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The Reform Journey Framework: Outlining Collaboration in Gameplay

A Conceptual Framework for Collaboration in Games, and a Collection of Properties in Collaborative Games

Master's thesis in Interaction Design

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CHALMERS UNIVERSITY OF TECHNOLOGY
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Abstract

This thesis proposes a conceptual framework to aid game designers in designing collaborative gameplay. Derived from an iterative process based on accumulated insights from papers in game research, game designer conference talks, and studies of collaboration in computer-supported cooperative work (CSCW) and computer-supported collaborative learning (CSCL), a compendium of 40 properties of collaborative games was created, and their affordances were put in relation to a central model of collaborative interaction between group members. The framework is a first step in creating a coherent mental model which gathers the various and divergent insights of the fields, and could serve both as a framework for a designer to work from as well as identifying new design dimensions for further research.

Keywords: Game design, gameplay, games, play, collaboration, cooperation, thesis, Reform Journey.

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Erik Bennerhed, Gothenburg, June 2020

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Thank you mother and thank you father who, in each and every act, made sure life kept on moving on and had somewhere to go while I was knee deep in not knowing.

Anders Sivertsson, Stockholm, June 2020

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Introduction

What makes for good collaborative experiences in games? At the time of writing, the two highest ranked board games on BoardGameGeek (BoardGameGeek, 2020) are both such games: *Gloomhaven* (Childres, 2017), wherein players assume the roles of adventurers and together explore scenarios and fight automated monsters; and *Pandemic Legacy: Season 1* (Leacock & Daviau, 2015), wherein the players scramble to retain control over the board as the game introduces ever more changes to its conditions and rules. The success of games such as *Monsters Hunter: World* (Capcom, 2018) and *Warhammer: End Times – Vermintide* (Fatshark, 2015) show that the concepts translate into digital media as well. Even in games where the primary goal is to defeat other players, team-based play has become a mainstay in games such as *Overwatch* (Blizzard Entertainment, 2016) and games within the MOBA (multiplayer online battle arena) genre, where players who help their teammates will have significant advantages towards reaching a winning state over players who only concern themselves with their own character and the opposition. As such, it grows increasingly clear that the allure of collaborative games is recognised by designers and consumers alike. However, pinpointing what game design elements create this collaboration - and why they work - is less obvious.

With games research being an as of yet young discipline (Lankoski & Björk, 2015), there is a lack of standardization in certain areas. The field has begun to explore what tools and insights game designers can utilise to create games with affordances for collaborative play between participants. However, there is a general lack of unity within what has been done so far. Depping and Mandryk (2017) criticise how researchers have varied significantly in terms of approach, context and terminology – the authors go so far as to state that *"[t]hese differences mean that game designers or researchers who wish to leverage multiplayer game mechanics to facilitate social relationships have little guidance on which mechanics or approaches to choose to implement"* (Depping & Mandryk, 2017). Insights from game designers on creating collaborative play is similarly limited. As the body of work continues to grow within both areas of research and design, it becomes relevant to investigate whether its diverse insights can be compiled into a cohesive and comprehensive whole.

As an attempt to provide clarity on these issues, this thesis explores:

> **What considerations should be made when designing multiplayer gameplay that supports, encourages or improves collaboration? What properties should these games have to fulfil these purposes?**

The deliverable is a framework of recommendations, guidelines, design dimensions, and/or game elements extracted from a synthesis of literature from existing research on collaboration in games. Furthermore, as Azadegan and Harteveld (2014) note, there exists a significant body of work on collaboration in other fields which has remained isolated from the approaches in games research. With this in mind, we include some additional insights from computer-supported cooperative work (CSCW) and computer-supported collaborative learning (CSCL) to the synthesised literature—more specifically, the activity theoretical approach as outlined by Bardram (1998), collaborative cognitive load theory as introduced by Kirschner, Sweller, Kirschner, and Zambrano (2018), and the jigsaw strategy for task independence as investigated by Nebel et al. (2017). The intent behind this thesis is to create a framework which offers a more holistic view of current knowledge of collaboration in games in a format that is useful for game designers.

This thesis follows a modified version of the theory-driven research process described by Olsson (2015). First, observations relating to collaboration are extracted from collected literature. These are then used as qualitative data for a Grounded Theory process, which ultimately creates groupings, categories and dimensions of insights. These insights are then reworked into recommendations in the form of a framework for a designer to follow. The framework is then explored and iterated upon to improve its generalisability, clarity, and applicability to improve its usefulness for designers, using co-design workshops, interviews, formal analysis of existing collaborative games, and an experimental game design session of a collaborative game.

Creating a holistic framework from collaborative games research that is useful, general and effective could prove a welcome tool for game designers who wish to encourage collaborative gameplay experiences in games. The created framework provides a mental model over how collaboration manifests in games, as well as provides a set of properties commonly seen in affording collaboration, which can aid their making of informed design decisions throughout their process. Furthermore, the synthesis of knowledge might highlight new design dimensions for researchers and practitioners alike to explore—more so when considering the integration of insights from CSCW and CSCL that are included in the corpus.

1.1 On Formatting

This thesis uses multiple fonts to distinguish between several concepts while maintaining legibility.

- *Italics* is used for quotes, for titles of games, as well as for emphasis. When used on a concept, it is to highlight that this word is used as nomenclature for the concept currently being described. It is also used to highlight the three interaction modes which are part of the created framework (see section 6.1.5).
- Small caps is used to denote gameplay design patterns (GPD patterns) as first described by Björk et al. (2003) and collected in either Björk and Holopainen (2004) or GDP3 (n.d.) (see Chapter 3: Theory). The latter is the most recent source and is continuously updated by the researchers, however not all patterns are included in it; therefore, pattern names followed by an asterisk, such as Team Play* are only present in Björk and Holopainen (2004) at the time of publishing. If a pattern exists in both collections, the more recent source (GDP3, n.d.) is used (i.e. no asterisk).
- **Bold** is used for concepts with similarities to GPD patterns. Commonly, their original author refers to these as patterns, game patterns, game design patterns, or similar—but they lack either the structure of GPD patterns or explicit definitions. For the reader's convenience, a footnote contains a working definition based on interpreting the original source; a diligent reader is welcomed to explore them further in the original source.
- ***Bold Italic*** is used to refer to Collaborative Games Properties, the collection of which is a product developed in this thesis. These are explained in more detail in section 6.2 as well as in Appendix C: Collaborative Games Properties.

2

Background

This thesis is in part a continuation of previous work by Barendregt et al. (2017), where a forced collaborative interaction game was developed to support training of collaborative skills in a special education context. The game, dubbed *StringForce*, uses two or four co-located tablet devices to form a layman's tabletop surface whereupon the game is played. The game has been further analysed by Eriksson et al. (2019) highlighting in particular the collaborative elements of the game using gameplay design patterns from a collection developed by Björk and Holopainen (2004) on a wiki with restricted editing access. However, in discussions with two of the authors—Torgersson and Björk—an interest was expressed in further investigations of what elements constitute a collaborative game experience in general.

