65). The objective of the analytical review was to make observations that could be used to develop the theoretical framework (Heath, Hindmarsh, and Luff 2010, 66).

In conversation analysis, the unit of analysis is the turn-at-talk (Sacks, Schegloff, and Jefferson 1974) where the meaning of a turn-at-talk is inferred from both its contents and its relationship to other turns-at-talk. This means that to figure out the full meaning of a turn-at-talk, one has to take in consideration the preceding conversation that forms the context (Tsoukas 2009), and the following talk that determined how the turn-at-talk was interpreted by the other participants and re-evaluated by the speaker (Gergen, Barrett, and Gergen 2004, 12). To account for the sequentially of interaction, the 156 individual turns-at-talk were analysed in the context of their immediately preceding and following interaction, forming 156 sequences each consisting of multiple turns-at-talk. Because many of the offers immediately followed each other in the data, some sequences overlapped in part but were regardless each analysed as separate sequences.
The sequences involving the offering of distinctions were compared to each other to create a taxonomy of sequences relevant for knowledge co-creation. Over the course of the analytical review, a total of 45 sequences were made into multimodal transcriptions based on their ability to illustrate the different types of turns-at-talk identified in the analysis (M. H. Goodwin 1995; C. Goodwin 2000; C. Goodwin and Goodwin 1992; Mondada 2007b; 2012b). Based on CA practice, transcriptions were produced as sequentially organized turns-at-talk, with overlapping speech represented as such in the transcription. All transcriptions were produced in the language used by the participants: mostly Finnish with a few cases where the participants read cards aloud in English.

The transcribing of the sequences was followed by multiple rounds of conversation analysis comparing the sequences with each other, reviewing the literature, and further refining the theoretical framework to make the inference to the best explanation (Ketokivi and Mantere 2010). First, a sequence was selected from the video data as a theoretically interesting event that illustrated how participants made assessments to co-create knowledge. Second, the sequence was transcribed into an excerpt using multimodal CA notation which included dividing the talk into sequentially organized turns-at-talk and transcribing relevant speech and bodily interaction (Mondada 2016). Third, based on the theoretical framework, the content of the assessments – and therefore what distinctions were offered – was inferred by the author. Fourth, a theoretical explanation was produced that would develop knowledge co-creation theory while conserving as much theory as possible.

Based on the analysis, a taxonomy of knowledge co-creation sequences was created which classified separate ways of offering distinctions, different responses that decided whether the offered distinction was created, and what kinds of earlier talk prompted offers. Because only some of the offers led to the creation of distinctions, sequences were also organized into productive and non-productive on the assumption that more distinctions led to more knowledge being co-created, which in turn was in alignment with the goals of the design game session. Guided by the research questions, the taxonomy of knowledge co-creation sequences was refined to account for the role of facilitation, boundary objects, epistemic object, and the design game’s institutional frame. The taxonomy of knowledge co-creation sequences and the resulting answers to the research question are presented in Chapter 7.

6.4 Presenting data in this thesis

Consistent with previous CA studies, this thesis presents data in excerpts, short pieces of transcription detailing one or more turns-at-talk. As the video recording cannot fully be presented within a static visual medium, the creation and presentation of transcripts is always a conscious act in which
the author highlights some aspects while omitting others – each excerpt is presented with the intention of presenting the inference process of the author with as few distraction as possible without misrepresenting the original video data.

Excerpts are presented in a way that preserves the anonymity of the players, the organizations they represent, and some of the details of the project being discussed. No facial expressions were used in the analysis because of the incompleteness of facial expressions in the recording, resulting from the orientation of the participants in relation to the video camera. For consistency in writing and tracking speakers in the pictures, gendered pronouns are used to refer to the participants.

Multimodal transcription consists mostly of tracking gestures in relation to speech, but also body positioning, eye contact and interaction with the material environment. In these parts, the actions taken by the participants are matched with the original Finnish transcription for accuracy but spacing and word choices are used to also match the English translation when possible.

For example, in the following excerpt presented on Table 7, row 1 consists of three lines: the gesture on top, followed by the Finnish transcription of speech, followed by an English translation provided by the author. All inference in this thesis is based on the original Finnish transcription, and the English transcription is presented for accessibility to the inference process. Finally, a theoretical interpretation of the turn-at-talk is presented on the right hand marginal to provide transparency to the inductive reasoning of the author.
Table 7: An example of multimodal transcription.

<table>
<thead>
<tr>
<th>Row</th>
<th>Speaker</th>
<th>Speech and actions</th>
<th>Theoretical explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>S1</td>
<td>*(POINTS AT OBJECTIVE CARDS) Mitens uudet ideat? How about new ideas?</td>
<td>Offer: offering a distinction</td>
</tr>
</tbody>
</table>

In the example, the action “points at Objective card” is transcribed as starting with the word “uudet” to reflect the context in which the combination of speech, gesture and positioning was interpreted by the author. The action is also consciously matched with the word “new” in the English translation by using the direct translation of the Finnish word “uudet” used in the same position. Furthermore, an image from the video data is presented and a circle is used to highlight the part of the image that is relevant for the transcription.

The full transcription notation used in this thesis is presented below:

(0.7) a pause in talk and its length in seconds
(.) a pause in talk less than 0.3 seconds
[] overlap in talk begins
] overlap in talk ends
= talk immediately continues after previous speaker
*(ACTION) non-speech action, * marks the approximate starting point of the action in relation to speech
. hh inhalation
hh exhalation
↑ ↓ raising and lowering speech
○ silent speech
hhehh, hihhh laughter
SUPPLIER1 names of the participants and organizations are replaced with capitalized pseudonyms
(continues) a turn-at-talk continues after overlapping talk
Empirical findings

This chapter presents the findings of this thesis describing knowledge co-creation, the game structure, and their connection in the studied design game activity. Section 7.1 begins by describing the general structure of knowledge co-creation sequences consisting of three types of turns-at-talk: offers, responses, and a new type of turn-at-talk, prompts. These types of turns-at-talk are described in detail along with variations in sections 7.2, 7.3 and 7.4. Section 7.5 then describes the game structure of interaction provided by the design game ATLAS, and section 7.6 maps the relationship between knowledge co-creation and the game structure of the studied design game. Notable deviations from the game structure are presented in section 7.7. At the end of the chapter, a summary of the findings is presented as answers to the research questions in section 7.8.

7.1 Structure of a knowledge co-creation sequence

Knowledge co-creation is defined in this thesis as interaction where participants create distinctions about an epistemic object. The result of knowledge co-creation is a developed epistemic object that is relevant for the participants. A total of 156 knowledge co-creation sequences were observed during the design game activity.

In the design game analysed in this thesis, the epistemic object being developed was the service co-design project which would be implemented by the Supplier and Customer organizations. The project was a shared referent for the participants when they used constructs such as “there are” or “it is” in their assessments. These constructs were variably used to refer to the service, the platform, the project context and/or the activities that would be taken during the project. As such, the project was not a formal or explicit project plan, but instead intangible idea of the project in the process of becoming, i.e. the epistemic object that was developed by creating new distinctions about it.

In the design game activity, a distinction was created whenever a participant made an assessment about the project i.e. offered a distinction, and another participant responded with agreement, i.e. accepted the distinction. If the offer was not followed by agreement, a distinction was not created and thus that
Empirical findings

offer did not result in change in the epistemic object. Some distinctions were preceded by a third type of turn-at-talk, a *prompt*. Prompts were turns-at-talk that the offers responded to, such as questions. Together the possible prompt, the offer, and the response formed a *sequence of knowledge co-creation* in which a distinction was either created and thus the epistemic object was changed based on the distinction, or not. The structure of a knowledge co-creation sequence is visualized in Figure 20.

![Figure 20: The structure of a knowledge co-creation sequence.](image)

Excerpt 1 shows a very simple sequence comprised of a prompt, an offer and an agreement. In Excerpt 1, Player 2 (P2) accepted an earlier distinction offered by Supplier 1 (S1), prompting Supplier 1 to offer the distinction that the users of the service could be both students and researchers. Player 2 (P2) agreed with the offer, thereby accepting the distinction. In this thesis, both the video data and the preliminary transcription of the entire video data were used to conclude *what was assessed* in each turn-at-talk, described in right hand marginal of each excerpt.⁹

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⁹ The contents of the assessments in this work have been determined by the author and presented for the reader alongside the appropriate transcripts. Inference of the content of assessments is based on the understanding that both the author and the reader are competent speakers that can decipher the contents of assessments if provided the appropriate context. This approach follows the lead of prior conversation analysts that have taken the content of assessments into account as due course for studying interaction (e.g. Pomerantz 1978; 1984; Ten Have 2007, 4–5; Schegloff 2007, 123; Hutchby and Wooffitt 2008, 47).
Excerpt 1: Knowledge co-creation sequence consisting of a prompt, an offer and an agreement (game turn 6).

[0:58:55 - 0:59:01]

<table>
<thead>
<tr>
<th>Turn</th>
<th>Player</th>
<th>Turn-at-talk</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>P2</td>
<td>Molemmat. Both.</td>
</tr>
<tr>
<td>2</td>
<td>S1</td>
<td>Itse asiassa käyttäjä voi olla opiskelija, Actually the user can be a student,</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>tai miksei- miksei tutkija, jos se on or why- why not a researcher, if they have</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>kursseilla tottunut tähän ympäristöön= on the course gotten used to the environment=</td>
</tr>
<tr>
<td>5</td>
<td>P2</td>
<td>=joo =yes</td>
</tr>
</tbody>
</table>

**Prompt:** accepting an earlier distinction Supplier 1 made

**Offer:** offering a distinction about student and researcher users of the service

**Agreement:** accepting the distinction

First, Player 2’s turn-at-talk did not contribute to the creation of the distinction in Excerpt 1 (row 1). Instead, Player 2’s turn-at-talk provided an opportunity for Supplier 1 to offer a distinction in response to the prompt. Because the turn-at-talk included an assessment that was new, i.e. an assessment with the same claim had not been previously made, and concerned the project as the epistemic object, it constituted offering a distinction. The offered distinction was that students and researchers, who had so far been discussed as separate user groups, could be the same people if some students become researchers (rows 2-4). Finally, Player 2 agreed with the distinction, thereby accepting it (row 5).

The inference from Excerpt 1 is that after Supplier 1 had offered the distinction that ‘a user can be either a student, or a researcher who has gotten used to the environment’ (rows 2 to 4) and Player 2 had accepted the distinction (row 5), the participants agreed that this assessment about the project was true. This in turn meant that a distinction was created, and the content of the distinction was considered a decided part of the project. The epistemic object was changed through interaction, meaning that knowledge had been co-created. Figure 21 visualizes the excerpt, how each of the three turns-at-talk contributed to the epistemic object i.e. the project, and how the epistemic object was changed.

---

10 Note that to be considered new for the interaction, the assessment does not have to be new for the speaker. The object of analysis in this thesis is the interaction, not individual cognition.
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Figure 21: Creating a distinction in Excerpt 1.

Figure 21 shows that the prompt, the offer and the agreement followed each other in Excerpt 1. First, Player 2 prompts Supplier 1, which itself does not add anything to the epistemic object. The project as an epistemic object is visualized as a metaphorical cloud in Figure 21 because the epistemic object is considered to be a single object that is shared by the participants even though it is not physically present (Knorr Cetina 2001). In the visualization, the epistemic object is compared to a shared ‘thought bubble’ used media like comics. Second, Player 2’s offer is a proposed addition to the project, shown as adding a note representing the distinction. The blue colour of the note represents the tentative nature of the offered assessment: before the response, the distinction is only Supplier 1’s offer and not yet an agreed part of the epistemic object. Finally, Player 2’s agreement accepts the distinction, making the distinction a part of the epistemic object. This is visualized as making the distinction green, marking it as a taken-for-granted part of the shared epistemic object.

In summary, the epistemic object was developed in the design game activity by creating distinctions. Distinctions were created when the participants offered and accepted distinctions with assessments about the project. When an offer was proceeded by a prompt, the offer was formed as responses to
the prompt, meaning that the prompt helped another participant offer a distinction. Because the participants were members of different communities-of-practice, knowledge was *co-created* by offering and accepting distinctions.

### 7.2 Variations on offering distinctions

Offering a distinction was the necessary condition for creating distinctions as each distinction had to be offered by a participant before it could be accepted and become a part of the project. This section addresses some key variations on how and by whom distinctions were offered.

#### 7.2.1 Offering distinctions with game material

In this thesis, the content of distinctions is inferred from speech with the assumption that the participants expressed the distinctions verbally (Tsoukas 2009). However, in some cases the participants used game material in addition to speech to offer distinctions. Individual pieces of game material were used to represent different choices, topics and perspectives which were brought into the conversation by touching, naming and pointing at the game material. A total of 14 offers using the game material were observed during the design game activity.

Excerpt 2 shows how the participants used Objective cards as physical artefacts and as texts to offer distinctions through touch and naming. In Excerpt 2, the participants were trying to decide which Objective card to select as the objective of the project. Supplier 3 (S3) first touched an Objective card to offer a distinction to Customer (C). Player 2 (P2) then asked which card she was referring to, and after answering the question, Supplier 3 offered a second distinction using the text on the same Objective card.
Excerpt 2: Offering a distinction with the game material (game turn 1).

[0:24:49 – 0:25:15]

1 S3 *(TOUCHES CARD) Insinöö, insinöörimäisestä näkökulmasta From an eng, engineer-like perspective

2 *(TURNS TO C) *(TAPS CARD) olis kauhean helppo valita it would be be terribly easy to choose [tämä ] [this ]

3 C [hhehhe]

4 S3 kos[ka ] because

5 P2 [Mikä] se oli?= [What] was it?=

6 S3 =tämä enabling =this enabling

7 [collaborative (.) platforms for various partners] [collaborative (.) platforms for various partners]

8 P2 [Mmmh]

9 S3 *(TAPS CARD) *(TAPS CARD) eli tää, hm, niinku yhteistyö, meaning this, hm, like collaboration,

10 oh alusta, joka palvelee (.). useita eri (.). tahoja. um platform, which serves (..) multiple (..) parties.

In the beginning of Excerpt 2, Supplier 3 offered the distinction that the objective of the project should be ‘Enabling collaborative platforms for various parties’ (rows 1 to 4). While Supplier 3 did not verbally make such an assessment, Facilitator had tasked the players to select one of the Objective cards, and the Objective cards had been read out aloud when they were placed on the table earlier on that game turn. In this context, Supplier 3 offered the distinction while touching the Objective card, signalling that she was offering the distinction regarding that card specifically, and used of the word “this” (row 2) when touching to card to further emphasize the connection between what she was assessing and the Objective card.
However, since Supplier 3’s distinction was using an Objective card that was not visible to some of the participants, Player 2 initiated a repair sequence by interrupting Supplier 3 and asking her to name the Objective card she was making the distinction with (row 5). A repair sequence is a common feature of interaction where a speaker is either asked to clarify or self-initiates clarification themselves on missing information about their prior talk (Sacks, Schegloff, and Jefferson 1974). The initiation of the repair by Player 2 about which card Supplier 3 was referring to is interpreted by the author to show that it was important to Player 2 to know which card was being used before responding to the offer. This repair sequence further highlights that the Objective card played a crucial part in forming and understanding the distinction being offered. Supplier 3 self-repaired her offer by reading the text on the card, filling in that the previous offer had referred to this specific Objective card (rows 6 and 8). The repair was acknowledged by Player 2 (row 7) and the embedded repair sequence ended.

After completing the repair sequence, Supplier 3 offered a second, more elaborate distinction (rows 9 and 10). Again, Supplier 3 made the assessment while tapping and naming the card, emphasizing that she was still talking about the same card. In addition to connecting the distinction to the card, Supplier 3 offered the distinction as a continuation of the card text, moving from the text on the card she read aloud as a self-repair (rows 6 and 7) to offer a distinction. The distinction she offered was that “collaborative platforms for various partners” should be the objective of the project because they were creating a collaborative platform that was expected to serve multiple parties (rows 9 and 10). This essentially made the card a part of the distinction being offered because the card text and the concepts presented in it were inseparable parts of offering the distinction. The game material thus enabled Supplier 3 to offer a distinction she would not have otherwise been able to offer.

The entire sequence, including the embedder repair sequence, is visualized in Figure 22.
In Figure 22, the Objective card was used by Supplier 3 in turns-at-talk Offer, Self-repair and Offer 2. All three turns-at-talk used the game material...
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through both speech and gesture to either offer a distinction or perform a self-repair. The use of game material in offers demonstrates how the game material enabled the participants to utilize the different choices, topics and perspectives represented in the game material by touching, naming and pointing the game material.

In summary, the pieces of game material such as Objective cards were used to offer distinctions that utilized ideas represented in the game material. When using the game material, the participants used the words and concepts represented by the game material to offer distinctions they otherwise could not have.

7.2.2 Recalling distinctions with the game material

In addition to using the words and concepts represented by the game material, the participants also used the game material to refer to specific distinctions offered earlier in the game. After a participant had associated a piece of game material with a distinction by using the piece to offer the distinction, participants could later call back to that distinction by using the corresponding piece of game material. This recalling then further reinforced the connection between the distinctions and the game material. A total of 6 offers recalling distinctions with game material were observed during the design game activity.

Excerpt 3 shows how the participants recalled a distinction offered earlier in the game by using the Objective card associated with that distinction. In the excerpt, Supplier 2 (S2) and Supplier 3 (S3) were able to call back to the earlier discussion on ‘Enabling collaborative platforms for various parties’ by gesturing at the Objective card used in that excerpt.
Excerpt 3: Recalling a distinction with the game material (game turn 1).

[0:26:01 – 0:26:11]

1 S1 *(HOLDS THE CARD)
[Nii vai onks tää, mikä] mikä [SUPPLIER3] sano
[Yeah or is this, what ] what [SUPPLIER3] said

2 S3 [Mitäs siellä nyt sit ] [nii ]
[What’s there now ] [yeah ]

3 F [Mm[m!]]

4 S3 *(POINTS AT THE OBJECTIVE CARD)
[Toi,] toi nyt oli aika niinku semmonen insinöörin
[That,] that was like from an engineering-like

5 näkökulmasta [aika ]
perspective [pretty ]

6 F [Mm[ ]]

7 S3 suora[vii]vainen
straightforward

8 C [Mm ]

Prompt: recalling a distinction using the Objective card

Offer: re-offering the recalled distinction using the Objective card

First, Supplier 1 prompted Supplier 3 to re-offer the earlier distinction that the objective of the project should be “enabling collaborative platforms for various parties” by recalling the offer through verbal and physical references to the Objective card (row 1). Because the distinction had not been accepted the first time it was offered, Supplier 1’s suggestion was not positioned as an offer but as a prompt for Supplier 3 to re-offer the distinction. As such, both Supplier 1 and Supplier 3 participated in recalling the earlier offer.

Second, Supplier 3 responded to the prompt by re-offering the same distinction as earlier in the interaction, reiterating the grounds of “engineer-like” and “straightforward” for the selection (rows 4, 5, and 7). Again, the distinction was offered while pointing at the card, using the card to connect the offered distinction with it and to recall the earlier discussion. The prompt and the offer are visualized in Figure 23.

11 Names of the participants are replaced with capitalized pseudonyms in speech, e.g. Supplier 3’s name is replaced with SUPPLIER3 to mark the replaced name.
Figure 23: Recalling an offered a distinction with the game material in Excerpt 3.

Figure 23 highlights that the Objective card was used to recall a prior offer in both turns-at-talk. Supplier 1’s prompt involves holding the Question card that Supplier 3 had offered a distinction with and referring to the previously offered distinction (“what SUPPLIER3 said”, row 1). During this turn-at-talk, the distinction offered earlier is visualized as a blue distinction since it had been offered but never accepted. After the prompt, Supplier 3 re-offered the same distinction as earlier that “collaborative platforms for various partners” should be the objective of the project. In both turns-at-talk, the same Objective card was used to tie each assessment to each other and to the earlier conversation that Supplier 3 had offered the distinction in the first place. As neither the prompt or the offer could have been possible without the Objective card, the association between the offered distinction and the Objective card is visualized as a green arrow for both turns-at-talk in Figure 23.

The participants also used the game material to recall distinctions that had been accepted and integrated into the epistemic object. Excerpt 4 shows how Supplier (S2) was able to offer a new distinction about the relationship of two cards by recalling the distinction that the objective of the project was to create a platform.
Excerpt 4: Prompting with the game material (game turn 5).

[0:48:49 – 0:49:06]

1  F *(TOUCHES CARD)  
   Milläs tavalla se littyis tähän? (4.5)  
   In what way is it connected to this? (4.5)

2  S2  
   No siinähän lukee tuottaa alusta yhteistyölle, 
   Well it says create a platform for collaboration
   niin sitähän täytyy ihan käytännössä kokeilla. 
   so then you must try it out in practice.