Similar 4-in-1 tabletop games have been explored by CITE, Collaborative Information Technology in Special Education, a project at Aarhus University in collaboration with University of Gothenburg with the objective to support collaboration, communications and social interaction in the special education context (Baykal & Eriksson, 2019). Through participatory design with children, teachers and parents, the researchers develop activities mediated by technology and evaluate their applicability as tools for training collaboration and collaborative learning. Baykal et al. (2020) investigated the use of 4-in-1 tabletop games and different collaboration levels using an extension of Activity Theory. In their study, they used three different games (Two games on 4-in-1 tabletop systems and one board game). The games were classified into being either symmetric or asymmetric and how it affected the players' collaboration and found that asymmetric games tended to induce higher levels of collaboration than symmetric games.

During the work of this thesis, the world was struck by a pandemic referred to as Covid-19. As an effect, new health regulations and recommendations were brought about in society which made the utilisation of 4-in-1 tabletops undesirable, considering that participants would have to break the recommendations to play. Therefore, this thesis doubled down on its focus on examining collaboration in general—although the background research of Barendregt et al. (2017) and Baykal et al. (2020) remained important to the process.

2.1 Stakeholders

A number of stakeholders will be affected.

2.1.1 Chalmers University of Technology

This thesis is written at the Interaction Design and Technologies Master's programme at Chalmers University of Technology. Institutional decisions may affect the work process of the work, which ultimately may influence the result of the work.

2.1.2 CITE

This project spurred from the CITE project and is therefore one of the relevant stakeholders. As CITE aims to investigate collaboration in special education, the findings and result of this thesis will be of interest for the CITE project at large.

2.1.3 Designers

The aim of this thesis is to produce useful guidelines for designing collaborative gameplay in games. As such, one of the key stakeholders of this work are designers in the industry working with games and game design. In cases where clarity may be catered towards either for instance researchers or designers, the latter choice will be opted for as the designers are the key (user group) of this thesis.

2.1.4 Researchers

While the primary focus of this thesis will be towards gameplay design and designers, researchers may still find the work produced from this thesis interesting. Efforts will be made to have a clear theoretical foundation with the work created, and discussions of interesting topics for future work will be provided.

3

Theory

This chapter concerns underlying concepts, theoretical frameworks and related research which forms the foundation for the thesis. After introducing elements of games as well as various models from design, a chronology of how collaboration in games has been studied in the recent decades is presented. Then, theories from other relevant fields, such as Computer Supported Collaborative Work (CSCW) and Computer-Supported Collaborative Learning (CSCL), are introduced, after which a few concluding statements are made—including a proposed definition of collaboration which is used for the remainder of this thesis.

3.1 Collaboration as an Ambiguous Term

While compiling this theory section, one thing has become abundantly clear: there is no consensus on what "collaboration" should imply—or indeed on whether it is the right term to use. Amongst the articles on Games Research, "collaborative" and "cooperative" are used sometimes interchangeably; sometimes deliberately differentiated, as categories or on a scale; and sometimes with one as a component within the other. While Zagal et al. (2006) makes a distinction between cooperation and collaboration based on how they have come to take form in the field of game theory, other authors like Rocha et al. (2008) have argued that the term co-operation has stronger ties to the jargon used in and around games. Yet others have neither defined what they mean by their chosen word nor explained their reasoning behind choosing it over others, opting for an implicit understanding. Baykal and Eriksson (2020) notes a similar lack of consensus in CSCL, and use of the word is similarly varying in the other works such as in Bardram (1998), Nebel et al. (2017) and Kirschner et al. (2018) included in this thesis.

Specifying a consistent model of collaboration, capable to express the nuances between how each source uses the word, in advance of familiarizing with the content would be an exercise in tenacity for both writer and reader with little guaranteed returns. Instead, it has been our experience that a layman's understanding of the concept of collaboration and/or cooperation works well enough to get a general understanding of what each article explores; therefore the reader is left to do so, with this notice that what they read might at first seem jumbled or inconsistent—to then revisit the question at the end of this chapter (section 3.3.4) and in chapter 6.

3.2 General Models and Terminology from Game Research

To give the reader a foundation of games, this section introduces a few definitions and models used to various degrees within game design and game research. Unless otherwise stated, whenever one of the below concepts are mentioned throughout the thesis, it refers to them as described here.

3.2.1 Game Mechanics

In an attempt to settle the broadly used term of game mechanics into a concept with more academic rigour, Miguel Sicart proposes the definition that "[g]ame mechanics are methods invoked by agents for interacting with the game world." (Sicart, 2008). This gives us a distinct concept of game mechanics as the actions an agent (controlled by a player or a computer system) can take to influence the current game state. Sicart moves on to describe how game mechanics can be contextual, i.e. dependent on the current temporal and spatial properties of the agent in relation to the game world, as well as compound, i.e. comprising "a set of related game mechanics that function together within one delimited agent interaction mode" (Sicart, 2008). (Consider for example the compound game mechanic of driving, which involves individual distinctive game mechanics such as accelerating, braking, or turning.)

3.2.2 Gameplay

Björk and Holopainen uses a working definition of gameplay as "the structures of player interaction with the game system and with the other players in the game. Thus, gameplay includes the possibilities, results, and the reasons for the players to interact within the game" (Björk & Holopainen, 2004). In other words, gameplay relates to what choices players have available to them, what motivates them to make the choice, how they invoke those choices through game mechanics Sicart (2008), and the consequences. With similarities to Sid Meier's well-known statement of games as "a series of interesting decisions" (Alexander, 2012), this is a perfectly suitable definition for the purposes of this thesis.

3.2.3 Gameplay Design Patterns (GPD patterns)

Björk and Holopainen (2004) argue that understanding gameplay requires breaking it down into aspects or elements of gameplay, which in turn requires a terminology for these aspects. Therefore, they propose a tool—first described in Björk et al. (2003)—which they call game design patterns. In recent years, the authors have moved to instead call them gameplay design patterns (c.f. Bergström et al., 2010) to emphasize their focus on gameplay rather than other elements of games like their music or graphics. This thesis conforms to this modernised terminology.

Game(play) design patterns are defined as "semiformal interdependent descriptions of commonly reoccurring parts of the design of a game that concern gameplay"

(Björk & Holopainen, 2004). As a tool, it is a structured way to describe a reoccurring feature through a name; a core definition; a general description; a section on using the pattern outlining design choices to be made; consequences of applying the pattern to a design; relations between this and other patterns; and references.

3.2.3.1 GPD patterns, design patterns, and patterns

Since multiple authors in the chronology below (section 3.2.6) have used patterns with varying formality to their definitions, this thesis makes a distinction between several similar terms:

- *GPD patterns* are established gameplay design patterns described in either Björk and Holopainen (2004) or gdp3. When the names of GPD patterns show up in text, they are formatted in Small Caps.
- *Design patterns* is the term used for descriptions by authors which build on or expands the GPD patterns foundation, but where the patterns are not part of the established gdp3 collection. These might be less clearly defined or structured, like those of Rocha et al. (2008) or Emmerich and Masuch (2017), or they might conform to the GPD pattern structure (like Reuter, Göbel, Steinmetz (2014)) but have not yet been added to the collection and therefore might have overlap with GPD patterns introduced elsewhere. When the names of design patterns show up in text, they are formatted in **bold**. For the reader's convenience, a footnote contains a working definition based on interpreting the original source; a diligent reader is welcomed to explore them further in the original source.
- *Patterns* is left more general, without any necessary connotation to the GPD patterns tool, to account for how some authors like Azadegan and Harteveld (2014) use it in a more typical way for the English language. This also allows for "patterns" to be used on occasion when referring to both GPD patterns and design patterns simultaneously.

3.2.4 MDA Framework

First conceptualized by Marc LeBlanc in his workshops on game design 2001-2004, then more formally described by Hunicke et al. (2004), the MDA framework *"attempts to bridge the gap between game design and development, game criticism, and technical game research"* (Hunicke et al., 2004) into a single formal approach to what a game is. It looks at the consumption of games; how their interactivity and nonlinearity make their consumption relatively unpredictable; and formalize it into a framework of three components: Mechanics, Dynamics, and Aesthetics.

- *Mechanics* denote *"the various actions, behaviors and control mechanisms afforded to the player within a game context"* (Hunicke et al., 2004). In other words, the component has similarities with Sicart (2008)'s game mechanics but also includes control mechanisms (such as ammunition for guns or spawn points for resurrection) which in Sicart's framework would be rules that affect contextual game mechanics. (Another distinction is that Mechanics—and

MDA as a whole—centres only around the player, whereas game mechanics make no difference between player-controlled or computer-controlled agents.)

- *Dynamics* denote *the run-time behavior of the [M]echanics acting on player inputs and each others' outputs over time"* (Hunicke et al., 2004). To elaborate, whereas Mechanics describe the means (actions) by which a player interacts with the game, the Dynamics encapsulate the actual interactions themselves and their consequences for the game state. Classic examples of Dynamics include Positive Feedback Loops and Negative Feedback Loops.
- *Aesthetics* denote *"the desirable emotional responses evoked in the player, when she interacts with the game system"* (Hunicke et al., 2004). When played, the Dynamics of a game give rise to reactions in the player on an emotional level. The MDA framework purports that these responses can be deliberately designed for—and these aimed-for emotions are what it calls Aesthetics.

Arguably, it might be valuable for game researchers and game designers to not only consider intended emotional responses but also those implied or afforded by the game system. Hunicke et al. (2004) suggests using Aesthetics *"like a compass [to] define models for gameplay"*, which in turn helps outlining Dynamics and Mechanics to support those Aesthetics. While it is certainly important for a designer to work with intent towards a clear goal of *desired* emotions, ignoring *other* emotional responses that the game system might evoke could constitute either happy accidents if they are welcome, lost opportunities if they are merely tangentially present, or at worst sheer flaws if they are detrimental to the intended experience. Considering these unintended responses that might result from the game could help the designer achieve a more thorough overview of their game's evoked emotions and what might be done to enhance or reduce their effects.

Similarly, a researcher might find more value in describing all emotional responses the game system appears to evoke rather than making assumptions on what the designer might have originally intended. Examples of such research can be seen in the exploration of Aesthetic ideals made by Lundgren et al. (2009). Consequently, this thesis uses Aesthetics in this broadened sense of afforded emotional responses rather than solely *intended* emotional responses.

3.2.4.1 MDA Mechanics versus Game Mechanics

Due to how the term "game mechanics" is both ubiquitous and lacking uniformity in the general jargon of games (see e.g. Sicart (2008)), several frameworks share 'mechanics' as a core part of their terminology but use the term to denote slightly varying ideas. Of interest for this thesis are the Mechanics part of the MDA framework (Hunicke et al., 2004), and Sicart (2008)'s concept of game mechanics (see above). To aid the reader in distinguishing between the two concepts, this thesis always refer to Sicart's concept as game mechanics (never the word "mechanics" in isolation) while instances referring to the concept(s) from MDA will always be written with initial capital letters (Mechanics, Dynamics, Aesthetics).

3.2.5 Material on Collaboration (Co-operation) in Game Design

Insights from game designers on creating collaborative play seems fairly limited. Fullerton (2019)'s ever popular textbook merely mentions that it—under the name of cooperation—exists as a form of "player interaction patterns" amongst several others (like *unilateral competition*) and offers little further advice. Although to a somewhat less extent, a similar draught seems to exist within the designer communities. Since 2003, a total of six talks—most recently in 2015—have been published to GDC Vault, the archive of recorded talks from the Game Developer's Conference (GDC) worldwide (GDC Vault, 2020). (A note: There might be more material in the paying members collection.)

- Game designers Raph Koster and Richard Vogel hosts a talk which less discusses game design per se but more about resources, ideas and concepts for a listener to research further. The talk focuses on graph theory, social networks, and game theory as a way to describe playing cooperatively (Koster & Vogel, 2003).
- Game designer David Bowring discusses the implications of adding a second player (Bowring, 2010) to an open world game has for gameplay and more, drawing from experiences in creating Saints Row 2 (Volition, 2008).
- Game writers Herdon et al. (2011) holds a panel discussion on the consequences co-operation games has on the design of in-game campaigns.
- Game director Patrick Redding hosts a talk on player cooperation—as opposed to systemic cooperation like agreeing to play a game together—and how to get players to cooperate with each other through negotiated actions (Redding, 2011).
- Game publisher and producer Christopher Allen discusses how contemporary tabletop games had made significant strides in cooperative gameplay while digital games often imply a cooperative aspect in its features but that those rarely translate to gameplay (Allen, 2013). The talk takes a stance similar to Zagal et al. (2006) by highlighting some gameplay aspects from tabletop games and suggesting how they could translate into a digital medium.
- Game designer Kevin Martens holds a seminar on his extensive lessons from 16 years of designing cooperative games (Martens, 2015) such as Diablo III (Blizzard Entertainment, 2012) (for which Martens was lead designer), Baldur's Gate II: Shadows of Ann (BioWare, 2000) and Neverwinter Nights (BioWare, 2002). Martens proposes three core values for cooperative games, namely: give players the wheel (empower the players to get it to work); remove barriers (make co-operation additive to the experience); and build bridges (use game features to build social bonds and reward the players for co-operation).

Despite their lacking number, these talks provide a rich volume of observations, advice and experiences from practising designers worthy to include in the corpus. Last but not least, (Salen & Zimmerman, 2004) feature an analogue by game designer

Reiner Knizia on his journey to design cooperative tabletop boards game The Lord of the Rings (Knizia, 2000).