3  

In Excerpt 4, Facilitator first prompted Supplier 2 to offer a distinction on how the Question card he was holding was related to the Objective card already on the table (row 1). Both Facilitator and Supplier 2 were standing and leaning over the centre of the table where the cards had been placed next to each other, and Facilitator touched the Objective card as she referred to the Question card with “this”. After an extended silence, during which it is assumed by the author that Supplier 2 read the text on the Objective card, Supplier 2 offered the distinction that the project would involve trying out the platform for collaboration in practice (rows 2 and 3). When offering the distinction, Supplier 2 was both sitting up next to the cards and verbally referred to the objective card with “Well it does say create a platform for collaboration”, recalling the previous distinctions offered and accepted related to the Objective card.

Figure 24 visualizes the two turns-at-talk and that the Objective card was used in them.
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7.2.3 Distinctions offered by the facilitator

During the game activity, the participants took two distinct roles: the players and the facilitator. Facilitator was responsible for maintaining the game.
activity by describing the rules and helping the players create distinctions, in contrast to the players who followed the game rules and created distinctions. However, Facilitator also participated in creating distinction by making offers and accepting distinctions just like the players did. A total of 35 offers made by the facilitator were observed during the design game activity.

Excerpt 5 shows how Facilitator (F) accepted the distinctions offered by Supplier 1 (S1) and Supplier 3 (S3), and offered a distinction of her own.

**Excerpt 5: Facilitator participated in creating distinctions (game turn 5).**

![Excerpt 5](https://example.com/excerpt5.png)

The interaction between Facilitator and the players in Excerpt 5 did not differ from the interaction between players: all participants similarly offered and accepted distinctions. First, Supplier 1 offered a distinction (rows 1 to 9) during which Facilitator and Supplier 3 responded with agreement (rows 4, 6 and 8). Second, Facilitator offered a distinction of her own (row 10), showing the active role of Facilitator in contributing to the creation of distinctions. Supplier 3 responded a third offer (row 11), and finally Facilitator accepted the distinction offered by Supplier 3 (row 12). The role of each participant in creating distinctions is visualized in Figure 25.
Figure 25: Facilitator participates in the creation of distinctions in Excerpt 5.

Figure 25 illustrates that Facilitator actively offered and accepted distinction. First, Supplier 1 offers a distinction that is accepted by Facilitator, who then offers a distinction of her own. Supplier 3 then offers a third distinction, which is finally accepted by Facilitator.

In summary, Facilitator participated in offering and accepting distinction in the same way as the other participants. As such, the actions of Facilitator
cannot be analytically separated from the knowledge co-creation process of the players – all participants took an active role in the creation of distinctions. As a result, Facilitator is considered as a full participant of the knowledge co-creation that took place in the design game activity who had a distinct role compared to the players.

7.3 **Responses to offered distinctions**

Once a distinction was offered, the responses of the other participants determined whether the distinction was accepted or not. Four types of responses were observed in the data. Agreement and elaborating responses were positioned as agreement with the offered distinctions, thereby accepting it to create a new distinction. Conversely, rejecting and ignoring responses were positioned as disagreement, leaving the distinction unacceptable which did not result in the creation of distinction.

7.3.1 **Agreement**

Agreement responses were defined by the presence of an explicit approval or the previous speaker’s offer such as “okay”, “yes” or “exactly”. In terms of assessment pairs, the agreement response was positioned as a same or upgrade type of agreement that aligned with the offered distinction (Pomerantz 1984, see also section 3.1.2 for the full range of possible assessment pairs). If an offer was immediately followed by an agreement, all other responses to that offer were also agreements, and the offered distinction was considered true for the rest of the design game activity. As such, offered distinctions that were followed by an agreement response created distinctions and developed the epistemic object. A total of 44 agreement responses were observed during the design game activity.

Excerpt 6 shows an example of an agreement response. In Excerpt 6, Customer (C) responded to Supplier 2’s (S2) offer first with acknowledgement and then with agreement.
Excerpt 6: Offer with an agreement response (game turn 1).

[0:26:24 - 0:26:41]

1 S2 to C Jos vaan öö, onko teille ajatuksena If umm, is it for you as a thought
   eli jos sen pukee sanoaksi [oik] so if I put it into words  [rig]

2 C [Mm ]

3 S2 ookoo että siis jos tässä kehitetään (0.5)
   tietty tapa toimia (. ) niin (0.4)
   [ANO]THER INSITITUTION12 saattais sit[ten]
   [ANO]THER INSITITUTION might [then]

4 C [Mm ]

5 S2 käyttää samaa tapaa [toim]ia
   use the same way of [wor]king

6 C [joo]
   [yes]

7 C *(NODS THREE TIMES)

10 S2 niin oisko se teidän puolesta ok?
   then would that be okay from your side?

11 C * (NODS THREE TIMES)
row 9, Supplier 2 still completed the full extended turn-at-talk to verify what Customer was saying (row 10). Finally, Customer agreed one last time, maintaining that the distinction had indeed been accepted (row 11). After the excerpt, Facilitator acknowledged the exchange and Supplier 3 continued with an elaboration of the offered distinction.

Because Supplier 2’s turns-at-talk amount to a single proposal and Customer agrees with it, the sequence can be simplified into a single offer that had a single response. The sequence is visualized in Figure 26.

Figure 26: Agreeing with an offer in Excerpt 6.

Figure 26 presents the knowledge co-creation sequence as Supplier 2’s offered distinction, visualized as an orange note conditionally added to the epistemic object. The offer is followed by Customer's agreement which transforms the orange offered distinction into an accepted distinction that is green to signify that the distinction is an accepted part of the epistemic object. After the distinction has been accepted by at least one participant, it is considered an accepted part of the epistemic object.

In summary, offers were accepted by agreement responses where a participant explicitly agreed with an offered distinction. After a participant responded with agreement, the distinction was created and became an accepted part of the epistemic object.
7.3.2 Changing the epistemic object through distinctions

The distinctions the participants created over the course of the design game activity changed the epistemic object – in the case studied in this thesis, the project. After a distinction had been offered and accepted by at least one other participant, all participants talked about the project as if the previously created distinction was true. This resulted in changes to the epistemic object to accumulate over the course of the design game activity.

Excerpt 7 presents an example of Supplier 2 (S2) offering a distinction on the last game turn, game turn 7. The distinction concerns the project’s participants and methods in a way that implies that the distinctions from earlier in the game were assumed to be true by the speaker.

**Excerpt 7:** Offering a distinction that builds on prior distinctions (game turn 7).

[1:08:17 - 1:08:46]

<table>
<thead>
<tr>
<th>1</th>
<th>S2</th>
<th>Esimerkkinä, öö, vaikkapa tota... kolme eri...</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td></td>
<td>käyttäjäryhmää, opettaja kautta professori,</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>oö, tota opiskelija, tai tutkija, niin um, a student or a researcher, then</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>käydä... Öö tota, jokaisen näiden kanssa go through, umm, with each of them</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>heidän polkunsä ikäänkuin läpi, et miten se their path like through, that how they</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>kuivittelis että tää saattais olla, ja would imagine that this could be, and</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>käyttäis ehkä sitä tulevaisuuden näkökulmaa maybe use the future perspective in it so</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>siinä et jos tää polku olis täydellinen. that what if this path would be perfect.</td>
</tr>
</tbody>
</table>

The distinction offered in Excerpt 7 by Supplier 2 was that the project should include three user groups – teacher/professors, students and researchers – and engage in future recall to find out how their customer journeys would be perfect (rows 1 to 8). This distinction was based on the distinctions from the earlier game turns which included coming up with the three user groups, discussing future recall and customer journey mapping as methods for the project, and making distinctions on how the user groups should be involved in the project using these methods. The distinctions are summarized on Table 8 with relevant parts of the distinctions underlined for emphasis.
Table 8: Distinctions utilized in Excerpt 7.

<table>
<thead>
<tr>
<th>Time (h:mm:ss)</th>
<th>Game turn</th>
<th>Participant who offered the distinction</th>
<th>Distinction</th>
</tr>
</thead>
<tbody>
<tr>
<td>0:30:46</td>
<td>2 Supplier 2</td>
<td></td>
<td>The future users of the service include teacher/professors, students and researchers, who may overlap over time.</td>
</tr>
<tr>
<td>0:38:37</td>
<td>3 Facilitator</td>
<td></td>
<td>Future recall is a method in which participants jump into the future and think which steps they took to get to that future.</td>
</tr>
<tr>
<td>0:39:01</td>
<td>3 Facilitator</td>
<td></td>
<td>Customer journey is a method that is used to describe the steps a customer takes over the course of interacting with the service.</td>
</tr>
<tr>
<td>0:40:48</td>
<td>3 Supplier 1</td>
<td></td>
<td>The journey of one researcher or student will be mapped out.</td>
</tr>
<tr>
<td>0:40:53</td>
<td>3 Player 1</td>
<td></td>
<td>Journeys of multiple users will be mapped out.</td>
</tr>
<tr>
<td>0:40:54</td>
<td>3 Supplier 2</td>
<td></td>
<td>Users whose journeys will be mapped out will be as different as possible from each other.</td>
</tr>
<tr>
<td>0:42:07</td>
<td>3 Player 1</td>
<td></td>
<td>Customer journey is a method that should be involved.</td>
</tr>
<tr>
<td>0:42:07</td>
<td>3 Player 1</td>
<td></td>
<td>Customer journeys should be used in the project.</td>
</tr>
<tr>
<td>0:42:24</td>
<td>3 Player 2</td>
<td></td>
<td>Journeys should describe different use cases and not just one person.</td>
</tr>
<tr>
<td>0:44:02</td>
<td>3 Facilitator</td>
<td></td>
<td>It is challenging to form a customer journey for a service which does not exist yet.</td>
</tr>
<tr>
<td>0:44:10</td>
<td>3 Supplier 1</td>
<td></td>
<td>Narratives are a way of describing a vision of the service as it could be.</td>
</tr>
<tr>
<td>0:45:25</td>
<td>3 Supplier 1</td>
<td></td>
<td>The project could use narratives that cover three scenarios: studying, becoming a university researcher, and joining a company to become a super researcher.</td>
</tr>
</tbody>
</table>

Table 8 presents the distinctions that Supplier 2 utilized in Excerpt 7, meaning that every distinction on Table 8 had been offered and accepted on the earlier game turns. This shows that distinctions developed the epistemic object incrementally, with each distinction modifying or adding some part to the epistemic object so that further interaction could assume the previously created distinctions to hold true. This accumulation of distinctions is visualized in Figure 27.
Figure 27: Offering a distinction that builds on previous distinctions in Excerpt 7.

In Figure 27, Supplier 2 offers a distinction that builds on top of all the related distinctions created in the earlier game turns, listed on Table 8. The earlier distinctions are visualized a group of green distinctions that have already become part of the shared epistemic object, and the new distinction is added to the epistemic object. At the end of the game, all the created distinctions have become part of the cumulative result of knowledge co-creation in the design game.

In summary, distinctions that were created during the design game became part of the epistemic object, and later distinctions were offered with the assumption that the earlier distinctions were true. Once distinctions were created, new distinctions could build on top of the distinction created earlier in the design game, incrementally developing the epistemic object further.

7.3.3 Elaboration

In some situations, offering a distinction was followed by a second offer that built on top of the first offer. An elaboration response incorporated an offered distinction as a premise into the second distinction, thereby both accepting the first offer and offering a new distinction for the other participants to accept. Elaboration responses played a key role in the knowledge co-creation in the design game since they resulted in multiple distinctions being offered and accepted. A total of 78 elaboration responses were observed during the design game activity.

In the absence of a fitting term in the available literature, this analysis calls this ‘yes and’ response an elaboration of the offer, inspired by Schegloff’s (2007, 65) “elaboration” as the category of accounts, excuses, disclaimers and hedges.
Excerpt 8 shows how Supplier 1 (S1) offered a distinction about involving a researcher or a course attendee as a potential user of the service. Player 1 (P1) responded with elaboration by offering a second distinction that several users could be involved, to which Supplier 1 responded with agreement.

**Excerpt 8:** An offer with an elaboration response and an agreement response (game turn 3).

[0:40:48 - 0:40:56]

1. S1: Eli siis, kuvaisimme yhden tämmösen tutkijan  
   So then we would map one researcher
2. P1: tai kurssilaisen, joka niinku tätä kautta  
   or course attendee, who like in this way
3. P1: Tai useampia=  
   Or several=
4. S1: Tai useam[pia, joo.  
   =Or seve[ral, yes.

In Excerpt 8, Supplier 1 offered a distinction (rows 1 and 2) which was followed by elaboration (row 3). Although the elaboration may at first seem like disagreement since it presents an alternative “or several”, the rest of the sequence treats it as an offer that not only should the project include one mapping either a researcher or a course attendee, but several of them. In this sense, the elaboration was in alignment with the first offer and therefore formed an agreement (Pomerantz 1984). The distinction that the project should include mapping several users was both separate from the first offer and assumed that the first offered distinction was true. As a result, Player 1 did not just agree with the first offer but instead built on top of it to offer a more elaborate second offer.

After Player 1’s elaboration, Supplier 1 responded with agreement (row 4). This last assessment in the third position (Schegloff 2007) represents the third step, re-evaluation, in the double interactant (Weick 1979). In the re-evaluation, Supplier 1 had an opportunity to clarify or correct his first offer based on Player 1’s response. In this third turn, Supplier 1 could have corrected having been misheard or misinterpreted by initiating a repair sequence (like in Excerpt 2 on page 99). In the absence of such a correction, Supplier 1 left the interpretation of his first assessment implied by Player 1’s second assessment standing and agreed with Customer’s elaboration. Figure 28 visualizes the role of each of the three turns-at-talk.
First, Supplier 1 offers a distinction. Player 1 responds with elaboration that offers a second distinction that implies that the first distinction is accepted. Finally, Supplier 1 responds with agreement, accepting the distinction offered in the elaboration. At the end of the sequence, both offered distinctions have been accepted and so two distinctions have been created in the span of three turns-at-talk.

In summary, offers were sometimes followed by another offer when participants responded with elaboration. In elaboration, a participant responded by offering a new distinction that built on top of the previous distinction, thereby both accepting the preceding distinction and offering a new one.

### 7.3.4 Rejection

Not every distinction that was offered was accepted by the other participants. In some sequences, the response following an offered distinction was positioned as a disagreement or a partial agreement. The result of the unaligned response was that the distinction was rejected, and no distinction was
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created based on the offer. A total of 9 rejection responses were observed during the design game activity.

Excerpt 9 shows how Supplier 1 (S1) made a distinction that the service can be used by corporate users in addition to students and researchers. This distinction is acknowledged by Customer (C) but rejected by Player 2 (P2).

**Excerpt 9:** An offer with a rejection response (game turn 6).

```plaintext
[0:59:01 - 0:59:18]

1 S1 miksei jos se menee yritysmaailmaan niin
why not if they go to the private sector then
why wouldn’t they be a corporate user like

2 miksei se olisi yrityskäyttäjä sitten tota
why wouldn’t they be a corporate user like

3 C Mm, niin
Mm, yeah

4 P2 Mietin vaan sitä niin et jos mä olisin yrityksessä
I was just thinking that if I was at a company
then I don’t know what would come out of it

5 niin mä en tiedä mitä sieltä tulisi ulos,
then I don’t know what would come out of it

6 mikä kaavio ja miten mikäkin tulkinta,
what kind of a chart and what interpretations,

7 miten se loppukäyttä- oikea, ihan viimeinen
how would the end use- real, really final

8 loppukäyttäjä niinku, et sielt ei tuu vaan numeroita
end user like, so there wouldn’t just be numbers

9 ja sit, sit itse ainakin olisin ihan pihalla
and then, then I would myself be really confused
```

Excerpt 9 shows that disagreeing with an offer constitutes rejecting the offered distinction. The offer that there corporate users are similar to academic users (rows 1 and 2) and the following response related to the needs of corporate users (rows 4 to 9) did not align, and as such they formed a disagreement (Pomerantz 1984). More specifically, Player 2 argued that a corporate user like herself might not be able to use the results of the service and therefore should not be equated with student and researcher users. The disagreement was constructed by providing additional information and experiences that contradicted the offer, similar to the way people preface or delay their disagreeing second assessments in everyday conversation, trying to soften the blow or not stating the disagreement explicitly (Pomerantz 1984). The sequence is visualized in Figure 29.
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Figure 29: Rejecting an offered distinction in Excerpt 9.

In Figure 29, Supplier 1 offers a distinction, but Player 2 rejects the distinction. As such, the offered distinction is not accepted, and the distinction is not created. The dismissal of the rejected distinction is visualized as a red cross on top of the offered distinction, as opposed to an accepted distinction turning green.

In summary, responses that contradicted or opposed offers rejected the offered distinctions, resulting in no distinctions being created.

7.3.5 Ignoring

In addition to outright rejection, another way the participants disagreed with offered distinctions was to ignore them. If an offer was just acknowledged and not agreed with or elaborated, the distinction was left hanging without being accepted. Some offered distinction were re-offered later in the design game activity but for the purposes of the following interaction, the distinction was not considered to be true. A total of 25 ignoring responses were observed during the design game activity.

In Excerpt 10, Supplier 1 (S1) offered a distinction about the involvement of a network in the pilot phase of the project but Customer (C) ignored the distinction and changed the topic instead.
Excerpt 10: An offer with an ignoring response (game turn 2).

[0:36:20 – 0:36:32]

Offer: offering a distinction about an example network of organizations

Acknowledgement

Prompt: asking Supplier 3 a question while ignoring the previous offer

In Excerpt 10, Supplier 1 offers a distinction that the project should involve an example network (rows 1 to 10). Customer acknowledges the offer multiple times with short continuers (rows 2, 5, 7, 9 and 11) but the offer is not followed by agreement or elaboration. Instead, Customer changes the topic by prompting Supplier 3 to offer a distinction about open data, and the following interaction continues the new topic. As such, the distinction offered by Supplier 1 is left unaccepted. The sequence is visualized in Figure 30.
In Figure 30, Supplier 1 offers a distinction, but the following turn-at-talk does not accept it. Instead the next speaker, Customer, addresses a third participant, Supplier 3. As the distinction offered by Supplier 1 is not accepted, it does not lead to the creation of a distinction and does not change the epistemic object. The ignoring of the distinction is visualized as a red cross over the distinction as it has the same outcome as rejecting the offer.

In summary, the creation of distinctions requires that offered distinctions are accepted by the other participants. If the next speaker ignored an offered distinction, the distinction was not accepted and did not change the epistemic object. These options are presented in Figure 31.
Figure 31: Responses to offered distinctions in knowledge co-creation sequences.

Figure 31 visualizes the four different types of responses to offers found in the empirical analysis, and their contribution to the epistemic object. The backward arrow from elaboration response represents the way each elaboration response also offered an additional distinction which had its own response and possible contribution.

7.4 Prompts for offering distinctions

Prompts were a type of turn-at-talk separate from offers and responses. Every time a participant made an offer in response to another participant’s turn-at-talk, the first turn-at-talk was categorized as a prompt. Examples of prompts included questions that invited offering distinctions as answers, and assessments that invited elaboration from the other participants.

7.4.1 Input-seeking questions

During the design game activity, the players prompted each other for distinctions by asking directed questions to get another player’s input on a topic. These input-seeking questions created openings for players who were not active in the conversation to offer distinctions as answers to the input-seeking questions. A total of 6 input-seeking questions that were followed by an offer were observed during the design game activity.

Excerpt 11 shows how Supplier 3 (S3) interrupted Supplier 2 (S2) to ask an input-seeking question from Customer (C), who had not offered any distinctions about the topic of gathering analysing data in the project. In response, Customer offered a distinction.
Excerpt 11: An input-seeking question as a prompt (game turn 6).

[0:56:20 - 0:56:01]

1 S2 to F No siis mehän (0.5) ollaan samaa mieltä
   Well we do (0.5) agree on
   että toi (0.5) hhh noinniinku
   that (0.5) hhh well like

3 S3 to C *(WAVES HAND AT GAME BOARD)*
   No mi-miten, [miten sää näet tämän?]
   Well ho-how, [how do you see this?]

4 S2 [ihan ensimmäisenä]
   [first of all]

5 C Mm, joo no jos ajatellaan toisiaan niitten
   MM, yes well if we now think about the
   opiskelijoiden näkökulmaa niin toisiaan
   students’ perspective then we do have a
   meillä on kurssipalautelomake ja sitten
   course feedback form and then there’s,
   on, voidaan nykyään myös saada myös
   nowadays we can also get with
   tällasilla hh verkkokeskustelumenetelmillä
   these hh online conversation methods
   sitä palautetta henkilökohtaisesti
   get feedback personally

At the beginning of Excerpt 11, Supplier 2 began to offer a distinction to Facilitator (rows 1, 2 and 4) until he was interrupted by Supplier 3’s input-seeking question to Customer (row 3). The input-seeking question was addressed directly to Customer, prompting Customer to offer a distinction. To answer the question, Customer offered a distinction about the currently available ways of gathering feedback from students at the Customer organization (rows 5 to 9). The sequence is visualized in Figure 32.
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Figure 32: Prompting an offer with an input-seeking question in Excerpt 11.