3.2.6 Collaboration in Game Research, a Chronology

Although some form of collaborative or cooperative activities have long been recognised as part of games (c.f. (Avedon et al., 2015)), research dedicated to what it means for games and how designers can work achieve it is more recent. This section provides a chronological summary of the research which make up the foundations of the corpus for this thesis. Since a significant part of the work will be to synthesise the material through a formal process (see Chapter 5: Plan), presenting its various sources on their own was deemed a better choice to minimise preliminary generation of connections which could influence the synthesis process.

3.2.6.1 Björk and Holopainen (2004)

As part of their extensive collection of game design patterns, Björk and Holopainen (2004) sorts 30 GPD patterns into a category called "Game Design Patterns for Social Interaction". These patterns are further divided into GPD patterns for competition, for collaboration, for group activities and for stimulated social interaction. A subset of GPD patterns from each of these categories are highlighted in Table 3.1, selected because they concern interacting with other players in a potentially mutually beneficial manner—at least at first—or attempt to pass off as mutually beneficial.

Table 3.1: A listing of game design patterns from Björk and Holopainen (2004) which have been deemed relevant enough to be treated, with motivations.

Category	Patterns Included	Motivation
Competition	Betrayal	Although Betrayal is about players in direct competition, it originates in some form of cooperative or collaborative stance to diverge from.
Collaboration	Cooperation, Collaborative Actions, Shared Rewards, Shared Penalties, Delayed Reciprocity	The patterns Björk and Holopainen (2004) have outlined as describing elements of collaboration.
Group Activities	Team Play*, Alliances*, Dynamic Alliances*, Secret Alliances*, Team Development*, Social Organizations*	These patterns treat subjects related to what other sources have discussed as part of collaboration.
Stimulated Social Interaction	Social Interaction, Trading, Social Dilemmas, Social Statuses, Negotiation, Bluffing	This category lists patterns that, although not necessarily creating collaborative play, to some extent provide base requirements for it.

3.2.6.2 Salen and Zimmerman (2004)

In chapter 28 of their influential book Rules of Play on games and game design, Salen and Zimmerman (2004) explore how *"games can be framed as a social phenomena [sic]"* and the consequences of such a framing. While not solely about collaboration, the chapter touches on a multitude of topics that relate to it, such as social relations (how they affect games and how games affect them), player roles, play communities, and social contracts (whereby players agree to behave in a specific way within a game context, regardless of how they can or do behave outside the game).

In addition to chapter 28, Chapter 2 (on the design process) includes an essay from board game designer Reiner Knizia where he discusses the process behind designing *Lord of the Rings* (Knizia, 2000), an influential cooperative board game. Although focused on how Knizia approached the design process, it also includes remarks on the design philosophy behind the collaborative aspect of the game.

3.2.6.3 Zagal, Rick, and Hsi (2006)

In the early years of the 21st century, computer games saw an increasing number of cooperative game mechanics being implemented with varying results as to whether they created collaborative play. In response, Zagal et al. (2006) turned to study collaborative board games to investigate what principles could be gathered from them to inform future collaborative computer games. Opting for a qualitative approach, they analysed Reiner Knizia's Lord of the Rings board game (Knizia, 2000) in depth to unveil seven observations akin to design principles. Four observations were dubbed lessons and highlighted good guidelines to adhere to, whereas the last three were dubbed pitfalls and highlighted design challenges to beware.

The four lessons are as follows (quoted from Zagal et al. (2006), pages 30-31):

1. *"To highlight problems of competitiveness, a collaborative game should introduce a tension between perceived individual utility and team utility."*
2. *"To further highlight problems of competitiveness, individual players should be allowed to make decisions and take actions without the consent of the team."*
3. *"Players must be able to trace payoffs back to their decisions."*
4. *"To encourage team members to make selfless decisions, a collaborative game should bestow different abilities or responsibilities upon the players."*

Zagal's three pitfalls (quoted from Zagal et al. (2006), pages 32-34):

1. *"To avoid the game degenerating into one player making the decisions for the team, collaborative games have to provide sufficient rationale for collaboration."*
2. *"For a game to be engaging, players need to care about the outcome and that outcome should have a satisfying result."*
3. *"For a collaborative game to be enjoyable multiple times, the experience needs to be different each time and the presented challenge needs to evolve."*

In addition to these seven principles, Zagal et al. (2006) took support in game theory to distinguish between three different types of games: competitive games, wherein players directly oppose; collaborative games, where *"all participants work together as a team, sharing the payoffs and outcomes; if the team wins or loses, everyone wins or loses"* Zagal et al. (2006); and cooperative games which are somewhere in between competitive and collaborative in that (some) players have reason to work together to reach a common goal but they are not necessarily sharing the payoffs equally—or at all.

3.2.6.4 Rocha, Mascarenhas, and Prada (2008)

Marking the starting point of an ensemble of similar design studies, Rocha et al., 2008 examined multiple popular cooperative games to extract design patterns relating to cooperation, after which they designed a game implementing their findings and discussed the experience with a preliminary evaluation. Although not formatted like game design patterns from Björk and Holopainen (2004), six new design patterns for collaboration were introduced: **complementarity**[1], **synergies between abilities**[2], **abilities that can only be used on another player**[3], **shared goals**[4], **synergies between goals** (where two different goals share synergetic properties that make their completion possible simultaneously), and **special rules for players of the same team**[5].

3.2.6.5 El-Nasr, Aghabeigi, Milam, Erfani, Lameman, Maygoli, and Mah (2010)

Extending the work of Rocha et al. (2008), El-Nasr et al. (2010) analysed 14 cooperative games to map out seven additional design patterns for cooperation within games: **camera setting**[6], **shared objects**[7], **shared puzzles**[8], **shared charac-**

[1] *"[. . .] even when you have two different character types for the same role, [. . .] they will have different abilities that will complement each other in that role."* (Rocha et al., 2008)

[2] *"[S]ome of the abilities of one character type have some synergy with abilities of another character type."* (Rocha et al., 2008)

[3] *"[A]n action will have a different effect when done on a friendly player."* (Rocha et al., 2008)

[4] *"[A] group of players will have one non-exclusive goal, that can be completed in a group."* (Rocha et al., 2008)

[5] *"[A]n action will have a different effect when done on a friendly player."* (Rocha et al., 2008)

[6] *"design choices for developing a successful camera in a shared screen co-op game"* (El-Nasr et al., 2010). The authors suggests three options: split-screen, moving with one character as the focus, or moving to encapsulate all players (and thus only moving in a direction if everyone moves in that direction).

[7] Objects with which multiple players interact simultaneously.

[8] *"[T]his pattern is a general category for all cooperative design puzzles [. . .] where both players encounter a shared challenge or obstacle."* (El-Nasr et al., 2010) See also Björk and Holopainen (2004)

ters[9], **special characters targeting [a] lone wolf**[10], **vocalization** [11] and **limited resources**[12]. Meant to complement the patterns found by Rocha et al. (2008), these patterns follow a similarly loose outline rather than the more structured form of game design patterns as proposed by Björk and Holopainen (2004).

In addition to the new patterns, El-Nasr et al. (2010) introduces *Cooperative Performance Metrics*, several metrics for analysing the cooperative nature of digital games, focusing on co-located gaming. They were iteratively created using practical applications and reviews from three industry game designers. These metrics consist of *laughter* or *excitement together*; *working out strategies* aloud by verbally coordinating their play; *helping* each other with controls or shared obstacles; *waiting for each other* to catch up before progressing; *getting in each other's way* denoting both leading ; and developing *global strategies* where players *"take different roles during gameplay that complement each other's responsibilities and abilities"* (El-Nasr et al., 2010). Recording 25 sessions with 60 participants in total ages 6-16, researchers investigated the videos and labelled each occurrence of the CPMs which were then tagged through a qualitative interpretative exercise and validated by inter-rater agreement. The results note that **complementarity** and **shared goals** as presented by Rocha et al. (2008) as well as **shared puzzles** and **shared objects** were particularly effective towards their CPMs (El-Nasr et al., 2010).

3.2.6.6 Bergström, Björk, and Lundgren (2010)

Bergström et al. (2010) explored how game aesthetics – here regarded as *"experiences significant to people's memories"* (Bergström et al., 2010) – can be consciously designed for by knowing which game mechanics give rise to them via game dynamics. More specifically, the authors explored how the MDA model can be applied to GPD patterns, so that game designers could use the two concepts in conjunction as a tool to afford certain emotional experiences. The study applies these tools to analyse four games and how their specific game mechanic choices *"can promote camaraderie between players – i.e. encourage active cooperation and invoke the feeling of togetherness"* (Bergström et al., 2010). In total, they highlight how 58 GPD patterns—21 of them newly added—interact with the experience of camaraderie in the games and suggest that camaraderie might be evoked or affected in other games by applying the GPD patterns.

[9] *"[P]roviding a shared non-player character equipped with special abilities that players can assume."* (El-Nasr et al., 2010)

[10] Computer-controlled agents, opposed to the players, that are designed to specifically target players who are working alone.

[11] *"[A]utomatic vocal expressions [from] player characters that alert players of different challenging events."* (El-Nasr et al., 2010). A form of foreshadowing which mostly only works if players are playing close together.

[12] Providing only a limited number of resources, in order to encourage players to split or exchange these between them.

3.2.6.7 Azadegan and Harteveld (2014)

Aida Azadegan and her colleague Casper Harteveld investigated how the field of Collaborative Engineering (CE) could be used in game design of collaborative games. They criticize the game research area to some extent by arguing that it has been too isolationist the last few years, and that it would be suitable to to connect to other research areas. For this reason, they explore the possibility of using CE in analysing games.

A central component of CE is the use of ThinkLets, which are tested and reusable design patterns that create a predictable and repeatable pattern in collaboration settings in groups working towards a common goal. While the number of ThinkLets, like with GPD patterns, are plentiful, they aim to invoke one or more of the following six validated patterns of collaboration(Azadegan & Harteveld, 2014; Briggs et al., 2006).

1. *Generate:* Move from having fewer to having more concepts in the pool of concepts shared by the group.
2. *Reduce:* Move from having many concepts to a focus on fewer concepts that the group deems worthy of further attention.
3. *Clarify:* Move from having less to having more shared understanding of concepts and of the words and phrases used to express them.
4. *Organize:* Move from less to more understanding of the relationships among concepts the group is considering.
5. *Evaluate:* Move from less to more understanding of the relative value of the concepts under consideration
6. *Build-Consensus:* Move from having fewer to having more group members who are willing to commit to a proposal.

They also divide analysis levels into *process analysis* (Macro-level), *activity analysis* (Meso-level), and *pattern analysis* (Micro-level). Process analysis is the analysis to identify whole activities within a game for use of CE. In activity analysis, the dynamics of the game are analyzed and one tries to get an understanding of how collaboration takes place in the game. In pattern analysis, one analyses what techniques are used to establish the collaboration pattern in a game, or where thinkLets can be of help. This is a fine-grained type of analysis that deconstructs the experience to an atomic level. While the researchers conclude that their paper *"does not provide a definitive answer on the applicability of CE for creating a patterns approach to collaborative games"* (Azadegan & Harteveld, 2014), it does offer an alternative approach to look at collaboration in games. The researchers conclude that the CE approach does help in gathering valuable insights from games without having to search for a battery of games to distil patterns from and then test their effectiveness. Possibly, this way of thinking, to introduce concepts from other fields than game design research, could help in forming a framework in designing games for collaboration.

3.2.6.8 Reuter, Wendel, Göbel, and Steinmetz (2014) and Reuter, Göbel, and Steinmetz (2014)

Arguing that collaborative or cooperative patterns covered by Björk and Holopainen (2004), Rocha et al. (2008), and El-Nasr et al. (2010) centred on more general principles of collaborative games, Reuter, Wendel, et al. (2014) set out to extract new patterns for a narrower focus: that of collaborative player interactions.

> Collaborative player interactions are synchronous actions in which multiple players coordinate themselves to reach an outcome which is intended to benefit their shared goals. These interactions may consist of several smaller actions. Each action may be directed upon another player or the game world in general and their distribution may vary between the players.
>
> Reuter, Wendel, et al. (2014)

They analysed 16 cooperative games (or game modes) and a further 12 games which allowed for team-based play. Their technical report, last updated 2015, provides 24 new game design patterns and three additions to pre-existing patterns (Reuter, Göbel, et al., 2014). Furthermore, they suggest classifying these interaction patterns among several dimensions to provide more guidance for designers. These dimensions are presented in Table 3.2.

As a preliminary evaluation of the validity and usefulness of the patterns, Reuter, Wendel, et al. (2014) invited external designers to redesign an existing game originally made by Bachelor students (Wendel et al., 2012) into a Serious Game, i.e. a [digital] game used for other purposes than entertainment (Susi et al., 2007) used for training of communication and teamwork.

3.2.6.9 Harris, Hancock, and Scott (2016)

Noting a lack of discussion as how to design game mechanics that generate **complementarity** (Rocha et al., 2008) between player characters, Harris et al. (2016) set out to investigate how interdependence could be generated between players in asymmetric games. Presented under the MDA framework, they identify several *"elements of asymmetric play"* as identified through design insights and studies of existing games (although they do not explicitly list which). They list six mechanical asymmetries: (asymmetry of) **abilities**[13], **challenge**[14], **interface**[15], **information**[16], **investment**[17] and **goal/responsibility**[18].

On the dynamic level, Harris et al. (2016) present the concepts of **directional dependence** and **timings (synchronicities)**. With directional dependence, the designer can vary how players' interdependences are expressed by varying who of the

[13] One player can do things (perform actions) another cannot.
[14] The kind of challenge one player faces differs from that of other players.
[15] The means by which players engage with the game differs, both in terms of input and output.
[16] One player knows something other players do not.
[17] The amount of time players dedicate to their roles differ.
[18] Players seek to achieve different outcomes.