Figure 32 shows how Supplier 2 first offers a distinction to Facilitator until he is interrupted by Supplier 3. Supplier 3’s prompt is not a response to Supplier 2 but a completely new opening that ignores the distinction Supplier 2 is offering. The prompt is directed at Customer, who responds by making Offer 2, offering a new distinction unrelated to the distinction offered in Offer 1. The input-seeking question is therefore used to prompt a distinction from a specific participant – in this case, Customer, while also being an ignore type response to Offer 1.

In summary, players used input-seeking questions to prompt offers from another player, giving them an opening to offer a distinction. Input-seeking questions were also used to change topic, even in the middle of another participant’s turn-at-talk.
7.4.2 Clarifying questions

While the players of the design game activity prompted distinctions with direct input-seeking questions, Facilitator asked the players *clarifying questions*. Clarifying questions were addressed to one or more players to prompt the players to offer further distinctions about the topic they were discussing. The players responded to clarifying questions by offering a new distinction to answer the clarifying question. A total of 22 clarifying questions that were followed by an offer were observed during the design game activity.

Excerpt 12 shows how Facilitator (F) asked a clarifying question from Supplier 1 (S1), eliciting him to talk about the role of the Supplier organization in the project. The clarifying question then led to Supplier 1 offering a distinction that Supplier 3 (S3) further elaborated.
**Excerpt 12: A clarifying question as a prompt (game turn 5).**

[0:51:26 – 0:51:48]

1. S1 kaupallinen [part]neri tuottais tänne, jollain commercial [part]ner would be brough here, in some
2. F [joo ] [yes ]
3. S1 tavalla ja se olis niinku monen, m-monen tutkijan tai, way and it would be, available to many researchers or,
4. tai käyttäjän käytössä, elikkä siis (. ) or to users, so then (. )
5. se olis silloin selkeä partneri tässä, tässä, niiku it would then be a clear partner in this, this, like
6. C Mm
7. F Mikä [olis silloin teidän rooli? What [would then be yo]ur role?
8. S1 [palvelukonseptissa] [service concept ]
9. (1.5)
10. S1 Meiltä tulis se alusta ja, ikäänku We would bring the platform and, sort of (1.0)
11. CUSTOMER tulis se, se käyttäjäkunta ja tämä (. ) the users would come from CUSTOMER and this (. )
12. partne[ri tuottais sen työ]kalun partne[r would produce the] tool
13. F [Kolmas °osapuoli° ] [Third °party° ]
14. S1 sin[ne ] the[re ]
15. F [Joo] [Yes ]
16. S1 ta[i jos] or[ if ]
17. S3 [Joo ] [Yes ]
18. S1 [sitten] [then ]
19. F [Teillä] [olis tallennustila ja ] [You ] [would have storage and]
20. S3 [Eli olisimme yksi eko]systeemin jäsenistä [So we would be a member of the ecosystem

**Offer 1:** Supplier 1 offers a distinction that the platform could have a commercial analysis tool partner

**Prompt:** Facilitator asks a clarifying question to provoke a distinction

**Pause**

**Offer 2:** offering a distinction about the ecosystem roles of Supplier, Customer and a third party

**Agreement:** Facilitator accepts the distinctions of Offer 1 and Offer 2

**Agreement:** Supplier 3 accepts the distinctions of Offer 1 and Offer 2

**Offer 3:** Facilitator begins to offer a distinction

**Offer 4:** Supplier 3 offers a distinction by elaborating Offer 2

In Excerpt 12, Supplier 1 offers the distinction that the analysis platform would have an analysis tool vendor (rows 1 to 8). The offer was punctuated by the acknowledgements of Facilitator and Customer (rows 2 and 6). In response to Offer 1, Facilitator asked a clarifying question from Supplier 1, prompting Supplier 1 to offer a distinction about the intended role of the Supplier organization (row 7). After a pause of 1.5 seconds (row 15), Supplier 1 responded with Offer 2 that the Supplier organization would provide the
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platform while Customer organization would provide users and a partner would provide the analysis tool (rows 10 to 14). Facilitator responded to Offer 2 by acknowledging Supplier 1’s offer (row 13) and then accepting the distinction (row 15). In response to Offer 2, Supplier 3 also joined in to accept the distinction (row 17) and just as Facilitator began to offer a distinction (row 19), offered a distinction as an elaboration of Offer 2 (row 20).

The clarifying question in was used to elicit talk (Nielsen 2012) from Supplier 1 about the topic selected by Facilitator: the role of the Supplier organization. For the creation of distinctions, the clarifying questions had two outcomes. First, the immediate effect of the clarifying question was to have Supplier 1 offer a new distinction in addition to the one he had already offered. Second, the new distinction offered by Supplier 1 provided an opportunity for Supplier 3 to offer an additional distinction by elaborating the second offer. Both outcomes resulted in new distinctions being offered, providing new opportunities to create distinctions.

The three-step process consisting of initial offer, clarifying question, offering a distinction and elaboration is visualized in Figure 33. Agreements and Facilitator’s Offer 3 are omitted to highlight Offer 2 and Offer 4 as outcomes of asking the clarifying question.
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Figure 33 visualizes how the clarifying question is used by Facilitator to elicit more distinctions from the players. The clarifying question does not accept the distinction of Offer 1, but instead prompts Supplier 1 to offer a second distinction that builds on top of the distinction of Offer 1. This is visualized in Figure 33 as Offer 2 offering a second orange distinction on top of the one offered in Offer 1. Offer 2 then creates an opportunity for Supplier 3 to make Offer 4 by elaborating Offer 2, thereby also accepting the two distinctions offered by Supplier 1.
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This positioning suggests that by asking a question which did not offer any distinctions, Facilitator was able to prompt new distinctions both in the form of the answer to the clarifying question (Offer 2) and the following elaboration of the answer (Offer 4). Because Facilitator was the one to ask the clarifying questions, the questions were also a way of selecting topics of discussion that Facilitator wanted to be addressed.

In summary, Facilitator asked clarifying questions to prompt the players to offer further distinctions. The answers to these clarifying questions could then prompt further distinctions through elaboration of the offers.

7.4.3 Game tasks

During the design game activity, Facilitator was responsible for ensuring that the game progressed, and game rules were followed. As the design game activity progressed through multiple game turns, Facilitator was able to prompt offers by giving or reminding players about a task they were expected to do in the design game. A total of 5 game tasks that were followed by an offer were observed during the design game activity.

Excerpt 13 shows how Facilitator (F) instructed the players to complete the game task of addressing the connection between the Question card they had answered on that game turn, and the Questions cards from previous turns already on the table. The game task then acted as a prompt for offers by Supplier 1 (S1) and Supplier 2 (S2).

Excerpt 13: A game task as a prompt (game turn 4).

[0:48:10 - 0:48:30]

1 F Okei. (1.0) Miten se kytkeytys näihin (0.5) Okay. (1.0) How would it connect to (0.5)
2 kortteihin täällä pöydässä? Eli pilotoidaan these cards here on the table? So piloting
3 (2.0) tosielämässä oikeilla käyttäjillä. (2.0) in real life with real users.

4 S1 User-kortti ainakin User card at least

5 S2 *(TOUCHES GAME BOARD) Joo, tähän näin. Yes, right here.

6 F [Mjoo ] [Myes ]

First, Facilitator asked the players how the Question card they had answered was connected to the ones already on the table, briefly summarizing
the main topics discussed during the game turn (rows 1 to 3). In response to the game task, Supplier 1 offered the distinction that the current Question card was related to the blue Participants card already on the table (row 4). Supplier 2 agreed with Supplier 1, further elaborating a specific position on the game board by pointing at it (row 5). Finally, Facilitator agreed with the offers (row 6). The sequence is visualized in Figure 34.

Figure 34: Prompting multiple offers with a game task in Excerpt 13.
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Figure 34 visualizes how the game task prompted Offer 1 from Supplier 1 which was further elaborated by Supplier 2 in Offer 2. The prompt, Offer 1 and Offer 2 were offered using the game material, highlighting that the game task specifically concerned the relationships between individual cards.

Facilitator did not always have to give the complete game task as in Excerpt 13, instead only alluding that a specific game task was due. Excerpt 14 shows how Facilitator’s (F) statement that Supplier 3 (S3) ‘has the card’ functioned as a prompt for Supplier 3 to offer a distinction by introducing her written answer to the Question card.

**Excerpt 14:** Referring to a game task as a prompt (game turn 6).

[1:05:30 – 1:05:54]

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>F</td>
<td>Okei, SUPPLIER3:lla on kortti. Okay, SUPPLIER3 has the card.</td>
</tr>
<tr>
<td>2</td>
<td>S3</td>
<td>Mä kirjotin- kirjotin lähinnä nyt tähän niinku tän et on I wrote- wrote mostly now here like that we have to think</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>mietittävä tän analyysin fokukset, joita voi olla useita about the focuses of the analysis which there can be many</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>ja sit mä laitoin tähän et näin et se voi olla tää and then I put here that like so it can be this</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>lessons learned tyyppinen koko pilotin tasolta tai sitten lessons learned type on at the level of the whole pilot</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>voi olla nää kurssipalautetyyppiset tai sit se voi olla or it can be course feedback type or it can be this</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>tää loppupalaute esimerkiksi oma hyötyanalyysi final feedback for example your own usefulness analysis</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>siis lähinnä niinku mainitsitkin et ehkä täält kannattaa meaning mostly like you said that maybe you want to take</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td><em>(STANDS UP AND REACHES CARD AT TABLE)</em> ottaa sit nyt tässä vaiheessa vielä niitä pitää muistaa at this stage when you have to keep them in mind</td>
</tr>
<tr>
<td>10</td>
<td>F</td>
<td><em>(TAKES CARD)</em> Joo Yes</td>
</tr>
<tr>
<td>11</td>
<td>S3</td>
<td>työstää hhehh to work on them hhehh</td>
</tr>
</tbody>
</table>

First, Facilitator prompted Supplier 3 that her possession of the Question
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Card was relevant for the following interaction (row 1). Supplier 3 took this as the game task of reading the answer to the card she had written before placing it on the table. Supplier 3 explained what she had written on the sticky note, offering a distinction as the answer the Question card – on this game turn ‘How will you analyse your data?’ (rows 2 to 9, 11). While Supplier 3 was offering the distinction, she handed the card to Facilitator, signalling that the card was ready to be placed (row 8). Facilitator accepted the distinction and took the card (row 9). The sequence is visualized in Figure 35.

Figure 35: Prompting an offer with a game task in Excerpt 14.

Figure 35 shows how Facilitator’s somewhat vague statement that Supplier 3 ‘has the card’ is positioned as a game task prompt that is followed by Supplier 3’s Offer. In this case, the response to the prompt does not lead to further offers, and Facilitator accepts the offer.

In summary, game tasks were used by Facilitator as prompts when the game tasks resulted in new offers. The same game tasks were repeated over the
course of the game turns, allowing Facilitator to only allude to the game tasks to prompt offers from the players.

### 7.4.4 Self-prompting with the game material

Not all offers were preceded by a prompt, as participants regularly launched into new topics that were not directly related to the previous turn-at-talk. However, some offers that did not have a preceding prompt from the other participants involved the use of the game material as a means of self-prompting. In these sequences, participants self-prompted with the game material when they offered distinctions as responses to the game material instead of responding to preceding turns-at-talk. A total of 14 offers using game material to self-prompt were observed during the design game activity.

In Excerpt 15, Supplier 3 (S3) followed Facilitator’s (F) statement by self-prompt an offer using a Question card. The question on the card was: “What is the motivation of the user? For example, influencing, gaining power, contributing ideas, learning, having fun, connecting with others, something else”.

Excerpt 15: Self-prompting with game material (game turn 2).

[0:30:30 – 0:30:46]

1 F Se ei oo mitenkään itsestään selvää. It isn’t in any way obvious.

2 (3.0)

3 S3 *(POINTS AT CARD) No äkkisteltään noista tulee ainakin that comes to mind

4 se sana vaikuttaa. (0.3) the word influence. (0.3)

5 Koska (. ) on se sitten organisaatio Because (. ) whether it’s an organization

6 tai yksittäinen henkilö, niin mitä hän or an individual, what they

7 haluaa saada on sillä (. ) ehh PLATFORM USE want to get with this (. ) ehh PLATFORM USE

8 CASE 14 aikaan on varmaan jonkun jokininen CASE is probably some sort of

9 vaikutus johonkin asiaan. influence on something.

10 F Mm–hm

In Excerpt 15, Facilitator stated that there is no easy answer to who the users of the platform are (row 1). With this statement, Facilitator did not select a next speaker and thus created an opening for anyone to fill with talk. After a silence of three seconds (row 2), Supplier 3 pointed at the Question card the participants had been discussing and offered a distinction that the users of the platform want to influence something by using it (rows 3 to 8). Finally, Facilitator acknowledged the offered distinction (row 9).

Compared to Facilitator’s turn, Supplier 3’s self-prompting with the Question card therefore allowed Supplier 3 to self-select herself as the next speaker, positioning the offer as a new topic separate from what Facilitator

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14 The precise nature of the platform is omitted to protect potential trade secrets of the organisations involved.
was talking about. In conversation analysis, self-selection refers to the tactics used by speakers to take a turn-at-talk without being selected to speak next by the other participants (Sacks, Schegloff, and Jefferson 1974).

Instead of responding to the immediately prior turn-at-talk by Facilitator, the self-prompting offer was made as if responding to the question “What is the motivation of the user?”, presented on the Question card and read aloud by Supplier 1 27 seconds earlier on the same game turn. As such, the use of the Question card was crucial not just for offering the distinction (cf. offering distinction with game material in section 7.2.1) but also for self-prompting the offer by formulating it as a response to the game material. The sequence is visualized in Figure 36.

**Figure 36:** Elaborating on game material in Excerpt 15.

Figure 36 highlights the lack of a prompt in Facilitator’s turn-at-talk and use of game material in offering the distinction in the absence of other prompts.
Supplier 3’s offer is positioned after Facilitator’s first assessment, but not as a second assessment to it. Instead, what Supplier 3 is responding to is the Question card used to make the offer. In this way, the card text provided a means of topic selection by Supplier 3, meaning the game material allowed Supplier 3 to change the topic to the topic of the Question card – much like Facilitator was able to select topics with clarifying questions (as presented in section 0).

In summary, participants self-prompted themselves to offer distinction using the game material in situations where no other prompts allowed them to offer those distinctions. As a result, the game material could be used as a means of topic selection by the players to offer distinctions about topics not currently being talked about.

### 7.5 Game structure of interaction

In the design game activity, the participants followed a *game structure of interaction* consisting of the *overall structural organization* in which the interaction was divided into game turns and phases, and the *game goals* related to those game turns and phases. Together the overall structural organization of the design game activity and the game goals of each game turn and phase provided a structure in which the goal of the entire design game activity was divided into individual tasks that the participant focused on completing before moving on to the next ones.

#### 7.5.1 Overall structural organization of the game activity

This thesis focuses on the design game activity part of the design game session, meaning the part of the interaction where the participants followed the game rules to complete game goals. In the briefing part of the design game session, Facilitator had instructed the players in how to play the design game by telling them that three things would happen on each game turn.

The game activity was opened by the facilitator saying “Okay, let’s start playing,” which was followed by describing how the Objective card would be chosen. After this line, the interaction proceeded in accordance with the game rules, constituting institutional interaction in the frame of a design game activity. Conversely, Facilitator closed the game activity by saying “So we have now gone through the full rounds and the game time is about to end, but we would still have one phase.” The wording of the line implied that the design game would continue, but the interaction that followed was no longer constrained by the structural organization of the game turn or
other game rules, so the following interaction is considered to form the de-
briefing part of the design game session and thus outside of the scope of this thesis.

The game activity was comprised of seven game turns, forming the *overall structural organization of the design game activity*. On each game turn, one player would first select a category of cards, draw a card from it and tell the other participants what is said. Second, the participants would together discuss what the question meant for the project. Third, the player who chose the category would be responsible for writing down a summary of the conversation on a sticky note, and the card would be placed on the game board next to one or more previously placed cards that the answer was connected to. These three tasks were completed in order on each game turn, resulting in a three-phase *overall structural organization of the game turns*.

The overall structural organization of the game turns consisted of the *Setup phase* in which the relevant game material, usually a Question card, is selected and introduced; the *Collaborate phase* in which an answer or a conclusion to the game material is reached; and the *Materialize phase* in which the answer is written and placed on the game board next to related cards from previous game turns. Together these three phases comprised each game turn. While all the tasks and their order were described by Facilitator to the players, the phrases “Setup phase”, “Collaborate phase” and “Materialize phase” did not appear in the data or the game rules (complete rules for the design game ATLAS are presented in Appendix I) but are instead labels used in this thesis to describe the structure of the design game. The overall structural organization of the design game activity is visualized in Figure 37.
In each phase, the immediate game goal of the interaction was dependent on the phase. In the Setup phase, the game goal was the selection and introduction of relevant game material so that the participants would have a question to answer on that game turn. In the Collaborate phase, it was creating distinctions to answer the game material. In the Materialize phase, it was documenting the answer by writing down main points of the conversation and placing the card on the game board while addressing the card’s connections to the cards from the previous game turns.

The following excerpts describe the role of each phase for creation and maintaining the overall structural organization and show how transitions between different phases were accomplished. In each transition, Facilitator took a position of authority regarding how the game would be played, but the players also followed the overall structural organization and initiated some transitions themselves.

7.5.2 Setup phase

The Setup phase was the first phase of each game turn, marking the beginning of a game turn. In the Setup phase, the participants determined whose turn it was to choose a card, drew one or more cards as determined by the rules, and introduced the cards usually by reading them aloud. If the players had
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Immediate questions about interpreting the game material, the questions were addressed before moving to the next phase.

Excerpt 16 shows how starting the Setup phase of game turn 2 was accomplished by Facilitator (F) and Supplier 1 (S1). In the excerpt, Facilitator asked Supplier 1 to start a new game turn by drawing a card, and after some clarifications, Supplier 1 complied with the request and selected a card, thus starting a new game turn and marking the beginning of the Setup Phase.

**Excerpt 16:** Starting a new game turn with a Setup phase (game turn 2).

[0:29:28 - 0:29:40]

1. F: Jos SUPPLIER1 voi ottaa
   If SUPPLIER1 can take the
2.   ensimmäisen vuoron niin se sopii]
   fir[st turn that’s fine ]
3. S1: *(POINTS AT GAME BOARD)
   Saankö vasta valita ]
   [Can I now choose ]
4.   minkä tahansa tota
   any one of umm
5. F: Jo, ihan mikä, mikä tahansa
   Yes any, any one
6. S1: *(POINTS AT GAME CARDS)
   Siis minkä tahansa näistä, oö
   So any one of these, umm
7.   [onks ne ny]
   [are they ]
8. F: [Joo, mikä tuntuu tärkeeltä
   [Yes, wh]at feels important
9. S1: *(POINTS AT GAME CARDS)
   Nään oli dimensioita nyt nää?
   These were dimensions right?
10. F: Ne on dimensioita joo
    They are dimensions yes
11. S1: *(REACHES FOR A BLUE CARD)
    Otetaan toi (.). Maa kiinnostaa tää
    Let’s take that (.). I’m interested in
12. F: Participants=
13. S1: *(TAKES A BLUE CARD)
    =et ketää tähän osallistuu
    =who is going to participate in this.

First, Facilitator asked Supplier 1 to “take the first turn”, referring to the first game turn on which a player chose a Question card (rows 1 and 2). Second, Supplier 1 did not immediately comply with the request to take the first turn, and instead asked if he could choose the card freely from all the categories and whether they could be considered “dimensions” of the project (rows 3-4, 6-7 and 9). Facilitator answered positively to all questions, allowing Supplier 1 to proceed (rows 5, 8 and 10). Finally, Supplier 1 started the Setup phase by selecting a blue Question card (row 11) which according to
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the Facilitator corresponded to the Participants category (row 12). As Supplier 1 reached for the cards, he assessed that he was interested in who would participate in the project (rows 11 and 13).

Together, the interaction on rows 3 to 10 formed a *pre-expansion* for the Setup phase, meaning that it was a preparatory sequence that took place before the main sequence (Schegloff 2007, 26). This pre-sequence formed a liminal stage, where the participants were not playing the previous game turn any more but had not begun to select the material either.