Table 3.2: The subcategories or dimensions with which Reuter, Wendel, et al. (2014) suggests extending Game Design Patterns (Björk & Holopainen, 2004) for player interactions to provide more guidance to designers.

Interaction Dimension	**Description**
Spatial relation	*Collecting* players in one location or *separating* them into smaller subgroups.
Spatial location	*Specific* if the interaction pattern occurs at designated location(s);*pervasive* if everywhere.
Temporal duration	Typical duration of the interaction pattern. *Short, medium* or *long*. [No guidance on what durations constitute which, limiting use.]
Player freedom	*Voluntary* collaborative interactions benefit players if they opt in; obligatory interactions are enforced.
Player experience	*"our observations on how players reacted to the interaction forms described in the pattern."* (Reuter, Wendel, et al., 2014) See as pointers, not conclusive results.
Functional role flexibility	Fixed player roles are predefined 'asymmetries'; free roles are exchangeable or built through other means (like being entirely tied to equipment loadouts available to everyone).
Functional role count	The number of players involved in the interaction. Can be *less than all* or *all* players.
Functional genres	For which game genre this pattern usually pertains to. Using Arsenault 2009 for genre definitions.
Examples	They argue that examples of existing implementations should be mandatory rather than optional.

players are dependent on the other and in what way – *mirrored*[19], *unidirectional*[20] or *bidirectional*[21]. With timings, the authors note that *"[i]nstances of interdependence between players in asymmetric games also have inherent time constraints"* (Harris et al., 2016). They outline 5 variations of timings: *asynchronous*[22], *sequential*[23], *expectant*[24], *concurrent*[25], and *coincident*[26].

They then apply their findings in a prototype asymmetric game, applying asymmetries of abilities, challenge and interface to create a two-player digital game with significantly differing player experiences. Within the varying levels they explore different dynamic asymmetries of timing and directional dependencies. This game is in turn used for an explorative study with quantitative statistical analysis (ANOVA) to investigate the effects of the various forms of interdependence on the player experience.

3.2.6.10 Depping and Mandryk (2017)

Criticising previous research for using too scattered approaches with inconsistent terms, mechanics, controls and use context, Depping and Mandryk (2017) summarized existing literature on *"game design for social closeness"* with the intent to provide better guidance to designers on which game design elements provide the most effect. They noted that existing research rarely investigate what collaboration actually pertains and suggest breaking it down into two categories based on established knowledge: **Cooperation**, as in having common or shared goals, and **interdependence**, "the degree to which [players] must rely on one another to perform their [goals] effectively" (Saavedra et al., 1993) through Depping and Mandryk (2017), simplified by us). Arguing that the existence of cooperation does not require interdependence and vice versa, but that previous research had always implemented both simultaneously, they conducted an experiment with two-way ANOVA *"to evaluate how cooperation (vs competition) and interdependence (vs independence) affect how players perceive the game and each other"* (Depping & Mandryk, 2017).

They designed a digital networked two-player puzzle game in four variations: one implementing neither cooperation nor interdependence, two implementing one category each, and one implementing both. Measuring participants' propensity to trust, interpersonal trust, conversational turns (the number of times the person who speaks switches), and more, the authors intended to answer two questions: "*First, do the two mechanics affect how players experience the game? Second, how do the two mechanics affect the relationship between players outside the game?*".

[19]Each player relies on each other in an identical way.
[20]Player A's progress is reliant on B's actions but not the other way around.
[21]Both players rely on each others' actions but in different (non-equivalent) ways.
[22]Player A performs an action (discrete or continuous); Player B does not relate it in any way.
[23]Player A completes an action some t time before player B begins their action.
[24]Player B can trigger an event or action if A is prepared (and waiting).
[25]Player A and player B continuously perform their respective actions.
[26]Player A and player B must perform discrete actions at the same moment (within some tolerance).

From their results, Depping and Mandryk (2017) concluded that cooperation and interdependence indeed seem to be two distinct concepts and that both separately increase experienced relatedness and enjoyment (see PENS (Rigby & Ryan, 2007)) as well as inter-player trust. Furthermore, they found that *"the number of conversational turns between players fully mediated the prediction of interdependence on [the] resulting closeness [i.e. trust]"* (Depping & Mandryk, 2017). This last result is promising as it might provide a handy measurement of how well a concept performs for a game designer interested in quick explorative prototyping of interdependence.

3.2.6.11 Emmerich and Masuch (2017)

Based on a review of existing literature, Emmerich and Masuch (2017) proposed a research model for social player interaction to investigate how these interactions *"can be anticipated and purposefully designed [for]"*. Their model suggests that three elements—the composition of the player group; the characteristics of the game as an artefact; and the characteristics of the environment during play—together create what Emmerich and Masuch (2017) call the *social context* of gaming, which leads to social interactions (in-game and in the real world), which ultimately determines the (social) player experience. In other words, they propose that elements like player history, their number, the game design patterns, the actions available to players, and whether there are spectators around all partake in determining how players behave and interact, contributing to the player experience. Furthermore, the authors outlined a method for measuring and analysing social player interaction. Building on the work of El-Nasr et al. (2010) and Bromley et al. (2014), they presented a list of social interaction events to annotate video recordings of the gaming sessions. They identified 14 categories for annotating:

- *Enjoying* – spontaneous expressions of enjoyment triggered by game events.
- *Swearing* – spontaneous expressions of frustration triggered by (failure of) game events.
- *Commanding* – one player telling the other what to do without explaining why.
- *Strategizing* – suggesting actions for both players, explaining what to work out strategy.
- *Synchronizing actions* – co-ordinating actions with the other player while performing them.
- *Helping* – advising about controls or how the game works, pointing out cues in the game.
- *Waiting* – expressions of impatience while waiting for the other player to act or finish.
- *Blocking* – pointing out that the other player stops them from doing what they intend to do.
- *Creating shared awareness* – informing each other on changes in the game state.
- *Shared history* – referencing prior experiences together, relating them to the

current situation.

- *Sharing success and failure* – celebrating group success or assuming collective responsibility for failure.
- *Talking trash* – insulting the other player or blaming them for failure.
- *Giving feedback* – appreciating contributions of the other player, judging performance or actions.
- *Off-topic comments* – conversation on subjects unrelated to the game

They built a mixed-design ANOVA study in which they explored the effects of three 'game patterns', which are the loosely defined **player interdependence**[27], **shared control**[28], and **time pressure**[29]. Their results show that players in high interdependence conditions spent a lot less time on utterings of frustrations, but more than twice as many imperative commands about how the other player should play, implying more inter-player communication and less frustration. The other patterns did not give as conclusive results for player interaction, although implementing shared control seemed to negatively impact participants' perceived competence and autonomy.

3.2.6.12 Harris and Hancock (2019)

Harris and Hancock (2019) iterated on their 2016 study on symmetry vs asymmetry, performing a thorough ANOVA-based study to investigate collaboration in games in two studies. Study 1 investigated the effect of symmetry vs asymmetry on connectedness, social presence, and individual experience. Study 2 investigated the effect of different degrees (loose, medium, or tight) of interdependence on social connectedness & engagement and individual experience.