Once the Setup phase had begun, the participants focused on the game material and the introduction of a new question that would become the topic for creating distinctions on that game turn. The role of the Setup phase was to introduce game material that would motivate and support the creation of distinctions in later phases.

7.5.3 Collaborate phase

The Setup phase was followed by the *Collaborate phase*, during which the participants offered and accepted distinctions to answer the question presented in the game material selected in the Setup phase. The Collaborate phase was begun when the participants started to offer distinctions to answer the question of that game turn.

Excerpt 17 describes how the participants transitioned from the Setup phase to the Collaborate phase on game turn 3. In the excerpt, Facilitator (F) had just introduced the Method cards that were used on that game turn. Supplier 1 (S1) then asked Facilitator to clarify that the players were expected to come up with an answer by selecting two of the method cards. Finally, the Collaborate phase then begun when Player 1 (P1) offered the first distinction to answer the game material.
Before the excerpt began, Facilitator had just described the Method cards, and at the beginning of the excerpt finished introducing that game turn’s game material (rows 1 and 3). Supplier 1 then asked Facilitator to clarify the task that the players were expected to perform because the previous game turn did not feature Method cards that the players had to choose from (rows 4 and 5). Facilitator replied that two important Method cards should be selected (row 6) and Supplier 3 (S3) stood up to have a better look at the Method cards. Finally, Player 1 started the Collaborate phase by offering the distinction that Personas would a good method for the project with the implication that selecting it would also be a way of answering the Question card (rows 9 and 10).

Again, rows 4 to 8 formed a pre-expansion of the Collaborate phase, since they were no longer part of the Setup phase but not part of the Collaborate phase either. Once the first distinction was offered by Player 1, the Collaborate phase begun.

The transition from Setup phase to Collaborate phase marked a shift in focus from discussing the game material to discussing the project itself, since...
answering the game material required creating distinctions about the project. This transition from just introducing the game material to using the game material to offer and accept distinctions was very important for the knowledge co-creation in the design game, since it effectively started the knowledge co-creation on each game turn.

In each Collaborate phase, the participants interacted to create distinctions about the project, focusing on the question defined in the game material. Interaction in the Collaborate phase included multiple knowledge co-creation sequences in which distinction were prompted, offered, elaborated, rejected and ignored based on what the participants knew about the project and what they chose to offer and respond. Each Collaborate phase went on until a participant, often the facilitator, concluded that the participants were ready to answer the game material.

### 7.5.4 Materialize phase

The Collaborate phase continued until a participant drew focus to documenting the created distinctions, starting the *Materialize phase*. In the Materialize phase, players created new game material by writing an answer to the game material based on the distinctions created on that game turn. The written answer never included every distinction created during the game turn but provided an answer to the game material from the perspective of the player writing it. The sticky note was then attached to the game card that had been the topic of that game turn and placed on the game board. Newly filled cards were placed on the game board next to cards that had been placed on previous game turns so that they would be available for referencing later in the game activity.

Excerpt 18 shows how Facilitator (F) asked Supplier 1 (S1) to write the answer to the Question card on game turn 2. When Supplier 1 started writing the answer, the Materialization phase was started. The beginning of the Materialization phase is also marked by Facilitator’s following request for the other players to address connections between that game turn’s Question card and the Objective card already on the game board.
At the beginning of Excerpt 18, Facilitator asked Supplier 1 to write down the answer to the Question card (row 1) while a previous discussion was winding down (row 2). Supplier 1 responded by picking up a sticky note that the answer would be written on (row 3). As Supplier 1 had signalled that he was about to write down the answer, Facilitator instructed the other players to already think about how the Question card of that game turn was related to the Objective card placed on the game board at the end of the previous game turn (rows 4-5, 7, 8 and 11). The instructions partially overlapped with the end of the agreement sequence in which Supplier 3 and Player 1 expressed agreement with a distinction offered before the excerpt began (rows 6, 8 and 10).

The transition from Collaborate phase to Materialize phase marked a shift in focus from creating distinctions about the topic written on the Question card to coming up with a written conclusion to the topic that would be written on the card. Because of this shift, the transition from Collaborate phase to Materialize phase was a moment of switching gears from creating distinctions about the topic in general to more focused and reflective creation of a
precisely worded written answer. This change can be observed in as Facilitator’s efforts to change the focus of the interaction from the project back to the game material (rows 4 to 11).

The goal of the Materialize phase was to write down the answer to the game material and place the answer with a card on the game board. Writing down the answer often involved the creation of additional distinctions. The Materialize phase ended after the card was placed on the game board and its connection to earlier cards was accepted. After this, Facilitator started a new game turn and a new Setup phase.

7.5.5 Transitioning from one game turn to another

Each game turn in the design game focused on selecting a question from the game material, addressing the question by creating distinctions, writing down an answer and placing it in relation to earlier game material. The transition from one game turn was therefore the end of a Materialize phase and the beginning of a Setup phase, but also the moment when one question was settled, and a new question would be selected. The beginning of a new game turn was marked by Facilitator’s request for a player to draw a new card.

Excerpt 19 shows how Facilitator (F) transitioned the interaction from game turn 4 to game turn 5. In the excerpt, Facilitator first summarized the distinctions of Supplier 2 (S2) and Supplier 1 (S1). After a pause when no other participants responded to the summary, Facilitator started a new turn by asking Customer (C) to draw a card.
Excerpt 19: Ending a game turn and starting a new one (game turn 4).

<table>
<thead>
<tr>
<th>F</th>
<th>*(WAVES HAND OVER GAME BOARD) Joo, ja tää yhteistyömälli, so[millä] Yeah, and the collaboration model using</th>
<th>Facilitator summarizes distinctions and Supplier 2 and Supplier 1 agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>S2</td>
<td>Joo</td>
<td>Yeah</td>
</tr>
<tr>
<td>F</td>
<td>ta[valla] kaksi organi[saa]tiota which two organizations</td>
<td></td>
</tr>
<tr>
<td>S1</td>
<td>Nii</td>
<td>Right</td>
</tr>
<tr>
<td>S2</td>
<td>Joo</td>
<td>Yes</td>
</tr>
<tr>
<td>F</td>
<td>toimii yhteen. work together.</td>
<td></td>
</tr>
<tr>
<td>F (SITS DOWN)</td>
<td></td>
<td>A moment of silence signaling that there are no further talk in this game turn</td>
</tr>
<tr>
<td>(0.5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F to C</td>
<td>Ookoo, ja sieltä sitten CUSTOMER ottaa Okay, and then CUSTOMER takes the</td>
<td>Facilitator begins a new game turn by asking Customer to draw a card</td>
</tr>
<tr>
<td>9</td>
<td>seuraavan kortin. next card</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Excerpt 19 began at the very end of game turn 4. Facilitator summarized the distinctions created by the players (rows 1, 3 and 6). Supplier 1 and Supplier 2 agreed with the summary, and none of the other players raised objections or additions (rows 2, 4 and 5). The pause after Facilitator’s summary was a signal by the participants that the topic was indeed fully settled (row 7). In response to the pause, Facilitator asked Customer to draw a card and thus start a new game turn.

The main role of transitioning between the game turns was moving from one topic to another. Ending a game turn meant that for the present moment the topic addressed in that game turn’s Question card was settled, and that a new topic would be addressed in the coming Setup phase. This gave the participants an opportunity to offer final distinctions on the game turn’s topic and then move to a new topic in the understanding that the old topic was finished.

While there was no game rule that a new game turn could only be started at the request of the facilitator, every game turn began with Facilitator asking the next player to draw a card. This regularity implies that the responsibility to end and start game turns was given to Facilitator by the players. The players’ role in maintaining the overall structural organization is addressed below.
7.5.6 Collaborating to maintain the game structure

Throughout the design game, Facilitator was in a position of authority on how the game would be played, asking players to proceed to the next phase or game turn. However, because of the regular overall structural organization of the design game, players also took initiative in maintaining it.

Excerpt 20 shows how Customer (C) introduced the game material and transitioned to the Collaborate phase without any input from Facilitator.

**Excerpt 20:** A player starts a Collaborate phase (game turn 5).

[0:50:23 - 0:50:45]

1 C Joo eli mitä ajattelitte luoda tai Yes so what are you aiming to create or
parantaa? Palvelu|prosessi, palvelu improve? Service |process, service
3 õmpäristö, palvelutorganisaatio (1.0) environment, service organization (1.0)
4 palveluverkosto tai ŋkosysteem, muita service network or ŋcosystem, other
5 (4.5)
6 Mun mielestä [noi nel] jää I think   [the fou]r
7 S2 [pitäsk]- [shoul- ]
8 C ekaa kuulostaa kaikki relevanth[heil]ta first ones all sounded relevan[thh ]
9 S2 [joo ]
 [yes ]

First, Customer introduced that game turn’s game material by reading the Question card (rows 1 to 4), followed by an extended pause (row 5). Compared to other game turns, Facilitator did not step in to provide instructions nor did any of the players ask Facilitator for clarification. Instead, Customer offered the distinction that the first four options all fit the project (rows 6 and 8), which Supplier 2 accepted (row 9).

Excerpt 20 illustrates how the roles of Facilitator and the players for maintaining the game structure changed over the course of the design game activity. As time went on, the players became proficient with the overall structural organization and interacted amongst themselves without Facilitator’s guidance, using the game structure to determine the relevant game goal of each phase and move to the next phase when appropriate. It should be noted that even though the players became proficient in following and enforcing the game structure, Facilitator was considered the authority on the game rules for the entirety of the design activity.
Excerpt 21 presents another example of Customer (C) taking initiative, this time in transitioning from Collaborate phase to Materialize phase by beginning to place the answer on the game board while the other participants were still talking about the project.

**Excerpt 21:** A player starts a materialize phase (game turn 5).

[0:51:52 – 0:52:03]

1 C *(STANDS UP)*

2 F joo eli se on vielä avoimena että olisko tässä yes so it’s still open if there would be

3 F joo[ta]n kolmansia[na] [toimijoita ]

4 S3 [Mm ] [Niin, kyllä] kyllä.

5 F Mn, joo. Mn, yes.

6 S1 to P1 Nii ei mikään ei estä et kaupallisesti yri[ty]s Yeah so nothing is stopping a commercial co[mp]any

7 P1 [Mm]

8 S1 olis tässä niinku mukana

9 from kind of joining

[tuomassa omaa, omaa tar]jontaa tänne ehkä. to bring their, their o]wn offering maybe.

10 C *(REACHES WITH THE CARD TOWARDS GAME BOARD)*

[°Siis° tää liittyy nyt ]

[°So° this is connected ]

Customer stands up with the written answer attached to the Question card.

Other participants continue the discussion about ecosystem members.

Customer suggests placing the card on the game board, starting the Materialize phase

In Excerpt 21, Customer stood up with the Question card she had filled, signalling to the other participants that she was ready to place the card on the game board (row 1). This embodied signal, however, went unnoticed by the other participants who were in the middle of an intense exchange about the project plan (rows 2 to 9). Customer, having stood up already, began talking over Supplier 1 by reaching toward the game board with the Question card and starting to assess the positioning of the card (row 10). This act finally halted the discussion about the ecosystem members, and the orientation of
the participants changed from discussing a detail of the project plan to placing the Question card on the game board, thus starting the Materialize phase.

However, Excerpt 21 also illustrates the tension between progression in the overall structural organization and the creation of distinctions. Supplier 1 was still offering distinctions when Customer started talking over him to change the focus of the interaction from talking about the project to placing of the Question card. Customer’s decision to move forward in the overall structural organization may have political motivations, such as shutting down discussion not relevant for the Customer organisation, but these factors are beyond the scope of this thesis. Instead, for the purpose of analysing the decision in the context of the design game’s overall structural organisation, changing the focus to the relevant game goal prioritizes the distinctions the players would create on later game turns around other topics over the distinctions that could have still been created in this phase of the current game turn. While the effects of this decision are beyond the scope of this thesis, it shows that following the game structure means giving up some flexibility in what topics to address and how for how long.

In summary, while Facilitator was the authority on how the design game was played, the players took active roles in initiating transitions between phases. As a result, the overall structural organization became a shared tool of all the participants as the players became more familiar with it.

7.6 The creation of distinctions within the game structure

The comparison of knowledge co-creation sequences and the game structure of the design game activity shows that the creation of distinction was highly regular and coincided with specific phases of the design game. Out of all the distinctions created on any given game turn, no distinctions were created during the Setup phase, most of the distinctions were created in the Collaborate phase, and a minority of distinctions were created in the Materialize phase. The correlation of new distinctions with the three phases is visualized in Figure 38.
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Figure 38: The creation of distinctions in the overall structural organization of the design game activity.

Figure 38 highlights the different roles each phase had for knowledge co-creation during the design game activity. On each game turn, the **Setup phase** involved interacting with the game material to determine and introduce the question and other related game material what would be the focus of that game turn. The game goal of this phase was to find out the question that would be answered on that game turn and to introduce the players to game material that would be used to develop the project in the later phases.

The **Collaborate phase** focused on answering the question of that game turn. The game goal of this phase was to discuss the project until the participants concluded that an answer to that game turn’s question had been answered and could be written down. The participants used all types of turns-at-talk reported in the previous sections, including prompts, offers and responses, and the use of game material to offer, recall and self-prompt distinctions.

Once the participants concluded that they were able to write down an answer, the goal of the **Materialize phase** was to document the answer by writing it down and placing the relevant game card on the game board to connect it to the answers of previous game turns. The game goal of this phase
was not specifically to come to any new conclusions about the project since
the participants had already arrived at an answer in the Collaborate phase.
However, some distinctions were still created in this phase to settle details
of the answer and extrapolate about the project. For example, placing the
cards on the game board allowed the participants to create distinctions by
suggesting and justifying the connections between different cards. At the
end of the Materialize phase, the game turn ended, and a new game turn
began.

The transitions between game turns and phases were one-directional,
meaning that once the transition from one phase to the other occurred, the
participants never returned to the previous phases of the same game turn.
However, there were some overlaps between the phases, such as continuing
to discuss the answer to a game turn's question while it was being written
down or starting the next game turn before the writing of the answer had
been finished, but once a phase or game turn had been started the partici-
pants never returned to an earlier phase or an earlier game turn.

The findings regarding distinctions in the game structure were consistent
throughout the design game activity. Table 9 presents the numbers of of-
ered distinctions and their responses over all game turns and phases of the
game activity. In addition to the numbers of offers, Table 9 also presents the
total number of created distinctions per phase, i.e. offers with elaboration
and agreement responses, to demonstrate each phase's contribution to
knowledge co-creation over the course of the game. Finally, the rightmost
column shows the duration of each phase to show the relative lengths of
time each phase took.
Table 9 shows that while the duration of each game turn and phase varied, no distinctions were offered in the Setup phase, most distinctions were created in the Collaborate phase, and that few distinctions were created in the Materialize phase. While this analysis cannot make statistical statements, the categorization shows that the phases were consistently different from one another in numbers of distinctions offered and accepted, while the game turns were consistently similar because the phases were similar across game turns.
7.7 Deviations from the game structure

Each game turn followed the same phases, each with their own game goals. However, two types of sequences were present in the data that did not conform to the three-phase model of the game turn. These sequences are presented as evidence that in addition to the game structure, other factors also shaped the interaction during the game activity.

7.7.1 Offering distinctions beyond the game structure

Each game turn, the participants selected a category of cards, most often Question cards, and created distinctions to form an answer to a question presented in the game material. While answering the questions resulted in creating distinctions, on some cases the participants created distinctions beyond what was necessary to answer that game turn’s question.

Sequences of offering distinctions beyond the game structure are presented on Table 10. Each of these sequences started with the first offer that did not address the question of that game turn and the duration was counted until the next offer that contributed to the question of that game turn, respectively. The sequences therefore represented ‘side-tracks’ in the interaction, where the participants addressed a parallel topic for one or more turns-at-talk.

Table 10: Sequences of offering distinctions beyond the game structure.

<table>
<thead>
<tr>
<th>Game turn</th>
<th>Phase</th>
<th>Time</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Collaborate</td>
<td>0:42:38</td>
<td>01:08</td>
</tr>
<tr>
<td>4</td>
<td>Collaborate</td>
<td>0:47:15</td>
<td>00:17</td>
</tr>
<tr>
<td>5</td>
<td>Collaborate</td>
<td>0:51:19</td>
<td>00:16</td>
</tr>
<tr>
<td>5</td>
<td>Materialize</td>
<td>0:53:32</td>
<td>00:27</td>
</tr>
<tr>
<td>6</td>
<td>Collaborate</td>
<td>0:58:37</td>
<td>06:55</td>
</tr>
</tbody>
</table>

Table 10 shows that sequences of discussing the project beyond the game structure took place on four of the seven game turns, and that most sequences lasted a minute or less.

For example, Excerpt 22 shows the beginning of a short side-track from game turn 5’s Collaborate phase. In the excerpt, the participants transcended the question presented on the Question card, “Is the aim of the project to create or develop a service process, environment, organization, network or ecosystem”. In the beginning of the excerpt, Customer (C) started the Materialization phase by taking a sticky note and offered a distinction to answer the Question card. Other players agreed, and Facilitator (F) encouraged the players to make general assumptions that there would be some
actors in the ecosystem instead of focusing on specific partners. However, Supplier 1 (S1) then offered a distinction that did not contribute to answering the Question card.

Excerpt 22: Participants pursue a distinction beyond the game structure (game turn 5).

[0:51:02 - 0:51:45]
1 C *(TAKES A STICKY NOTE)  
Joo, noi varmaan sisältyy tollaseen, noin muut  
Yes, those others are probably included in

2 tohon verkostoon ja ekosysteemiin mut  
the network and ecosystem but

3 *(PLAYER1, SUPPLIER1 AND SUPPLIER2 NODDING)  
Mm (0.5) Kaikenlaisia  
Mm (0.5) All kinds of things

4 S3 *(BEGIN TO WRITE ON THE STICKY NOTE)  
5 C  
6 F *(RAISES HANDS WIDE ABOVE HEAD)  
ajatella (.). mahdollisimman (.). laajasti  
think (.). as broadly as (.). possible

7 *(POINTS AT GAME BOARD)  
et täss on mahdollisia toimijoita.  
that there are possible actors here.

The Question card discussed in Excerpt 22 was: “What are you aiming to create or improve? Service process, service environment, service organization, service network or ecosystem, or other aspects?” After discussing which option would best fit the project, Customer offered the distinction that the other options presented on the Question card could be included in
the option “service network or ecosystem” and that it would best describe the project (rows 1 and 2). The distinction was collectively accepted by the participants through nodding and Supplier 3’s comment (rows 3 and 4), and Customer began writing down the answer on a sticky note (row 5). While Customer was writing the answer, Facilitator made a further assessment that at this stage of planning it might be best to stay at a general level and only talk about potential partners (rows 6 to 11).

However, after Facilitator’s assessment, Supplier 1 offered a distinction on a potential commercial analysis tool partner (rows 13 to 18). This distinction was not offered to answer the Question card of that game turn, and it was positioned as not aligning with Facilitator’s previous turn-at-talk that the participants should keep a general view. Instead, Supplier 1 took an element of the project and offered a distinction by elaborating that specific element, in this case about the analysis tool vendor as a specific type of partner. As such, this offer went beyond the game structure to address the project in a way that was not required to complete the game goals.

Whereas Excerpt 22 shows a sequence where one participant offered a distinction outside of the game structure, Excerpt 23 shows the beginning of a longer side-track that took a total of 6 minutes 55 seconds on game turn 6. In the excerpt, Player 2 (P2) began by asking Facilitator for permission to talk, and then proceeded to offer a distinction as an input-seeking question from the representatives of the Supplier organization. This is turn prompted Supplier 1 to offer a second distinction as an elaboration, starting off a long sequence of offering distinctions beyond the game structure.
Excerpt 23: Player beings a sequence to offer distinctions beyond the game structure (game turn 6).

[0:58:37 - 0:58:55]

1 P2 to F  Voinks mä kysyy yhden tarkentavan kysymyksen? Can I ask one further question?
2 F  Joo Yes
3 P2 *(LOOKING AT S1 and S2)  Ihän koko tähän projektiin, mulle ei ihan auennut se About this whole project, I didn’t quite get
4  että te rakennatte alustan, opiskelijoille, mut onks that you are building a platform, for students, but
5  siitä tarkoitus että opiskelijat, tulevat tutkijat, is it meant to be that students, future researchers,
6  käyttää tätä alustaa, eli loppukäyttäjä on silloin use this platform, so the end user would be then
7  se yritys joka saa sieltä *(WAVES HANDS) (0.5) jonkinnäköisen (. the company that gets from it (0.5) something (.)
8  ulos (. ) jotain *(WAVES HANDS) (1.0) out (.) something (1.0)
9  Onks se [nä]in? Vai [niinku]... *(WAVES HANDS) Is it like [ke] this? Or [like ]
10 S1  [No] [Var]maan molemmat niin siis= [Um] [Probab]ly both I mean that=
11 P2 *(NODS) =Molempia =Both

In the beginning of Excerpt 23, Player 2 asked Facilitator if she could ask a more detailed question (row 1) and Facilitator allowed it (row 2). Asking for permission to talk was exceptional in the data, possibly signalling that Player 2 already anticipated that the question might launch them to a parallel discussion. Player 2’s question was addressed to Supplier 1 and Supplier 2 as representatives of the Supplier organization, one of the two stakeholder organisations of the project present. As such the question was an input-seeking question that offered the distinction that the end users of the platform were either the students of the Customer organization, or the companies that will use the analysis or other output of the platform (rows 3 to 9). Supplier 1 elaborated that both cases were true (row 10), and Player 2 accepted the elaboration (row 11).

After the excerpt, Supplier 1 offered further elaborations on the different kinds of end users: students, researchers and corporate users. This in turn prompted Player 2 to offer further distinction. Excerpt 24 shows the further offer by Player 2, and how Facilitator joined in to offer distinctions beyond the game structure.
Excerpt 24: Facilitator offers distinctions beyond the game structure (game turn 6).

[0:59:04 - 0:59:32]

1  P2 Mietin vaan sitä niin et jos mä olisin yrityksessä
I was just thinking that if I would be at a company
2 niin mä en tiedä mitä sieltä tulisi ulos, mikä
then I won't know what would come out of it, which
3 kaavio ja miten mikäkin tulkinta (. ) miten se
cart and how to interpret what (. ) how the
4 loppukäyt- oikea, ihan viimeinen loppukäyttäjä niinku,
end use- real, last end user would like,
5 et sielt ei tuu vaan numeroita ja sit,
that there wouldn't just be numbers and then,
6 sit itse ainakin olisin ihan pihalla
then at least I would be completely lost

7  S2 Kyllä.
Yes.
8  P2 *(NODS)
Hmmm.

9  F to P2 Mm, voisko olla joku semmonen palvelu joka
Mm, could there be a service that would
10 tuottais myöskin niinku analysiä?
produce also like analysis?

11 P2 Ja sellasen analysin mikä on (0.5)
And the kind of analysis that is (0.5)
12 F ih[misluettava ]
hu[man-readable ]
13 P2 [ymmärrettävä ] ja myös innostava ja
[understandable] and also exciting and
14 workshop-osallistava workshp usable

In Excerpt 24, Player 2 offered a distinction that if the end user is in a company, they might not be able to use an analysis provided by the platform (rows 1 to 6). The distinction was agreed with by Supplier 2 (row 7) and the agreement was further acknowledged by Player 2 (row 8). After the acknowledgement, Facilitator joined in to elaborate that there would be a service that gave human-readable analysis (rows 9, 10 and 12), which was further elaborated in overlapping speech by Player 2 (rows 11, 13 and 14).

Facilitator's joining in to offer distinctions about a topic beyond the game structure in Excerpt 24 stands in contrast with the observation that Facilitator was responsible for maintaining the game structure during the design game activity. Instead, the excerpt shows that Facilitator was, at least in some situations, willing to prompt and offer distinctions when the players were also engaged in offering them. Once the sequence of offering distinctions beyond the game structure ended, Facilitator asked Supplier 3 to write
down the answer to the Question card, resuming the game structure. This departure from and return to the game structure is visualized in Figure 39.

Figure 39: Offering distinctions beyond the game structure.

Figure 39 illustrates that the participants collectively departed from the game structure to prompt, offer and accept distinctions about the project, and returned to the game structure once the topic had been exhausted. These observations suggest that while playing the design game, the participants had other goals beyond the immediate game goals related to a phase of the game turn. Speculation on the source of these goals are beyond the scope of this thesis, but the deviations show that the game structure could be departed from to offer distinctions that were tangential for the design game activity but still contributed to the epistemic object at hand.

7.7.2 Agreement sequences

The design game activity was interspersed with collective moments of realization marked by agreement sequences. An agreement sequence began after a participant offered a distinction that brought some aspect of the project to a conclusion, such as not knowing more about the partners in the ecosystem (in Excerpt 22). This relieving distinction triggered a collective realization and began an agreement sequence. In agreement sequences, the relieving distinction was followed by a “cluster of agreement” (Pomerantz 1984, 66) where multiple participants expressed strong agreement toward the distinction.
Table 11: Agreement sequences during the design game activity.

<table>
<thead>
<tr>
<th>Game turn</th>
<th>Phase</th>
<th>Time</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Collaborate</td>
<td>0:26:47</td>
<td>00:05</td>
</tr>
<tr>
<td>2</td>
<td>Collaborate</td>
<td>0:34:41</td>
<td>00:09</td>
</tr>
<tr>
<td>3</td>
<td>Collaborate</td>
<td>0:42:27</td>
<td>00:03</td>
</tr>
<tr>
<td>3</td>
<td>Collaborate</td>
<td>0:44:44</td>
<td>00:04</td>
</tr>
<tr>
<td>4</td>
<td>Collaborate</td>
<td>0:47:41</td>
<td>00:29</td>
</tr>
<tr>
<td>5</td>
<td>Collaborate</td>
<td>0:51:49</td>
<td>00:11</td>
</tr>
<tr>
<td>6</td>
<td>Collaborate</td>
<td>1:05:20</td>
<td>00:10</td>
</tr>
</tbody>
</table>

Table 11 shows that agreement sequences took place on every game turn except the last one, game turn 7, and on game turn 3 there were two agreement sequences. The agreement sequences were not as much departures from the game structure as sequences that took place separate from the game structure, because the participants did not make assessments that were unmotivated by the game goals and materials. Agreement sequences always took place after the half-point of a game turn, when at least some distinctions had been created.

Excerpt 25 shows the agreement sequence from game turn 5. In Excerpt 25, Supplier 3 (S3) offered a relieving distinction about the role of the Supplier organization in the ecosystem which was in turn followed by the agreement sequence in which Facilitator (F) and Supplier 1 (S1) enthusiastically accepted the distinction.
**Excerpt 25**: An example agreement sequence (game turn 5).

[0:51:46 – 0:52:03]

1. S3: Eli olisimme yksi ekosysteemin jäsenistä
   
   So we would be one member of the ecosystem

2. F to S3: Ai[van ]
   
   Ex[actly]

3. S3: [eri ]laisia
   
   [different]

4. tehtä[viä eri
   
   ta[sks different ]

5. S1 to S3: *(POINTS FINGERS DOWN)
   
   [Niin nimenomaan] se ekosysteemin
   
   [Yeah precisely ] the ecosystem’s

6. ro[oli tulis siinä joo ]
   
   ro[le would be there yes]

7. S3: *(REPEATS GESTURE)
   
   [Niinku ylhää–]
   
   [Like from up–]

8. ylänäkökulma[sta]
   
   top perspect[ive]

   
   [yes] so

10. se on vielä avoimena että olisko
    
    it’s still open if there would

11. tässä [jo[tain] kolmansiakin [toimijoita ]
    
    be s[ome ] third [parties too]

12. S3: [Mm ]
    
    [Niin, kyllä]
    
    [Yeah, yes ]

13. kyllä.
    
    yes.

14. F: Mm, joo.
    
    Mm, yes.

**Offer 1**: offering the relieving distinction that Supplier organization would be a member of the ecosystem

**Agreement**: accepting the distinction

**Offer 2**: elaboration that the ecosystem has different tasks

**Agreement**: accepting the distinction

**Offer 3**: elaboration that the role was from a top perspective

**Offer 4**: elaboration that there could still be additional third partied

**Agreement**: accepting the distinction

**Agreement**: acknowledging the agreement

In Excerpt 25, Supplier 3 (S3) offered the distinction that the platform provider is one of the ecosystem members (row 1). This distinction was the conclusion to the topic raised by Supplier 1 in Excerpt 22 that transcended the game material. The distinction was first accepted by Facilitator (row 2) and then continued in agreement by Supplier 3 (rows 3 and 4). Supplier 3
offered the distinction with elaboration that there are different tasks in the ecosystem and Supplier 1 enthusiastically agreed by proposing that the ecosystem role is important, repeating the word “ecosystem” and making a gesture pointing fingers down for added emphasis (rows 5 and 6). Supplier 3 agreed again, elaborating with the words “top perspective” and mimicking Supplier 1’s hand gesture of fingers pointing down (rows 7 and 8).

Finally, Facilitator elaborated that there could still be additional third parties (rows 9 to 11). While the content of Facilitator’s summary did not exactly match Supplier 3’s initial assessment of Supplier organization being one of the ecosystem members, the summary was positioned as agreement with Offer 3 by beginning the summary with “yes”. Supplier 3 then elaborated with Offer 4 (rows 12 and 13) and Facilitator acknowledged the agreement (row 14), ending the agreement sequence.

Based on the reaction of the other participants, the relieving distinction offered by Supplier 3 (that Supplier would be one of the ecosystem members) was a significant contribution to the epistemic object. However, aside from the agreement sequence described in Excerpt 25, nothing in the content of the relieving distinction made it qualitatively different from other distinctions offered in the design game activity. Instead, what made the agreement sequences different was the response the relieving distinction got from the other participants.

One agreement sequence was observed on each game turn, where the participants came to an agreement about a specific distinction, except for the last game turn. The relieving distinctions that were followed by agreement sequences on each game turn are summarized in Table 12.
Table 12: Agreement sequences during the design game activity.

<table>
<thead>
<tr>
<th>Game turn</th>
<th>Card category and text</th>
<th>Relieving distinction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Objective: What is the objective of this project?</td>
<td>The goal of the project is to develop a platform that can be used with multiple partners</td>
</tr>
<tr>
<td>2</td>
<td>Participants: What is the motivation of the participant?</td>
<td>The platform will close the gap between commercial and academic users’ perspectives</td>
</tr>
<tr>
<td>3</td>
<td>Methods and Tools: Take 5 method cards. How could those be employed in your project?</td>
<td>Two separate agreement sequences: 1. scenarios should be used in the project because they can describe different user groups and use cases; 2. scenarios can be created based on narratives, which are more creative way of thinking about the platform</td>
</tr>
<tr>
<td>4</td>
<td>Project definition: Where are you in the process?</td>
<td>The project will include a real-life pilot with actual users and actual data</td>
</tr>
<tr>
<td>5</td>
<td>Project definition: What level are you developing?</td>
<td>The platform provider is one of the ecosystem roles</td>
</tr>
<tr>
<td>6</td>
<td>Lessons learned: How do you analyse user data?</td>
<td>The environment will enable creating public analyses for academic users and private analyses for commercial users</td>
</tr>
<tr>
<td>7</td>
<td>Methods and tools: What data gathering events are you planning?</td>
<td>No agreement sequence</td>
</tr>
</tbody>
</table>

Comparison between the card texts and the relieving distinctions in Table 12 shows that agreement sequences did not result from coming up with an answer to the game material but by offering a distinction that expanded the understanding of the project. This means that the agreement sequences were not motivated by the design game, as one would expect if the relieving distinctions had been direct answers to the Question cards. Instead, the content of the relieving dictions suggests that the participants had goals or motivations related to the development of the project beyond those provided by the game structure. Explaining why there was no agreement sequence on game turn 7 fall beyond the scope of this thesis.

7.8 Summary and answers to the research questions

The empirical study of this thesis approached the data with five research questions concerning knowledge co-creation in a design game activity:
RQ 1: How are distinctions offered and accepted?
RQ 2: What is the role of the facilitator in offering and accepting distinctions?
RQ 3: How are boundary objects used to offer and accept distinctions?
RQ 4: How does the epistemic object affect offering and accepting distinctions?
RQ 5: What is the effect of the institutional frame of a design game activity on offering and accepting distinctions?

This section summarizes the findings of the empirical study by answering the research questions.

7.8.1 Answer to RQ 1: How are distinctions offered and accepted?

In the design game activity, the offering and accepting of distinctions formed individual knowledge co-creation sequences, short pieces of sometimes overlapping interaction between at least two participants consisting of an offer by one participant and a response to the offer by another participant. All participants, including the players and the facilitator, offered and accepted distinctions. The empirical study therefore supports the theoretical extrapolation that distinctions are first offered and then accepted by different speakers.

The response to an offer was observed as the second assessment that followed the offer. Whether the response aligned with the offer determined whether the offer was accepted or not, which in turn determined whether a distinction was created. Four types of responses were observed: agreement, elaboration, rejection and ignoring. Depending on whether the response led to the creation of a distinction, i.e. to the creation of knowledge, these responses were either productive or unproductive for knowledge co-creation.

Agreement and elaboration were productive responses that accepted an offer, leading to the creation of a distinction. An agreement response was an assessment that aligned with the distinction, while an elaboration response was an assessment that both aligned with the distinction and offered a new distinction that built on top of the previous distinction. Elaboration was used by the participants to create multiple distinctions over fewer turns-at-talk than would have been possible by individually offering and accepting each distinction.

Rejection and ignoring were unproductive responses because they left an offer unaccepted and thus did not lead to the creation of a distinction. A rejection response was an assessment that did not alignment with the offer, such as challenging the offer or making a contradicting assessment. An ignoring response, on the other hand, was observed when the following turn-at-talk was unrelated to the offer, and no other responses were observed. In both
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cases, the offer was left unaccepted, and so a distinction was not created. However, some offers that had unproductive responses were re-offered later in the game activity, and some of those re-offered distinctions were accepted.

Offers were sometimes preceded by a prompt, a first assessment that motivated another participant to offer a distinction. In the design game activity, three types of prompts were observed: prompts that were used by the players, prompts that were used by the facilitator, and the use of game material to offer distinctions not directly related to the preceding turns-at-talk. Players prompted offers with input-seeking questions, where a player asked another player for their input on a topic, creating an opening for the other player to offer a distinction in response.

In the design game activity, all participants took the roles of players except for the facilitator. Figure 40 illustrates all types of turns-at-talk used by the players in knowledge co-creation sequences and their outcomes for creating distinctions. The arrow from Elaboration back to offers represents the way in which each elaboration was itself another offer that had its own response, possibly leading to the creation of another distinction. The dashed arrow leading from the unproductive response back to offers refers to the possibility of a player re-offering the same distinction later in the design game activity. All turns-at-talk listed on Figure 40 were available to all participants without using additional elements such as boundary objects or facilitation.

**Figure 40:** Prompts, offers and responses used by the players in knowledge co-creation sequences.
The empirical study shows that once a distinction was accepted, a corresponding change in the epistemic object took place, and the participants referred to the changed epistemic object as a collectively accepted fact. As the epistemic object was changed, new distinctions could be offered about the changed project to incrementally develop the epistemic object. At the end of the design game, the result of the knowledge co-creation was the developed epistemic object which had been changed by all the accepted distinctions.

Figure 41 visualizes how each turn-at-talk affects the epistemic object and thus contributes to the co-creation of knowledge based on the excerpts presented in this chapter. In Figure 41, an ideal knowledge co-creation sequence takes place between two participants and consists of a prompt, an offer, and an agreement response. Each of the three turns-at-talk has a distinct role in the sequence that results in a change in the epistemic object: the prompt creates an opening for an offer, the offer presents a tentative distinction that is not yet an accepted part of the epistemic object, and the agreement finally accepts the distinction, resulting in new knowledge being created in the form of the developed epistemic object.

**Figure 41**: Contribution to the epistemic object in a knowledge co-creation sequence.
In Figure 41, the sequence begins with Participant A prompting Participant B to offer a distinction. This prompt could be an input-seeking question, such as “what do you think we should do?” While creating an opening for offering a distinction, the prompt itself does not offer or accept a distinction, and therefore does not directly contribute to knowledge co-creation.

In response to the prompt, Participant B offers a distinction by making an assessment about the epistemic object. The assessment could be “I think this project should last for two months”, which would offer the distinction that the intended timeframe of the project is two months. Once the offer has been made, the distinction becomes a provisional change to the epistemic object that may or may not hold true depending on the response. In Figure 41, this is visualized as adding a blue note to the epistemic object, representing that the distinction is not yet an accepted part of it.

Finally, Participant A responds with agreement, thereby accepting the distinction as a part of the epistemic object. An example of an agreement would be “yes”, “absolutely” or other assessment that aligns with the offer. In Figure 41, accepting the distinction is visualized as a second arrow that changes the blue note to a green note, marking the distinction as a part of the shared epistemic object that is taken for granted in later interaction. This example shows how the empirical study supports and expands the theoretical extrapolation that the offering and accepting of a distinction leads to the creation of a distinction, and a corresponding change takes place in the epistemic object that is being developed.

7.8.2 Answer to RQ 2: What is the role of the facilitator in offering and accepting distinctions?

The facilitator participated in offering and accepting distinctions like the other participants, and therefore had a direct contribution to the creation of new knowledge. However, the facilitator also helped the players offer and accept distinctions by using two types of prompts that were exclusive to the facilitator: clarifying questions and game tasks. By prompting the players, the facilitator helped draw distinctions out from the players so that those distinctions could then be responded to. The empirical study supports the theoretical extrapolation that the facilitator role supports knowledge co-creation.

The facilitator used clarifying questions to prompt distinctions about a topic the facilitator deemed relevant. Clarifying questions invited offers either from a specific player or from the players in general, such as “how would we use it in practice?” Asking a clarifying question therefore created a space for the players to fill by offering a distinction which could then be responded to, leading to the creation of a distinction if accepted by another participant.
In the most productive cases, a clarifying question started a chain of elaboration responses from the players which led to several distinctions being offered and accepted.

With *game tasks*, the facilitator prompted the players to offer distinction to fulfil the game’s rules and goals, such as "how would this card connect with these other cards?" These prompts reminded the players about the game goals and encouraged the players to offer distinctions to fulfil them. The use of game task prompts was not tied to any specific parts or phases of the design game activity and the players regularly offered distinctions to complete game goals without being prompted by the facilitator. However, game tasks were used as prompts only by the facilitator.

The facilitator’s prompts are visualized as parts of knowledge co-creation sequences in Figure 42.

![Figure 42: The facilitator's turns-at-talk in knowledge co-creation sequences.](image)

Figure 42 illustrates that the role of the facilitator in offering and accepting distinctions was to *facilitate* by prompting the players into offering distinctions and *participate* in knowledge co-creation by offering and responding to distinctions directly. However, only the person in the role of the facilitator used clarifying question and game task prompts, supporting the extrapolation that these prompts were forms of institutional talk only available to a participant acting in the facilitator role, which in turn was part of the design game.
7.8.3 Answer to RQ 3: How are boundary objects used to offer and accept distinctions?

During the design game activity, the participants used multiple resources available to them, including gestures and the pieces of game material that were used as boundary objects. The boundary objects were physical artefacts that all participants could use despite being members of different communities-of-practice. The physical form of the boundary objects made them available for use in interaction through speech and gesture, such as naming, pointing and touching individual cards.

Boundary objects were used by the participants to offer distinctions by involving a boundary object in the offer. Combinations of speech and gesture were used to formulate distinctions that both referred to the boundary objects (e.g. “this card”) and incorporated vocabulary and concepts from the game material into the verbal distinctions (e.g. “those are probably included in a network or an ecosystem”). When using the text on the game material, the participants adopted words into their distinctions and thus incorporated the words used in the game material into a shared vocabulary. Boundary objects therefore directly enabled the participants to offer distinctions they otherwise could not have offered. The empirical study therefore supports the theoretical extrapolation that assessments are produced using multimodal resources.

When the participants used boundary objects to offer distinctions, the offered distinctions became associated with the used boundary objects, making it possible to use the boundary objects as representations of the epistemic object. This association then made it possible to later recall distinctions by using the same boundary object that was used in offering the distinction, such as using a Question card to refer to a distinction that had been offered as an answer to that card. The association between a distinction and a boundary objects was created regardless of whether the offered distinction had been accepted, and the boundary objects were used to re-offer distinctions that had not been accepted. The empirical study therefore supports the theoretical extrapolation that in design games, participants use the game material as boundary objects to offer and accept distinctions.

Once boundary objects had been established as representations for the various aspects of the epistemic object, the participants were able to offer more complex distinctions by using combinations of boundary objects and their corresponding distinctions. For example, addressing the relationship between the Question cards of previous game turns required the participants to use multiple boundary objects to prompt and offer distinctions. The empirical study therefore supports the theoretical extrapolation that bound-
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Boundary objects are used to offer and accept distinctions about the epistemic object by using them as representations. Figure 43 visualizes a generic example of cumulating associations between a single boundary object and multiple distinctions.