Harris and Hancock (2019) first study found that the type of symmetry had a significant effect on connectedness, social presence and individual player experience. Playing as asymmetric characters with different abilities produced more feelings of connectedness, social presence and individual playing experience.

In their second study, Harris and Hancock (2019) obtain findings suggesting that higher levels of interdependency have a positively significant effect on feelings of social connectedness, engagement and individual player experience. A more thorough analysis of their presented results reveal that participants report in a pattern suggesting that medium or tight level coupling gives significantly better scores than loose coupling but are not significantly different from each other. However, when participants were asked to rank which type of gameplay they preferred the most, the significant distinction was between medium and tight and not between medium and loose (which were non-significant from each other). Here is an interesting mismatch,

[27] *"The degree to which players are dependent on the other player's actions"* (Emmerich & Masuch, 2017)

[28] *"[G]iving players simultaneous control over the same characters."* (Emmerich & Masuch, 2017)

[29] The players have a perceivably limited amount of time to perform the task before a failure state is reached.

as these results to some extent contradict each other. Clear from the data, however, is that higher levels of interdependence seem to foster higher levels of feelings of social connectedness, engagement and individual player experience.

3.3 Collaboration in Other Fields

This section will describe other research of collaboration in other fields, spurring from computer-supported cooperative work (CSCW) and computer-supported collaborative learning (CSCL) related fields.

3.3.1 Collaborative Cognitive Load Theory

The Collaborative Cognitive Load Theory (CCLT) is a theory proposed by Kirschner, Sweller, Kirschner, and Zambrano (2018) aimed at further developing the already established Cognitive Load Theory (Sweller, Ayres, & Kalyuga, 2011) into the field of collaboration. It relates to the area of Computer Supported Collaborative Learning (CSCL) and aims to explain how teams and tasks can be formed efficiently for a group and how to improve learning for the involved individuals. While learning is not the focus of this thesis per se, the theory does introduce some interesting concepts in how to structure a group activity so that the results are meaningful.

The Collaborative Cognitive Load Theory presents the dichotomy of *Intrinsic Cognitive Load* and *Extraneous Cognitive Load*. Intrinsic Cognitive Load is load tied to the *"inherent complexity of the information that needs to be processed"* (Kirschner et al., 2018), that is, workload that is directly tied to the actual meant process or activity. Extraneous Cognitive Load refers to the *"load imposed by information elements unrelated to the learning task such as the way the information is presented"* (Kirschner et al., 2018).

The researchers also present the term Element Interactivity which is a term used to describe a task's complexity. Element interactivity is easiest described when related to low or high element interactivity. Low element interactivity is material to be processed that needs minimal references to other elements, imposing a low workload on memory. For example, learning specific symbols in a new language or studying glossaries in a new language has low element interactivity as each and every symbol/word has a direct translation and does not need to be related to for instance the word order in a whole sentence. Although it may certainly be hard to learn new words, it imposes low element interactivity because each individual element can be learned independently of each other (Sweller, 2010). High element interactivity, on the other hand, involves elements that heavily interact which makes it harder to process these elements in isolation. These interactions make the workload higher. For example, when speaking an unfamiliar language, knowing when to put each word exactly where in a sentence could be argued to have a high variation of possibilities which is an example of high element interactivity. Each word is related to the other words in the sentence and all words need to work well together (Kirschner et al., 2018). The element interactivity is determined by both the nature of the task and

the level of expertise of the individual. For a native who knows the language and has internalized all the grammatical relations, this knowledge can be retrieved as a single chunked entity (Kirschner et al., 2018), so the element interactivity is lower for the native than for the novice.

Kirschner et al. (2018) argue that collaborative settings have implications on extraneous cognitive load in the way that maintaining communication and a collective working memory requires investment in form of *transactive activities*. Transactive activities are activities that *"enable groups to acquire collective knowledge of who the others are and how they can deal with the task [...], the group's accuracy and willingness to resolve it, and how all members should coordinate what they are doing with each other to accomplish the task together by mediating the acquisition individual and group domain specific knowledge and the shared, generalised knowledge"* - (Kirschner et al., 2018). Essentially, transactive activities revolve around activities that enable teams to transfer knowledge, processes, ideas, etcetera to other group members to 'coordinate' activities and actions between them.

These transactive activities come with a transaction cost. The transaction cost can be described as *"the cost of setting up, enforcing, and maintaining the reciprocal obligations, or contracts, that keep them embers of a team together [and]... represent the "overhead" of the team... linked to the resources (time, skills, etc.) employed to allow a work team to produce more than the sum of its parts"* (Ciborra & Olson, 1988) via Kirschner et al. (2018). If the transaction cost is higher than the benefit of performing the action in a group, then it is not worth making it a group effort rather than performing it individually. That is, if it is hard or requires more effort to share cognitive load with a group, the positive effects of it could be annulled by the costs of communication and coordination. In other words, if the cognitive load caused by transactive activities is too strong (by causing heavy extraneous cognitive workload), making it a group activity for the purpose of collaboration could actually be counterproductive. Therefore, it is important to keep track of task design (and in extension, game design), not only in terms of the activity itself, but also the task's context both in an intrinsic and extraneous manner.

Kirschner and his colleagues conclude that collaboration works like a scaffold for the team, potentially beneficial for the team but if too much extraneous load is involved, it may become harmful instead. One way to create a good collective working memory is by helping the members of a group exchange knowledge and information with each other. Making people dependent on each other has been shown to be a successful way of doing this (Johnson et al. (1989); Langfred (2000)).

Kirschner et al. (2018) go on by describing different factors influencing the collective working memory and collaboration in relation to the above presented theory. These are summarised into 9 Collaborative Cognitive Load principles, presented below:

- *Task complexity:* Effective collaboration occurs when a task is complex enough to justify the extra time and effort involved in the necessary transactional activities. If a task is not complex enough, unnecessary transactional activities will cause extraneous cognitive load and will, thus be detrimental to learning.

- *Task guidance & support:* When learners face new collaborative situations and environments (e.g., in CSCL), the more guidance and support a task provides for collaborative learning, the lower the extraneous load caused by transactive activities.
- *Domain expertise:* The greater the expertise of team members in the task domain, the lower the extraneous load caused by transactive activities.
- *Collaboration skills:* The availability of collaboration skills of the team members will lower the extraneous load caused by transactive activities.
- *Team size:* The more members that a team working on a learning task, the higher the number of transactive activities, and thus the extraneous load caused by transactive activities.
- textitTeam roles: Team roles make clear who has responsibility for what and as such will lower the extraneous load caused by transactive activities.
- *Team composition:* The more experience team members have coordinating their actions on tasks in general (i.e., they know what to expect from each other in terms of task execution), the lower extraneous load caused by transactive activities.
- *Prior task experience:* The more experience team members have coordinating their actions on tasks in general (i.e., they know what to expect from each other in terms of task execution), the lower extraneous load caused by transactive activities.
- *Prior team experience:* The more experience team members have working with each other on a learning task, the lower the extraneous load caused by transactive activities.