![Figure 43: Using boundary objects to refer to prior distinctions.](image)

In Figure 43, Participant A uses a boundary object that was previously used to offer a distinction, thereby associating the boundary object with that distinction, to prompt Participant B. The boundary object is visualized as being associated with a distinction that is an agreed-upon part of the epistemic object. In response to the prompt, Participant B offers a distinction that utilizes the boundary object and the earlier distinction, and further associates the newly offered distinction with the boundary object. Through this process of creating more distinctions using the same boundary object, the association between the boundary object and the epistemic object becomes more complex as the boundary object can be used to refer to a range of distinctions.

Over the course of the design game activity, the participants modified the boundary objects by adding written answers to them and placing the cards on the game board to form constellations of connected Question cards.
When the modification of a boundary object took place by writing down an answer, it provided opportunities to offer distinctions by reformulating and expanding the previously accepted distinctions into the written answer. Since the positioning of Question cards on the game board was given special meaning in the rules of the design game, the constellation of individual boundary objects became another boundary object that represented the relations between the individual boundary objects, providing even more opportunities to offer distinctions. When writing down the answer, the participants did not include every distinction created on that game turn, so the written answer was only there to remind the participants of the distinctions that the Question card could be used to represent. Filled Question cards were left on the game board, making them available to the participants to use in later game turns for recalling distinctions.

In addition to offering distinctions, participants also used boundary objects to self-prompt offers, meaning that the boundary objects were used to justify offering a distinction that was not related to the immediately preceding talk. These offers were formulated either as answers to the questions on the game material, or otherwise relevant to the interaction by referring to material currently on the table. Thus, self-prompting allowed the participants to switch between topics in a way that allowed new distinctions to be offered without disrupting the flow of the interaction. Figure 44 visualizes self-prompting and offers with boundary objects in knowledge co-creation sequences.

![Figure 44: Turns-at-talk utilizing the boundary objects in knowledge co-creation sequences.](image)

Figure 44 shows that the use of boundary objects enabled the participants to prompt themselves and offer distinctions using the boundary objects. The responses to those offers were not different from the productive and unproductive responses to offer made without boundary objects, but earlier
distinctions offered with the boundary objects could be recalling by using
the same boundary objects even if the distinction had not been originally
accepted.

7.8.4 Answer to RQ 4: How does the epistemic object affect offering
and accepting distinctions?

The epistemic object of the design game activity was the project being
planned. The development of the project involving the Customer and Sup-
plier organizations was both the game goal of the design game activity and
the stated goal of the design game session that the design game activity was
embedded in.

The epistemic object was the shared referent that distinctions were offered
about across all topics, game turns, and participants. Over the course of the
design game activity, the participants offered distinctions ranging from the
project’s schedule, participants, partners and methods, but the object of
those distinctions was consistently the things that would take place during
the project. When distinctions were accepted, they became taken-for-
granted parts of the epistemic object. Later distinctions could then build on
the accepted ones by taking the accepted distinctions as true statements
about the epistemic object. At the end of the design game activity, the result
of knowledge co-creation was the developed epistemic object, and the
knowledge co-created in the design game was comprised of all the distinc-
tions that were offered ad accepted during the design game activity. The
empirical study therefore supports the theoretical extrapolation that dis-
tinctions are made about the epistemic object, meaning the conceptual
artefact that the participants want to develop.

The epistemic object was shared across boundaries between communities-
of-practice in the sense that all participants could make distinctions based
on their respective knowledge, regardless of whether they were members of
the Supplier or Customer organisations or not. By recognizing that they
were referring to the same epistemic object despite of their different back-
grounds, the participants were able to offer distinctions from their own per-
spectives, for example by referring to their professional practices or organ-
izational interest related to the project. Similarly, participants were able to
accept distinctions offered by participants with a different background on
the grounds that they were all talking about the same epistemic object.

7.8.5 Answer to RQ 5: What is the effect of the institutional frame of
a design game activity on offering and accepting distinctions?

The institutional frame was observed in the game structure of the design
game activity, which consisted of the overall structural organization of the
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activity and the game goals corresponding with the overall structural organization. The overall structural organization of the design game divided the design game activity into seven individual game turns which were further divided into three phases. While the participants occasionally deviated from the structure to offer distinctions beyond the game structure, the participants always returned to the structure of the game as the intended way the interaction should be organized.

The institutional frame of a design game activity was communicated to the players by the facilitator through explaining the game rules, game material and game goals involved in the design game activity, including the game turns and their three comprising phases. Each game turn, the same three phases repeated with distinct game goals for each phase: choosing material for the Setup phase, creating distinctions to answer a question for the Collaborate phase, and modifying the game material while reconciling the created distinctions with distinctions from earlier game turns in the Material phase. Each phase therefore had a specific immediate goal to focus the shared attention on one task at a time before moving to the next one together.

During the game activity, the facilitator maintained the game structure by announcing game turn transitions and explaining game rules, and the players participated in maintaining the game structure as they learned it. The facilitator was in a position of authority on how the game structure was to be produced by the participants, since questions about how the game should to be played were addressed to the facilitator. For example, the facilitator was responsible for asking the next player to draw a card at the beginning of each game turn. However, once the regular overall structural organization of the interaction had been established, the players took active roles in initiating transitions between phases, and the overall structural organization became a shared resource for maintaining the institutional frame of the design game activity. The empirical study therefore supports the theoretical extrapolation that the game rules and facilitation together create the institutional frame of a design game activity.

Over the course of each game turn, distinctions were created in the Collaborate and Materialize phases, while the Setup phase focused on introducing that turn’s boundary object that would be used to offer distinctions about an aspect of the epistemic object. The effect of the phases on the offering and accepting distinctions was that there was a short-term goal presented by the facilitator at every point in time, and in Collaborate and Materialize phases those short-term goals encouraged offering distinctions. The empirical study therefore supports the theoretical extrapolation that the frame of a design game activity provides an overall structural organization of interaction specific to that design game.
While the phases of the game turns provided immediate goals for the participants, the game turns helped the participants change from one Question card to the next, switching the topic to a fresh one after the old one had been exhaustively addressed. On each game turn, the overarching goal was to select, answer and write down the answer to an Objective card or a Question card. Once the three phases were completed, the game turn ended and a new one began, with the old boundary object placed onto the game board and one or more new boundary objects introduced to the interaction at the beginning of the game turn.

Transitions between the phases of the game turn supported the creation of distinctions by providing a focus first to the game material, then to the project, and finally to the game material from the previous game turns. Transitions between game turns supported the creation of distinction by delineating the point where interaction around one topic ended and a new topic was selected. The empirical study therefore supports the theoretical extrapolation that institutional frame design game activity affects the creation of distinctions.

However, two kinds of deviations from the game structure were observed that provide additional insight to the limits of the game structure. First, the participants collaborated to know more about the epistemic object, even beyond the game structure. While most distinctions were offered to fulfil the game goals of answering Question cards and addressing the connections between answers to different Question cards, the participants also offered distinctions that differed from the topic described in the game material of that game turn. In these situations, the institutional frame of a design game activity was temporarily lifted to allow for the offering of distinctions about the epistemic object based on other motivations than following the game structure. One possibility is that offering distinctions beyond the game structure was motivated by the participants’ desire to know more about the epistemic object, i.e. the intrinsic motivating power of the epistemic object overtook the motivating force of the institutional frame. Another possibility is that the participants had institutional goals that were not immediately related to the design game, e.g. an organizational pressure to make sure the project plan would be created regardless of whether the interaction adhered to the institutional frame of the design game activity.

Second, on all but the game turn, a single distinction was followed by an agreement sequence, where several participants enthusiastically agreed with a specific relieving distinction. The agreement sequences were not a feature of the game structure, because agreement sequences did not result from coming up with an answer to the game material. Neither did the relieving distinction summarize or combine previously accepted distinctions. In-
stead, agreement sequences seemed to respond to a distinction that expanded the understanding of the participants about the epistemic object, and the participants wanted to recognize it as a breakthrough. Another possible explanation is that the agreement sequences were part of the social process of collaboration, where the agreement sequences had a role in reinforcing a sense of working towards the same goal or providing a moment of relaxation for the participants.

While the precise theoretical explanation of the deviations from the game structure fall beyond the scope of this thesis’ research problem of how can design games support knowledge co-creation, the deviations show that the institutional frame of the design game activity and the game structure it provided were always contingent on the participation of the people involved. Opportunities to pause the gameplay for pursuing an interesting aspect of the epistemic object or for gathering around shared agreement about a specific distinction were taken by the participants without explicit remarks of doing so, and the participants were able to return to the game structure every time. This suggests that these deviations were only temporary pauses from the game structure and not complete breakdowns of the activity where the design game activity would have had to formally begin again.
The research problem of this thesis is: “How can design games support knowledge co-creation?” This section answers the research problem by presenting a theoretical interpretation of the findings that expand the preliminary theoretical framework presented in Chapter 5.

8.1 Knowledge co-creation sequences

In the process view of the theoretical framework, knowledge co-creation in a design game activity was viewed as a sequence of events where preceding events affect how the following events will occur. At each point in time, the participants can choose their actions, but the actions available to them are both enabled and constrained by the preceding events. For example, a participant who has been prompted to offer a distinction can make an offer which can then lead to the creation of a distinction. On the other hand, a participant cannot accept a distinction that has not been offered by another participant.

The empirical study shows that knowledge was co-created in the design game activity by developing the epistemic object in interaction between the participants through various suggestions, counteroffers, agreements and disagreements that followed each other. These sequences of turns-at-talk that led to the creation of distinctions can be analytically divided into individual knowledge co-creation sequences consisting of three turns-at-talk: prompts that provide opportunities for offering distinctions, offers that present a distinction for the other participants to accept, and responses that determine whether the offer is accepted. The structure of a knowledge co-creation sequence and all the constituting turns-at-talk identified in the empirical analysis are visualized in Figure 45.
Figure 45: Knowledge co-creation sequences in a design game activity.

Based on the empirical analysis, distinctions are created in knowledge co-creation sequences when one participant offers a distinction as an assessment about the epistemic object, and another participant accepts the distinction by responding with an assessment that aligns with the offer. If the offered distinction is accepted, a distinction is created, and thus new knowledge is co-created by changing the epistemic object according to the distinction. In cases where the offer and the response are not in alignment, no distinction is created and thus no knowledge is co-created. The observation that distinctions are created in verbal interaction between at least two participants coming to agreement about the distinction means that knowledge is co-created in productive dialogue.

Based on the empirical study, dialogue requires two things to be productive, i.e. to result in the co-creation of new knowledge. First, distinctions must be offered in the dialogue, and second, the responses to the distinctions must align with at least some of the offers. Responses to offers can therefore be described as either productive responses if they align with the offer, and unproductive responses if they don’t align. Moreover, the empirical analysis shows that dialogue is the most productive when the participants respond to offers with elaboration, a type of response that offers a new distinction that builds on the offer, thus both aligning with the offer and offering a new distinction. The empirical study therefore shows that it is the response, not the offer, that determines how productive interaction is for the co-creation of knowledge.
The empirical analysis also identified that some offers were prompted by another participant. Prompts are turns-at-talk that either directly request an offer from another participant or otherwise create an opportunity for one or more participants to make offers, encouraging the creation of distinctions. Prompting can be made with a turn-at-talk where a participant says something to which another participant makes an offer in response, or a participant can self-prompt by using a boundary object to offer a distinction that is not directly related to the preceding talk.

Based on the preliminary theoretical framework, the use of boundary objects and facilitation are both conceptualized as features of design games, and the turns-at-talk made possible by their presence are highlighted in Figure 45 in blue and green. The empirical analysis shows that the facilitator supports the creation of distinctions directly by prompting the players to offer distinctions. Two types of prompts were identified as features of facilitation: asking *clarifying questions* from the players and giving *game tasks* to the players. The use of these prompts always led to new distinctions being offered, thus supporting knowledge co-creation. The types of prompts used by the facilitator were not used by the players, suggesting that these types of prompts are directly related to the facilitator's institutional role within the design game activity.

Based on the empirical study, boundary objects are used in design game activities as representations for various aspects of the epistemic object to prompt, offer and respond to distinctions. Boundary objects are used by the participants to *self-prompt* the offering of distinctions in situations where the distinction would not naturally follow from the preceding interaction. When participants *make offers with the boundary objects*, the participants can leverage the attributes of the boundary objects themselves, such as the text on the game material, to offer distinctions where the boundary object is a part of the distinction.

As distinctions become accepted parts of the epistemic object, the epistemic object is partially instantiated into the boundary objects used to offer them. This makes it possible for the participants to refer to aspects of the epistemic object with physical gestures and *recall distinctions* that have already been accepted or that were initially met with unproductive responses.

Based on the theoretical framework, each prompt, offer and response is an assessment (Pomerantz 1984), which implies that they are knowledgeable actions based the explicit and implicit personal and group knowledge of the participants (Cook and Brown 1999; Polanyi [1966] 2009). While the participants do not necessarily explicate what kind of knowledge their turns-at-talk are based on, they do make intelligent decisions in the moment based on the totality of their knowledge about the epistemic object and related topics (Bereiter 2002; Polanyi [1966] 2009; Tsoukas 2003).
This back-and-forth of prompting, offering and responding to distinctions based on the totality of each participants’ knowledge illustrates the dialogical nature of knowledge co-creation (Tsoukas 2009). Knowledge of all participants is brought into the process when one participant offers a distinction based on the totality of their knowledge, and the other participants respond to the offer by elaborating, accepting, rejecting or ignoring the distinction based on each of their totalities of knowledge about the epistemic object. Knowledge co-creation sequences therefore describe the interaction that leads to the creation of new knowledge in a design game activity.

8.2 Game structure

Interaction within a design game activity takes place within an institutional frame, which informs the participants of the type of interaction taking place. The institutional frame is a feature of the design game that is initially established by the facilitator and the presence of game material that both act as metacommunication that a design game activity is taking place.

The institutional frame of a design game activity has two main effects for knowledge co-creation. First, the institutional frame provides the game structure: a prescribed overall sequential organization where each part of the design game activity has a set of institutional goals that the participants orient to. In the empirical study, the game structure consisted of seven game turns which in turn comprised of three phases, each with their own game goals. Second, the institutional frame resignifies the objects and actors as relevant for the game structure, turning the physical boundary objects into game material with special significance in the game structure, and the participants into the players and the facilitator, each of whom has a specific role in the game structure.

The game structure is produced by the participants when they orient themselves to the game goals of the design game activity. The facilitator has a key role in communicating a recognizable form of overall structural organization at the opening of the design game activity (Nielsen 2012; Robinson 2013). In the design activity analysed in the empirical study, the facilitator explained the game rules and made explicit calls to the transitions between game turns and phases, thus reproducing the game structure. Over the course of the design game activity, the players also gained the ability to reproduce the game structure by referring to game goals, interacting with the game material, and initiating transitions in the overall structural organization of the design game.

The empirical study suggests that during a design game activity, participants follow the game structure to problematize individual parts of the epistemic object so that they can create distinctions about a single topic at a time. This
helps the participants offer and accept distinctions about the same aspect of the epistemic object instead of talking past each other. Each cycle of problematization, creation of distinctions, and resolution of the problem forms a game turn, and the design game activity is comprised of individual game turns. Figure 46 visualizes the game structure along with the use of boundary objects and the epistemic object in three theoretical phases – Problematize, Develop and Resolve – that correlate with the Setup, Collaborate and Materialize phases observed in the empirical analysis.

Each game turn begins with problematizing a part of the epistemic object, focusing the collective attention of the participants on a specific problem that will be addressed during that game turn. While distinctions are not created in the Problematize phase, problematizing one specific part of the epistemic object allows later phases to focus on creating distinctions about the problem of that game turn.

In the Develop and Resolve phases of the game turns, the participants engage in productive dialogue where distinctions are offered and followed with at least some productive responses to co-create knowledge. Based on the empirical analysis, the interaction in Develop phase is the most productive of the three phases, meaning that the most distinctions were created. The reason for this is that the game goal of the Develop phase is the creation of
Theoretical interpretation

distinctions until the participants consider that the epistemic object has been developed to the point that they are able to resolve the problem of that game turn.

Once the participants are confident that the epistemic object has been sufficiently developed, the Resolve phase begins where the goal is to resolve the problem and consolidate the shared understanding of the epistemic object. The game goal of the Resolve phase is not the creation of distinctions but the resolution of the problem, but the phase still makes it possible for the participants to offer additional distinctions when modifying the boundary objects. Producing a final formulation of the epistemic object that resolves the problem also provides an opportunity to bring out any disagreements that may have been left unaddressed in the Develop phase. This was shown in the empirical study when the participants reformulated and expanded the previously accepted distinctions into the written answer that became part of the game material.

The game structure prescribes the use of boundary objects in all phases, but their use varies greatly by phase. In the Problematization phase, new boundary objects are introduced and used to problematize a part of the epistemic object. In the Develop phase, the boundary objects introduced on that game turn are used to represent the problematized part of the epistemic object, while the boundary objects introduced on earlier game turns are used by the participants as representations for the parts of the epistemic object that have already been resolved. The difference between the new and the old boundary objects is that only the current game turn’s boundary objects are problematized and open for new distinctions – the boundary objects of previous game turns are taken as unproblematic, and instead represent stable, agreed-upon aspects of the epistemic object that can be used as the basis for new distinctions.

In the Resolve phase, boundary objects introduced at the beginning of the game turn are modified to represent the final understanding of the problematized part of the epistemic object. By modifying the boundary objects and placing them among the boundary objects of previous game turns, the participants turn that game turn’s boundary object into a stable representation no longer missing an answer, thus de-problematizing the part of the epistemic object it represents. However, the relationships between individual stable boundary objects can still provide opportunities for creating distinctions, as distinctions about the interconnectedness of the different parts are created.

The use of boundary objects to represent parts of the epistemic object closely resembles the knowledge practices in design described by Ewenstein and Whyte (2009, 22–23), where some visual representations raise ques-
tions and draw attention to their incompleteness, while others provide stable reference points. Like the ones used in Ewenstein and Whyte’s multifunctional design teams, the boundary objects used in design games are relevant to members of different communities-of-practice. However, where the designers described by Ewenstein and Whyte problematized and de-problematized different representations according to their moment-to-moment needs, the problematization and de-problematization in the design game activity follows the game structure.

The end of a Resolve phase is also the end of that game turn and is marked by either starting a new game turn with a new Problematize phase, or by closing the game activity. If a new game turn is started, the participants repeat the same three phases with new boundary objects and a newly problematized part of the epistemic object. This cyclical nature of the game structure creates support in prescribing the next thing to happen in each point in time, while being flexible to allow the participants to pace the design game activity according to the needs of their collective knowledge co-creation process.

During the design game activity, the participants can temporarily suspend the game structure by interacting with the other participants according to other organizing principles than the game structure. In the empirical study, participants deviated from the game structure when they offered distinctions about the epistemic object beyond what was required by the game structure, and when a distinction was followed by an agreement sequence that was not related to any reoccurring part of the overall structural organization. These temporary suspensions allow the participants to pursue goals outside of the game structure, such as pursuing interesting aspects of the epistemic object and reinforcing a sense of agreement and collaboration, without breaking down the design game activity. The suspension lasts until a participant resumes the game structure by acting in a way that reproduces the game structure, such as referring to the game goals, after which the interaction continues according to the game structure until the next suspension takes place or the design game activity ends.

At the closing of the design game activity, the result of the design game activity is a developed epistemic object which is now a part of the conceptual knowledge of the participants, physically represented by the constellation of modified boundary objects. The final form of the developed epistemic object completes the generative dance of knowledge co-creation for that design game activity (Cook and Brown 1999): the participants have drawn upon their respective knowledges to co-create new knowledge in collaborative interaction.
8.3 Four types of support for knowledge co-creation

Whereas knowledge co-creation sequences and the game structure both describe the design game activity as a process, the system view of the preliminary theoretical framework extrapolated that design games provide four types of support for knowledge co-creation: boundary objects, facilitation, the epistemic object, and the institutional frame. Based on the empirical research, this thesis proposes that design games provide *physical, social, conceptual* and *structural support* for knowledge co-creation in a design game activity. The four categories of support for knowledge co-creation are presented in Figure 47 as a visual guide to the various elements of knowledge co-creation in a design game activity.

![Figure 47: System view of knowledge co-creation within the institutional frame of a design game activity.](image)

In Figure 47, the central process of co-creating knowledge by developing the epistemic object through collectively accepted distinctions is visualized as coloured arrows that place distinctions from the participants onto the epistemic object. While in principle, each distinction can be traced to a participant who offered it, the offered distinction must be accepted in the interaction between the participants, visualized as bold black arrows, before the distinction is created and becomes an accepted part of the epistemic object.
**Physical support** for knowledge co-creation is provided by boundary objects, i.e. physical artefacts meaningful for all participants from various communities-of-practice, used as representations for various parts of the epistemic object (Knorr Cetina 2001; Ewenstein and Whyte 2009). The use of boundary objects as representations is visualized in Figure 47 as dashed light green arrows between the boundary objects and the epistemic object, where multiple boundary objects are *used to represent* parts of the same epistemic object (Ewenstein and Whyte 2009).

Whereas the preliminary theoretical framework extrapolated that boundary objects can be used as representations of the epistemic object, the empirical study expands this understanding by showing that using boundary objects allow the participants to focus on the one part of the epistemic object represented by a boundary object while de-problematizing all others (cf. epistemic and technical objects in Ewenstein and Whyte 2009). Once a boundary object has been used as a representation, the epistemic object is partially *instantiated* into that boundary object, giving participants the ability to refer to the epistemic object through the physical boundary objects (Knorr Cetina 2001; Ewenstein and Whyte 2009). As specific boundary objects are used as representations for specific parts of the epistemic object, the participants are also able to move from a topic that has been exhausted of potential distinctions to a new topic, and re-introduce earlier distinctions by referring to the corresponding boundary objects.

In addition to representing parts of the epistemic object, boundary objects are also used to represent knowledge of the participants by providing a shared language that overcomes the syntactic knowledge boundary of lacking shared words (Carlile 2002; 2004; Bechky 2003). In the empirical study, the participants offered distinctions by elaborating the meaningful details of boundary objects, such as text and relative positioning. As boundary objects are meaningful for all participants, distinctions offered using the boundary objects can be accepted by the other participants on the grounds that they too understand the epistemic object and the relationship between the epistemic object and the language on the boundary objects. This aligns with the theoretical framework to suggest that the participants implicitly negotiate a shared meaning for the words by using them, forming a shared vocabulary anchored to the physical boundary objects that helps overcome the semantic knowledge boundary of not having shared definitions for words (Bechky 2003; Vaajakallio 2012; Carlile 2004).

**Social support** is provided by facilitation, meaning the actions taken by a participant in the institutional role of a facilitator (Drew and Heritage 1992; Hirvensalo 2015). Whereas the preliminary theoretical framework extrapolated that the facilitator supports knowledge co-creation, the empirical study shows that the facilitator both supports the creation of distinctions,
and participates in creating distinctions to input their substantive expertise (Huxham and Cropper 1994, 5). By taking the institutional role of a facilitator in the interaction, visualized in Figure 47 as bold black arrows, the facilitator is able to support knowledge co-creation by using institutional talk associated with the facilitator role to elicit new distinctions from the players (Drew and Heritage 1992; Nielsen 2012). Techniques such as asking clarifying questions and asking the players to do game tasks create opportunities for players to offer distinctions, which in turn provide opportunities for the other participants to accept or elaborate the offers, resulting in the creation of more distinctions.

Conceptual support for knowledge co-creation is provided by the epistemic object. In a design game activity, the epistemic object supports knowledge co-creation by providing a shared object that the distinctions are made about, and by motivating the continued collaboration. As extrapolated in the preliminary theoretical framework, the epistemic object allows participants to be mutually understandable when offering distinctions based on their own knowledge. This allows the other participants to then place those offers in the context of their own knowledge and accept them, co-creating knowledge across the knowledge boundaries between communities-of-practice (Carlile 2004). Epistemic objects also motivate the creation of distinctions though their incompleteness which invites the participants to collaborate to know more about them (Rheinberger 1997; Knorr Cetina 2001; Nicolini, Mengis, and Swan 2012), as shown in deviations from the game structure in the empirical study.

The three categories of support described above are not exclusive to design games as they are in line with other types of knowledge co-creation sessions such as brainstorming (Nielsen 2012). However, within the institutional frame of a design game activity (Drew and Heritage 1992; C. Goodwin and Goodwin 1992), these types of support are resignified as features of a design game activity as extrapolated in the preliminary theoretical framework (Harvianinen 2012; Waern 2012). Boundary objects are resignified into game material that has special significance in the design game and further communicated to the participants that a design game activity is taking place. Participants are resignified alternatively into players or into non-player game roles such as gamemasters or referees, formulated in Figure 47 as game facilitator. The epistemic object is not itself resignified, but development of the epistemic object is resignified into the institutional goal of the design game.

Like all institutional frames, the institutional frame of a design game activity is produced by the participants, while also affecting how the participants act (Drew and Heritage 1992). The participants co-produce the institutional frame (M. H. Goodwin 1995) by acting in accordance with it: following the
roles of players and game facilitator, orienting to the game’s goals, following the game rules that constrain interaction (Vaajakallio 2012; Hannula and Harviainen 2016), and using objects and taking actions with special significance within the design game (Waern 2012).

The institutional frame of a design game activity thus provides structural support for knowledge co-creation by providing a game structure that allows the participants to follow the cyclical process of game turns and phases to co-create knowledge. What is noteworthy of the institutional frame of a design game activity compared to other types of knowledge co-creation sessions is that it provides an arbitrary but acceptable set of roles, goals, constraints, special inference, resources and overall structural organization for knowledge co-creation within the game activity. Design games utilize the participants’ cultural understanding of games and game-playing to create a context in which the participants readily accept the features of the game if they fall within their cultural understanding of games. The effect of the resignification is therefore that the participants recognize the activity not as a knowledge co-creation session or a workshop but as playing a game.
9 Discussion

In this chapter, the theoretical and practical implications of this thesis are discussed to understand its position in the larger literature, provide directions for future research, and describe how the results of this thesis can be applied in practice. Finally, the results are evaluated against the epistemic virtues of qualitative research, and limitations of the research are discussed.

9.1 Theoretical implications and future research

The focus of this thesis is on knowledge co-creation in design game activities, and the empirical study concerns a single design game session in which the design game ATLAS was played. However, the results of this thesis have implications for future research regarding knowledge co-creation in design games of all kinds, supporting knowledge co-creation with various methods not limited to design games, and the study of knowledge co-creation in general.

9.1.1 Implications for design games in knowledge co-creation

This thesis presents a theoretical framework for analysing design games as a distinct type of knowledge co-creation method by highlighting the institutional frame of the design game activity as the thing that makes the activity a design game. The institutional frame encloses the physical, social and conceptual support available to the participants, resignifies them as parts of the design game, and provides a fourth type of support, structural support, to knowledge co-creation in the form of a game structure.

Earlier research has repeatedly pointed out that design games provide a “structure” for interaction (e.g. Johansson 2005, 83; Vaajakallio 2012, 225; Hannula and Irrmann 2016). This thesis proposes the theoretical concept of game structure to explain this structuring ability of design games. Game structure is comprised of the overall structural organization of a design game activity and the game goals associated with each part of the overall structural organization. Game structure can be used as an analytical framework for studying how design games provide clear shared goals for collabo-
ration and guide the participants in developing an epistemic object. Additionally, this thesis helps compare the structural support provided by design games to other knowledge co-creation methods by showing how the game structure is created through facilitation (Cooren et al. 2006) and can be compared to other activities that have recognizable forms such as doctor’s appointments (Robinson 2013). However, what remains exceptional in design games is their ability to make the structure of the activity visible for participants and researchers alike and provide means for designing interactions through the tools of game design.

While this thesis identified a distinct game structure with specific phases and goals, it is important to keep in mind that the rules, roles, goals and material of any design game are arbitrary: different or altered design games will inevitably have a different game structure. Moreover, the institutional frame of any design game activity is based on the cultural understanding of game-playing (Stenros 2015, 110), which includes the idea that the rules and goals are not only arbitrary but contrived i.e. exist for no other purpose than to make the game activity possible (Suits 1978). This suggests that different games have different institutional frames, and the institutional frames of design games can be designed to create contexts that are conducive for knowledge co-creation.

However, the results of this thesis describe the game structure not just as it was observed in the empirical study concerning the use of ATLAS, but additionally rooted the model of game structure in knowledge co-creation theory to describe how the observed game structure guided the participants in problematizing and de-problematizing aspects of the epistemic object with the help of the boundary objects. These results are more widely applicable than just the study of ATLAS, since various design games can produce a similar game structure that divides the larger topic into smaller topics and provides helpful physical support for creating distinctions in an organized manner. For example, the design game Topaasia is designed to help a team develop their working practices by discussing a single question at a time, such as what is team’s greatest challenge, and choose their preferred answer from a set of answer cards (Hannula and Harviainen 2018).

As this thesis is focused on studying knowledge co-creation solely in design game activities, future research should address the larger context within which design game activities take place. Within a design game session, i.e. a design gaming encounter (Stenros 2015, 147; Goffman 1961, 36), a design game activity is preceded by a briefing or other preliminary activity, such as introduction, and followed by a debriefing of the design game and its results. While these parts of the design game session were left beyond the scope of this thesis, debriefings have been identified as crucial components of simulation games based on their impact on learning (Fanning and Gaba 2007;
Discussion

This raises the question whether debriefing might also have an important role for knowledge co-creation in design games, even though knowledge is already co-created during design game activities themselves which features built-in moments of reflection (Hannula and Harviainen 2016).

The theoretical framework presented in this thesis assumes that it is always better to have as productive dialogue as possible in which as many distinctions are created as possible. However, future research should more carefully observe how the epistemic objects and boundary objects developed in design game activities are later used. This longer-term view of the intended and unintended results of design game activities should then be combined with an evaluation of the results by defining a set of goals and expectations that the participants are pursuing. The expected and unexpected value that design game activities provide could then be compared to the expectations to better understand the use and usefulness of design games for the organizations at large. If such evaluations can be made, the theoretical framework of creating distinctions can be used to track under which conditions the most valuable distinctions were created.

Conflicts of interest involved in knowledge co-creation (Hirvensalo 2015) were not specifically analysed in this thesis, but they also did not feature prominently in the data despite involving two organizations with potentially differing interests. This could mean that the presence of game goals and game roles in the institutional frame of the design game activity helped to downplay the organizational roles and interests involved and stopped conflicts of interest from disrupting the knowledge co-creation process. If design games stop conflicts of interest from being expressed, this can also mean that existing conflicts of interest remain unaddressed while playing design games, denying the participants of the chance to address and resolve those conflicts as a source of new knowledge (Carlile 2002).

However, this thesis did identify some breaks in the institutional frame of the design game activity that involved offering distinctions beyond what was required by the game goals, and agreement sequences that did not line up with any specific parts of the design game activity’s overall structural organization. These breakdowns suggest that design game activities involve other social processes in addition to the game structure and the structure of individual knowledge co-creation sequences addressed in this thesis, or that these other processes are suppressed by the game structure until they break out in deviations. Future research should analyse both what kinds of breakdowns can happen in design game activities and whether these informal social processes might become more visible in less structured knowledge co-creation gatherings. Studying breakdowns in design games specifically, such as disagreement over the creation of distinctions or lack
of shared understanding about the epistemic object, can inform future research how the participants manage conflicts within the game structure and how these breakdowns are recovered from.

### 9.1.2 Implications for facilitating knowledge co-creation in general

This thesis proposes a categorization to four types of support for knowledge co-creation: physical, social, conceptual and structural. Similar models seeking to consolidate different theories have been proposed before, focusing on material and conceptual objects of collaboration (Nicolini, Mengis, and Swan 2012), and on social and physical resources for interaction in facilitated brainstorming sessions (Nielsen 2012). However, the model proposed in this thesis presents a way to address the interrelationships between physical artefacts, conceptual artefacts and social actors in a way that can be operationalized to knowledge co-creation at the level of turns-at-talk. Because the framework proposed in this thesis takes into consideration a wider selection of objects and actors, it can be used to evaluate the significance of various objects and actors for the offering and accepting of distinctions in diverse settings beyond just design game activities.

This thesis builds on the ideas proposed by Ewenstein and Whyte (2009) that physical boundary objects and conceptual epistemic objects are linked by a representation relationship, as described in their paper on the use of epistemic and technical objects in architectural design. However, this thesis shifts the perspective from talking about multiple objects that change between unfolding epistemic objects and stable technical objects depending on their use, to talking about one epistemic object that motivates collaboration. In this sense, this thesis places primacy on a singular epistemic object being developed in knowledge co-creation. As such, this thesis aligns with Knorr Cetina’s (2001) descriptions of epistemic objects as long-term objects of interests that are materially unfolding over time into multiple instantiations, but where no individual physical artefact contains the whole epistemic object (Knorr Cetina 2001, 182–83). This may be a result of the empirical context studied in this thesis – the participants were planning a single project – but offering and accepting distinctions also required that the participants were in the belief that they were talking about the same epistemic object. This suggests that people engaged in knowledge co-creation are creating distinctions about one epistemic object at a time even if they address multiple epistemic objects during a single activity.

This thesis also proposes that the representation/instantiation relationship between an epistemic object and the boundary objects do not exist before use: establishing an existing boundary object as a representation of the epistemic object requires an initial offer to associate the boundary object with
a part of the epistemic object. Once this initial connection is made, the connection is retained by all participants. It is therefore important that the ability to represent should not be mistaken for an a-priori connection that exists between representations and epistemic objects outside of the interaction they are used in. On the other hand, this thesis does not address the use of boundary objects that have been designed to represent specific epistemic objects, which may also be especially useful in knowledge co-creation because of their established relationship. Examples of these kinds context-specific representations include architectural drawings (Ewenstein and Whyte 2009), technical drawings (Carlile 2002), context-specific game material (e.g. Ehn and Sjögren 1991), technical readouts (Knorr Cetina 2001) or the results of experiments (Nicolini, Mengis, and Swan 2012).

The idea that boundary objects can only be used as representation for the aspects of an epistemic objects after a participant has made the connection also has implications for considering boundary objects “tangible definitions” in knowledge work. Bechky (2003) describes physical machine parts being used as effective boundary objects between engineers designing machines and assemblers putting them together, and argues that the ability of boundary objects to help overcome situations where language fails also applies in knowledge work. This runs counter to the findings of this thesis, where the participants specifically used the language available on the boundary objects to establish a shared syntax, as opposed to referring to the physical attributes of any boundary objects like machine parts. The findings of this thesis are more in line with Carlile’s (2002) descriptions of assembly drawings being used as boundary objects, where the language on the boundary object was used by all the collaborators, and the boundary object helped focus the collaboration on developing a shared epistemic object that the boundary object represented. This triangular relationship between a physical artefact, such as a game card or a drawing, the language already visible on the artefact, and the corresponding epistemic object that is being developed warrants further research to understand what kinds of boundary objects can best be used to support knowledge co-creation.

In addition to boundary objects and epistemic objects, the design game also supported knowledge co-creation by providing a facilitator role to one participant. The facilitator of a design game activity used institutional talk, as expected based on prior literature, by asking clarifying questions and giving the players game tasks to complete. However, other documented forms of facilitator’s institutional talk were not observed, such as encouraging collective reflection among the participants (Gergen, Barrett, and Gergen 2004; Heron 1999). This may be a result of the way the author categorized assessments made by the facilitator about the epistemic object as offers that directly created distinctions, instead of classifying those turns-at-talk as prompts used by the facilitator to merely help others create distinctions.
Because this thesis shows the facilitator’s direct contribution to knowledge co-creation, this thesis supports the notion that input “substantive expertise” (Huxham and Cropper 1994, 5) by offering and accepting distinctions based on their knowledge about the epistemic object. Within the theoretical framework of this thesis, each offer and response is an act of knowing that injects the knowledge of that participant into the collective knowledge co-creation process. As a result, the facilitator did not just act as a content-neutral party as proposed by Phillips and Phillips (1993) and others. This suggests either a greater variance in facilitation practices than suggested by prior literature, meaning that only some facilitators participate in knowledge co-creation, or that the theoretical framework of knowledge co-creation as the offering and accepting distinctions has revealed that facilitators contribute more to knowledge co-creation processes than previously understood.

This thesis conceptualizes the institutional frame as a structural support for knowledge co-creation, as it resignified objects and actors in the design game activity and provided the game structure for interaction. The results of this thesis suggest that the institutional frame is reproduced by the participants based on metacommunication surrounding a knowledge co-creation activity (cf. Goffman 1961). The arbitrary nature of design games makes visible the institutional structures that affect all interaction in highly structured institutional contexts, such as workshops (Rixon 2013) and process simulations (Smeds, Suominen, and Pöyry-Lassila 2014). Future research can now address whether different structural supports can be found in other institutional contexts for knowledge co-creation than design games, and whether the institutional frame can be affected by the expectations of participants, e.g. regarding their role as organizational representatives.

More generally, the single case study approach of this thesis creates many avenues for expanding and generalizing its results over time, across contexts, and beyond individual knowledge co-creation activities. By following Bereiter (2002) in considering knowledge co-creation as knowledge work in which the participants create conceptual artefacts that are used to create value in other contexts, longitudinal data can help uncover the impact of specific knowledge co-creation activities. Comparing knowledge co-creation to knowledge work implies that the epistemic objects developed in knowledge co-creation activities are exploited in other contexts, which in turn raises further questions. Are conceptual artefacts used by the same participants who create them? If not, how are conceptual artefacts introduced to people who did not participate in developing them? This question has great relevance especially for practitioners who want to gain the maximum impact from knowledge co-creation activities for the benefit of the participating organizations at large.
According to Tsoukas (2009), distinctions become part of the organizational background and result in changed practices. This suggests that future research should study the use of conceptual artefacts created in knowledge co-creation activities and evaluate their effects on the practices in the participating organizations. Future research can also find out to what degree are emergent practices, such as knowing the rules of the activity, kept from one session to another if the participants are the same over multiple activities, or if each knowledge co-creation activity begins from a neutral state.

Comparison across cases where different knowledge co-creation methods are used with different participants can shed light on how the elements identified in this thesis can manifest in different circumstances. For example, depending on the participants and the organizations involved, their goals and attitudes may affect knowledge co-creation and its results positively or negatively. Similarly, a different material environment and the practices of other facilitators can provide different types of support for knowledge co-creation. Comparison between design games and other knowledge co-creation activities is especially needed to juxtaposition the game structure of design games with the institutional frames of other types of activities. This comparison would show to what extent the ability of the institutional frame of a design game activity to resignify boundary objects and other resources changes the way they are interacted with when compared to situations where there is no game-related institutional frame.

Finally, future research on knowledge co-creation should elaborate on the theoretical framework of this thesis to study what kinds of knowledge and ways of knowing participants draw upon when offering and responding to distinctions. Figure 48 presents a visualization that illustrates how further research with a wider scope in terms of time and setting can expand on the framework presented in this thesis by including the background knowledge of the participants regarding the conceptual artefacts, people and tools embedded in their practices.
This wider scope could test many underlying assumptions of this thesis’ theoretical framework and provide further insight into how the knowledge of participants can better be leveraged in knowledge co-creation. For example, bringing practice-relevant objects and participants into the activity to better represent practice knowledge (visualized in orange and blue in Figure 48). The role of materiality and tools embedded in the practices of the participants should also be addressed in further research: would bringing visualizations or physical tools of the different communities-of-practice into knowledge co-creation activities affect how distinctions are offered and accepted? And if the epistemic object would be a historical event, such as a past project that the participants are trying to analyse (like in Hirvensalo 2015), how would the knowledgeability of the participants regarding each other feature in offering and accepting distinctions?

9.1.3 Implications for understanding knowledge co-creation

This thesis contributes to the literature on knowledge co-creation by providing a detailed account of the interaction that leads to the creation of new knowledge: the knowledge co-creation sequences. Within the theoretical framework of this thesis, the most simplistic way of defining knowledge co-creation is ‘two people who know different things go into a room, interact, and exit knowing something neither of them knew.’ This thesis pro-
poses a theoretical framework for studying the process and results of individual knowledge co-creation activities without resorting to black box descriptions such as “conceptualization” (Nonaka 1994), “creating a concept” (von Krogh, Ichijo, and Nonaka 2000), or “modelling solutions” (Engeström 2001). This formulation then presents three questions that should drive further research into knowledge co-creation: What do the participants enter the room with (process inputs)? What do they do there (process steps)? What new do they know after leaving the room (process outputs)?

This thesis proposes that participants bring to the knowledge co-creation activity their knowledge and ways of working that reflect the communities-of-practice they are members of, such as organizational units and professional disciplines. Knowledge co-creation is interaction between the participants where they create distinctions about a shared epistemic object i.e. the object that is relevant to all participants and that they want to know more about. The result of knowledge co-creation is the development of the epistemic object, and the interaction results in increasing the conceptual knowledge of the participants.

This thesis has brought together the work of Cook and Brown (1999) on the generative dance with the work of Bereiter (2002) on conceptual artefacts to create a theoretical framework of knowledge and knowing in interaction. Based on the theoretical framework, this thesis conceptualizes knowledge co-creation as a collaborative version of Bereiter’s (2002) knowledge work done between participants of various backgrounds, and demonstrates how Cook and Brown’s (1999) productive inquiry takes place through creating distinctions. The framework places emphasis on the co-creative, non-deterministic nature of knowledge co-creation where the results depend not only on who participates and what knowledge they bring to the process, but how exactly the participants are able to offer, accept and elaborate on distinctions, and how each turn-at-talk is produced, interpreted, re-evaluated and built upon in their interactions.

The results of this thesis provide empirical support for the theory-driven proposition of Tsoukas (2009) that new organizationally relevant knowledge is created in interaction through distinctions: linguistic changes that reflect an underlying conceptual change. This thesis proposes that dialogue is productive when distinctions are being both offered and accepted, and unproductive dialogue is interaction where distinctions are not offered or accepted. If no offers are being made, participants are not contributing to the shared object. Conversely, if distinctions are offered but not accepted, the participants make claims that do not lead to greater understanding because of the lack of agreement. These observations support the descriptions of dialogical knowledge creation of Tsoukas (2009).
However, the level on which distinctions were operationalized in this thesis differ considerably from the ones cited by Tsoukas (2009). While distinctions were operationalized in this thesis as individual turns-at-talk that resulted in changes to the epistemic object, the examples Tsoukas (2009) cites as distinctions are second hand accounts of epiphany or increase in shared understanding. Events like Tsoukas’ descriptions of distinctions were observed in the empirical study of this thesis in the form of the agreement sequences, but the analysis showed that the distinctions that were followed by agreement sequences did not differ from the distinctions that were not followed by agreement sequences. As such, future research should apply conversation analysis methodology to the instances cited by Tsoukas (2009) to better understand the divergence between the way this thesis studied each assessment about the epistemic object as its own distinction, and the way Tsoukas (2009) describes distinctions as great leaps in shared understanding.

This thesis presents a concrete way of observing the use of physical and conceptual artefacts in interaction between representatives of different organizations, and how physical and conceptual artefacts are connected by the relationship of representation/instantiation. Future research should look at other contexts of knowledge co-creation more critically to distinguish what is being developed and what is being used to develop when knowledge is co-created to strengthen the theory on epistemic objects, boundary objects and other objects of collaboration (Nicolini, Mengis, and Swan 2012).

Finally, since this thesis brings together multiple perspectives in organization research on knowledge creation, the results of this thesis should be discussed with other fields such as education where a similar undertaking of adapting the findings of diverse fields related to knowledge creation is taking place (Paavola, Engeström, and Hakkarainen 2012; Paavola, Lipponen, and Hakkarainen 2004; Cacciamani, Perrucci, and Khanlari 2018). The methods described and used in this thesis provide a methodological basis for detailed comparison in which conceptualizations from multiple fields can be compared with each other at the level of turns-at-talk. For example, the description of the epistemic object as a conceptual artefact presented in this thesis is a close parallel to the concept of a trialogical object in education research, a concept that has also been applied to organization research (Hannula et al. 2014; Pöyry-Lassila 2015).

### 9.2 Practical implications

The practical contribution of this thesis concerns the design and facilitation of design games to support knowledge co-creation. One of the key implications of this thesis is that the institutional frame of a design game activity
provides a *designed* set of roles, goals, constraints, special inference, resources and overall structural organization. This means that a person who is willing to put in the effort into choosing a suitable design game – or going as far as constructing a completely new one – should take into consideration what kinds of interaction the institutional frame of the design game is likely to encourage. The implication is that *design game designers* (Vaajakallio 2012, 175) can leverage the cultural understanding of games to have more control over specific aspects of knowledge co-creation compared to facilitators using already conventionalized knowledge co-creation session formats such as brainstorming sessions (Nielsen 2012).

The results of this thesis provide several guidelines for designing and facilitating design games to support knowledge co-creation. First, the goals of the design game must be clear on two levels: why are the participants playing the design game, i.e. what is the design goal that they are pursuing, and what are the participants supposed to do while playing the game, i.e. what is the game goal. The design goal and the game goal also need to be in alignment: if the participants cannot understand how working toward the game goal will help them reach the design goal, they will struggle to trust the process implied by the game structure of the design game.

Second, the participants need to have a shared thing they are developing. In *ATLAS*, it’s the project plan, but it could be a service, the working practices of a team, or other epistemic object that the players need to develop further. If the participants disagree on what they have come to develop, some of the participants’ contribution will be missing from the intended object of development. In a design game, rules and mechanics can support the creation of new distinctions by allowing the participants to rapidly change topics or perspectives to keep the epistemic object evolving – a single static question is quickly answered, but a problem that eludes the players even as they get closer to it will unite and motivate the players to get behind a single goal.

Third, the game can and should make things a bit hard – after all, a challenge can make games more fun (Koster 2005), and eliminating the familiar ways of approaching a problem can help find a novel approach (Hannula and Harviainen 2016). However, adding extra rules or steps that feel irrelevant may negatively affect the motivation of the participants. Instead, the game rules and material should define a game structure that takes the participants closer to their design goals in a way that slows down the process only when it serves the knowledge co-creation process, such as encouraging reflection during the game (see also Hannula and Harviainen 2016). However, this guideline should not be taken as an encouragement to build a linear track of progression, as too rigid structures rob the participants from opportunities to improvise and experiment, thereby decreasing their sense of autonomy.
Finally, the game material must be meaningful for everyone at the table. If the design game is used by software engineers collaborating with accountants, the material must be understandable and relevant for both groups. After all, the point is to bring in the professional knowledge of both groups, and they cannot apply their knowledge to something they do not recognize. Context-specific material can help participants draw on their professional knowledge, but all participants need to be able to offer distinctions using the game material to participate in developing the epistemic object. As such, generic game material concerning a shared domain, such as the Question cards of ATLAS, allow knowledge from various communities-of-practice to be leveraged in the design game activity.

The role of the facilitator is to maintain the design game activity by communicating to the players that they are playing a game and encourage the players to create distinctions about the epistemic object. The first thing the facilitator must do at the beginning of the design game activity is to create confidence that everyone in the group has gathered to solve the same problem. The point is to encourage all participants to bring out their diverse knowledge in the form of offers and responses even though they have different amounts and levels of knowledge about the epistemic object. The facilitator must also establish trust in the process: even though it is impossible to know what the result will be, the participants are playing the design game specifically because they want to know previously unknown qualities about the epistemic objects.

The role of a facilitator is to participate in the design game by helping others play the game, not play it themselves. Various prompts can be used to elicit input from the players, such as asking clarifying questions and giving game tasks, but the goal of the facilitator is to help players offer distinctions based on their knowledge. This is especially important if some organization or area of expertise is only represented by few people, since leveraging that knowledge relies on the participation of those people. The same goes for making sure the players respond to each other – knowledge is only co-created if other participants agree with the offered distinctions. Knowledge of the participants only matters if it is deployed in talk or in action, and distinctions that are not agreed with do not become accepted by the group. In the best case, players can instantly elaborate on each other’s offers, creating multiple distinctions in a short amount of time.

Finally, the facilitator represents the game. Often only a few of the players have played any design games before, and usually none have played the specific design game being played at that time. The facilitator should explain the game, but let the players learn by doing. Subtle cues, such as making eye contact with the player whose turn it is or pointing at cards, can provide just
enough support that the players establish commonly accepted ways of playing the design game. The game is meaningful only if used, so the facilitator’s job is to give permission and even demand that the players play the game.

Many of these practical suggestions can be used in other types of knowledge co-creation activities, such as workshops or even meetings. Even in traditional meeting, a participant can identify the situation as an opportunity for knowledge co-creation, take a facilitator role in defining the epistemic object that should be developed, and guide other participants into offering distinctions using available boundary objects.

9.3 Evaluation and limitations

The evaluation and limitations of this thesis are based on the research approach and methodological choices made in conducting the research. The empirical study of this thesis is a qualitative theory elaboration study, and as such this section is structured using the qualitative evaluation criteria proposed by Lincoln and Guba (1985): credibility, transferability, dependability and confirmability. The evaluation of the results is presented for endogenous dialogue, i.e. for evaluation of whether the selected epistemic virtues have been followed within the selected research approach and reasoning strategy, not for defending the selection of the approach (Ketokivi and Mantere 2010).

9.3.1 Credibility

Credibility refers to the truthfulness and persuasiveness of the causalities and relationships inferred in the thesis (Guba and Lincoln 1989). Credibility of a study is justified by the credibility of interpretations, internal validation of the inquiry, continuous revision of hypotheses, and referential adequacy (Lincoln and Guba 1985). The reasoning strategy of this thesis for establishing causalities is theoretical contextualization, meaning that the author has sought warrants by establishing that the claims are based on authentic interpretation of the data, and are relevant for the theories observations have been generalized to (Ketokivi and Mantere 2010, 324).

The credibility of the analysis is based on the author’s ability to connect their conclusions to the data and provide transparency to the reasoning process behind each step of interpretation. In conducting the research, the author collaborated with a wide range of video researchers in collaborative video analysis sessions, where the accuracy of individual transcriptions was verified, various interpretations for the phenomena exhibited in the data were produced, and the credibility of each interpretation was discussed (Jordan and Henderson 1995). The researchers involved in these video analysis sessions were researchers of the ATLAS project, other researchers at
the SimLab research group, and graduate students of a video analysis research method course at Aalto University. The video analysis sessions took place in the years 2014 to 2018, approximately three times a year on average. These rounds of collegial evaluation were then used by the author to construct and clarify the chain of interpretation presented in this thesis so that the data is presented as authentically as possible.

In the type of interaction analysis utilized in this thesis, the interpretations of the author are not subject to the approval of the people recorded in the video data, and as such the author had not been in contact with the people who participated in the design game session the data was recorded at. Instead, the perspective of the participants is captured in the data itself, and the interpretations of the author are authentic to the decisions that the participants made when choosing their next actions in the specific situations recorded in the video data (Streeck and Mehus 2005).

To build credibility into the interpretations, the author also documented the analysis process in this thesis so that the chain of interpretation follows transparently from the data to the findings and ultimately to the results of this thesis. Similarly, when choosing the theoretical explanations of the events interpreted from the video data, the author produced the transparent account of selecting specific theoretical interpretations while conserving the existing theory of knowledge co-creation as far as possible in this thesis.

9.3.2 Transferability

Transferability describes the generalizability of the findings, i.e. whether the findings can be applied in other contexts and to other research subjects (Lincoln and Guba 1985). In qualitative research, the results are said to be generalizable into theory, not across samples. This means that the theories created in this thesis can be applied to understand other instances where the same phenomena are observed, but that future research be conscious of the limitations in generalizability that result from explaining empirical observations only in a specific context (Fisher and Aguinis 2017, 441).

The results of this thesis are theoretically generalizable to other cases based on the theoretical fit of the phenomena being observed. Figure 49 illustrates the results’ expanding generalizability across the research fields presented in section 9.1 Theoretical implications and future research. The results of this thesis are empirically generalizable to the study of ATLAS design game session because of the similarity in context. When the results of this thesis are theoretically transferred into wider contexts, the researchers building on the results of this thesis must be mindful of the limitations arising from the specific context of this study. The specific results transferable to each progressive field of literature have been described in section 9.1.
The most important limitations of transferability that arise from the data sample used in this thesis concern the set of participants and organizations featured in the data sample and the use of ATLAS as the design game. The organizations and participants are all located within the general fields of information technology industry, service design, and higher education. As such, the observed interaction of the participants may reflect an industry-dependent approach and practices that cannot be replicated in other contexts. However, research in the field of conversation analysis has shown that the lowest levels of regularity in interaction, such as turn-taking and repairs, can be found across contexts (Schegloff 2007). This suggests that the most transferable results of this thesis concern the structure of knowledge co-creation sequences, while the content of the sequences or the progression of the whole session is less transferable.

In the literature, the concept of design game has been used to describe various collaborative design methods with different game rules, game material, participants and goals (Vaajakallio 2012, 89). While deep analysis of a single design game, in this thesis ATLAS, is justified within the research approach of this thesis, the applicability of the results to other design games is limited by the features of the design game the results are applied to, and the organizational purpose the design games are used for.

A key feature of ATLAS as a design game is that it uses abstract service design language and asks the participants make sense of how the material relates to the goals of that specific design game activity during the game, as opposed to having game material that would be grounded in a specific organizational context. The findings of this thesis are therefore most transferable to the study of design games where the participants have to negotiate the meaning of game material, such as the design game Topasia (Hannula and Harviainen 2018). Conversely, the findings are less transferable to the
The purpose of ATLAS is the co-creation of knowledge, which limits the transferability of this thesis to design games used for other purposes. These include the exploratory design games described by Eva Brandt (2004) used for conceptualizing design, exchanging perspectives and creating scenarios. Likewise, the results of this thesis have limited transferability to design games created to study design (e.g. Habraken and Gross 1988) as ATLAS is deliberately geared to act as a design tool for planning projects. ATLAS is also not a simulation game that would simulate constraints or outcomes (Crookall and Saunders 1989) or a game for building design competence (Vaajakallio and Mattelmäki 2014), since the purpose is to facilitate interaction where participants create new knowledge based on what they collectively already know about the subject.

The transferability of this thesis is also constrained by the strength and scope of the theory used in the theory elaboration approach, since drawing from disparate areas of literature may weaken the theory by introducing contradicting assumptions or limiting the generalizability to narrow conditions (Fisher and Aguinis 2017). To limit the scope of literature addressed, and therefore strengthen the generalizability of the results of this thesis within that literature, the theoretical basis of this thesis was focused on knowledge as a human phenomenon instead of knowledge independent of human practitioners. Because of that limitation in perspective, the results of this thesis contribute to understanding knowledge co-creation as a human phenomenon, with limited implications for information systems or other mechanical perspectives into knowledge in organizations.

While these limitations cannot be circumvented, both the context and analysis process of this thesis has been described in detail to provide transparency for the reader in evaluating the role of context in the generated theory. To avoid generating overly complex theories (Fisher and Aguinis 2017, 441), the theoretical models presented in this thesis minimize the number of new theoretical constructs, instead aiming to introduce existing concepts from parallel fields to provide a more complete picture of knowledge co-creation in a design game session.

### 9.3.3 Dependability

Dependability describes the consistency of the study with the aim of providing results independent from the researcher’s identity that account for the
ever-changing context the research has taken place in (Guba and Lincoln 1989). The empirical study of this thesis utilizes video data to study interaction, which is highly dependable because it records the moment-to-moment events that took place, and allows the analyst to repeatedly revisit those events over the course of the research process (Jordan and Henderson 1995). Another advantage of using a single video recording as the data is that the analysis only addresses a single continuous event that is not subject to changes in the research environment, like for example a series of interviews being conducted over time in a living and changing organization would be.

The technical quality of the recording was adequate for analysing speech and the use of the game material by the participants, but most of the participants' faces and body language was partially obscured because of the single camera setup of the recording. These deficiencies of the video data meant that the analysis had to base the interpretations primarily on the voice and hand gestures such as touching or pointing at the game material. However, based on the turns-at-talk before and after each obscured expression and gesture, the author was able to conclude that the missing expressions or gestures did not significantly alter the meaning conveyed through speech and hand gesture.

The author of this thesis did not participate in the interaction analysed in the empirical study, but the author was a contributor to the creation of the design game ATLAS used as a case in this thesis. Conducting research in an empirical context that is personally familiar to a researcher provides both advantages and disadvantages to the research: the author has been able to draw upon their deep personal experience with the topic in finding theoretically interesting phenomena and explanations but has risked being led by their pre-existing conceptions in the analysis.

9.3.4 Confirmability

The final criterion, confirmability, refers to the neutrality of the study, i.e. that its results have not been skewed by bias, values and prejudice toward the subject (Guba and Lincoln 1989). Confirmability is justified by ensuring that the findings can be traced to the data as an ‘audit trail’ of inference (Lincoln and Guba 1985). The abductive reasoning strategy used in the empirical analysis follows the principle of selecting the best explanation from a set of competing explanations (Niiniluoto 1999; Dubois and Gadde 2002). Because inference to the best explanation applied in this thesis is always cognitive and not computational, there is no way to remove bias from the analysis – just like one cannot fully remove an analyst from their analysis.
This thesis follows the declared epistemic virtue by having triangulated the interpretations with other researchers versed in similar forms of video analysis as described earlier, and by describing the analysis process in detail to demonstrate its rigor through reflexivity. First, the literature review describes the selected theoretical basis that the thesis aims to conserve and consolidate. By selecting a specific theoretical literature that the author intended to contribute to, the available interpretations the author could make from the data were constrained, making sure that the observations made were theoretically relevant. Second, in reporting the findings, the inference process of matching observations with theoretical explanations is made explicit to clearly provide the theoretical explanation that arises from the literature being conserved. Finally, the discussion of the results compares the findings of this thesis to the literature being consolidated, providing a view into the contribution of this thesis in relation to the theoretical context. This declaration of considered theoretical literature, the documentation of the inference, and the comparison between the literature and the inference made the author accountable to both the literature and the data, strengthening the argumentation and reducing the risk of bias.
References


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Appendices

Appendix I: Rules of ATLAS, a design game for planning service co-design projects

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Introduction

The ATLAS game is a board game for 3 to 5 players and up to two facilitators. The suggested playing time is two to three hours provided at least one of the participants is already familiar with the rules.

The objective of the ATLAS game is to collaboratively create a project plan for a service co-development project. During the game, the players draw hexagonal tiles from stacks, place them on the table and collaboratively answer questions presented on the tiles.

If you play the ATLAS game, we at Aalto University ATLAS project would love to hear from you! Please find our up-to-date contact information at http://atlas-research.fi and send your feedback, comments and experiences to us.

Contents

The game material includes the following game pieces. We suggest you print the game pieces on cardstock or heavy paper. Tiles can even be glued on to cardboard or foamboard for ease of placing. Suggested printing size for each document is provided in the brackets.

- Player sheets for every player (A4)
- Objective (7 green tiles, A3)
- Project definition (8 red tiles, A3)
- Participants (6 blue tiles, A3)
- Methods & Tools (10 yellow tiles, A3)
- Lessons Learned (8 purple tiles, A3)
- Method & Tool Cards (10 yellow cards, A3)
Additionally, to play the game you need:

- Sticky notes and pens
- Persona cards that will represent the participants of the project. Any cards or photos of potential participants can be used as long as you have a wide array of different ages, sexes and backgrounds. When designing the game, we used Service Design Toolkit persona cards (www.servicedesigntoolkit.org) and cards from the Hullunkuriset perheet card game.

**Project case**

The aim of the ATLAS game is to create a service co-development project plan. This includes defining the project objectives and scope, choosing the participants of the collaboration events i.e. users, citizen or other stakeholders, and selecting the methods and tools that are going to be used in the project with the participants. Because of the focus on service co-development, the players are not to design a complete service because the final service concept can only be co-developed with the eventual participants.

Before playing the ATLAS game, the participants of the game should agree on a case for the game. The case provides a shared understanding of the goals, expectations, stakeholders, challenges and opportunities the project faces. The case does not have to be comprehensive, and the players will elaborate upon the case over the course of the game.

Examples of cases previously used in research include developing a university’s campus services, developing the economic life of a small coastal community that has lost manufacturing jobs, and developing service opportunities around big data.

**Beginning of the game (15 minutes)**

1. Sort tiles into piles, each containing tiles of a single color. Make sure everyone has tiles of every color in reach.
2. Fill your player sheets by filling in your name, level of expertise and expectations. Learning points are filled in during the game.
3. Select a motivation for co-creation by spreading the motivation tiles onto the table and discussing which of these motivations fits your case. Choose one motivation and write down in your own words the objective of the project on a sticky note and place the objective tile with the note to the center of the table.
4. The player with the shirt of the brightest color takes the first turn.
Every turn (45 minutes)

1. The player whose turn it is selects a stack of any color. (In the first turns it is advised to place Project definition tiles but the players are free to choose as they wish.)
2. The player reads aloud the question on the tile.
3. All players discuss the question on the tile. The player who chose the tile has the responsibility to sum up any conclusions onto a sticky note and place it on the tile.
4. The player who chose the card chooses an available edge on a tile that is already on the table, places the tile and addresses how the information on each tile connected to the new tile affects the answer on the tile.
5. The turn continues clockwise and the next player chooses a new tile to place on the table.

The placing of the tiles can end in two ways:

1. The time allocated to placing the tiles ends
2. All the tiles have been placed or no more tiles can be placed

Wrapping up (15 minutes)

Once the placing of the tiles has ended, take out the Wrapping up tile and collaboratively summarize the decisions you have made during the game. Each question is written with one tile category in mind, but you can also use the general discussion in the game when writing the answers.

Once the players are happy with the wrap up or they run out of time, the game ends.

The ATLAS game was developed as a part of “ATLAS: map for future service co-development” project in collaboration by: Encore, SimLab, BIT Research Centre
Knowledge Co-creation in Design Games

Conversation Analysis of an Interorganizational Design Game Session

Otso Hannula