3.3.2 Nebel, Schneider, Beege, Kolda, Mackiewicz, and Rey (2017)

Nebel et al. (2017) investigated how *voluntary cooperation* versus *dependent cooperation* affects performance and collaboration in a group of 4 player a modified version of the game *Minecraft*. Participants were to work together on building a house from a set of instructions and were divided into 2 conditions: voluntary cooperation (VC) and increased task independence (ITI). The ITI condition was based on the jigsaw strategy in which *"information and tasks are distributed among participants, resulting in a broken up main task that needs to be solved together to be completed"* (Nebel et al., 2017). In the VC condition, all participants had access to the same resources and abilities.

The researchers noted a difference in mental *workload* and mental *effort*, where mental effort corresponds to an individual's invested cognitive capacity when working on a task, and mental load relates to the needed cognitive capacity to process the complexity of a task (Krell, 2015; Nebel et al., 2017). That is, mental effort is the amount of cognitive resources that has to be devoted from an individual to obtain relevant outcomes from a task (personal characteristics), while mental load relates more to

the required cognitive capacity needed for a task (task characteristics) (Krell, 2015; Nebel et al., 2017).

Nebel and his colleagues found that one can design tasks that increase mental effort but not affect mental load. They conclude that an increased level of mental effort does not need to be harmful for tasks that are interdependent, and that an increased level of mental effort may help alleviate some tasks between group members so that peers that can manage mental load more efficiently can take on some of the workload required by it – and in the long run increase the quality of the whole group's work on the task.

Mental effort was also reportedly significantly less reported in the VC group than the ITI group (p=.008). Interestingly, the researchers noted a significant difference between the time spent explaining things to each other between the VC group and the ITI group. ITI group members reportedly interacted significantly more with each other by explaining things to each other than the VC group members. While the total amount of time communicating with each other was similar between the two groups, the quality of their discussion may be different due to their dependency on each other (VC/ITI).

Nebel et al. (2017) may be argued to be a useful article as it distinguishes between mental effort and mental load and states that you can utilize the collective effort of a team to manage the collective load between group members. Additionally, it offers an alternative perspective on interdependence compared to studies stemming from game research.

3.3.3 Collaborative Activity Theory

In Jakob Bardram's (1998) PhD dissertation, he builds on the pre-existing Activity Theory paradigm first introduced by Lev Vygotsky to present different levels of collaboration among teams and team members (Bardram, 1998). One interesting aspect of this theory is the distinction of different levels of collaboration: Co-ordination, Co-operation and Co-construction.

Since Bardram builds on some pre-existing work regarding the Activity Theory framework, this coming section will describe the core of the Activity Theory, followed by explanations of the three levels of collaboration in Bardram (1998).

3.3.3.1 Activity Theory

The Activity Theory presents a framework to work around that helps describe relations between artefacts and human use, situated in activities. It describes a *subject* (that is, an individual or a group) engaged in an activity, pursuing an *object* (in the sense of a goal). This relation can be mediated by *tools/artefacts*.

The activities in Activity Theory can be explained in three different levels. At the bottom level, there are *operations* which are routinized and unconscious types of behaviour, such as rapid typing or walking. At the middle level, we have *actions*

which are more deliberate and conscious types of behavior, requiring aspects such as conscious planning or manipulation. At the highest level is the *activity*, which provides a context and is the basis for both the actions and operations (Preece et al., 2015).

The activity is driven by *motives*, which are based on needs from the subject. This could for example be to finish a master's thesis – that is, a rather abstract endeavour. Actions are driven by *goals*, which are more obvious or deliberate than motives, such as finishing a paragraph describing Activity Theory. Lastly, operations are led by *conditions*. These are simply low-level fits/misfits necessary to attain the goals, such as rapidly typing on a keyboard to form words (Preece et al., 2015).

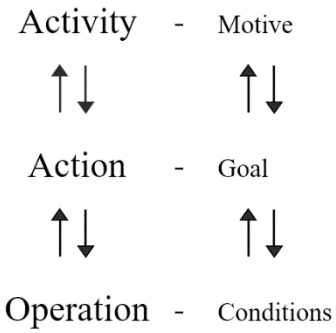


Figure 3.1: Activity Theory Model, derived from Preece et al. (2015).

3.3.3.2 Collaboration as Co-ordination, Co-operation, Co-Construction

Bardram (1998) uses the term collaborative activity as an umbrella term for all collective activities and underlines that his interpretation of collaborative activities is that not all of these activities need a common objective. Below is an explanation of the three levels of collaboration: Co-ordination, Co-operation, and Co-construction presented by Bardram (1998).

Co-ordinaton
Co-ordination is the shallowest/lowest and most *"rudimentary form of inter-subjective collaboration"* (Bardram, 1998). This is a condition when groups are gathered together upon a common object, but their individual contributions are only shallowly related to each other. They still act as on a one-by-one basis in utilizing their scripted roles, each one working on their own individual task (Bardram, 1998). However, it is co-ordination that ensures that an activity is working in harmony with the surrounding activities.

Co-operation
The middle-level of a collaborative activity is co-operation, which contrary to co-ordination, gathers group members for a shared focus on a common object and objective (Bardram, 1998). In contrast with co-ordination, co-operation enables group members to adjust their own actions in relation to other's actions in accordance to the overall collective activity. This makes co-operative activities more stable, as the

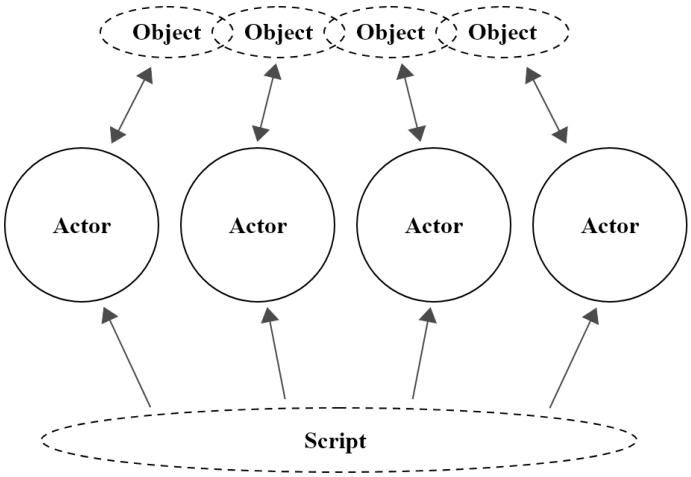


Figure 3.2: Co-ordination. Model derived from Baykal and Eriksson (2020).

actions relate to each other in some way. On the other hand, the means of realizing the activity may not be agreed upon, be present or possibly wholly unknown. In this way, the participants may have a shared and agreed *goal*, but have not addressed their motive (See Figure 3). Actors in this level may go outside the boundaries of their given scripted roles, however they do not question or reconceptualize the script itself.

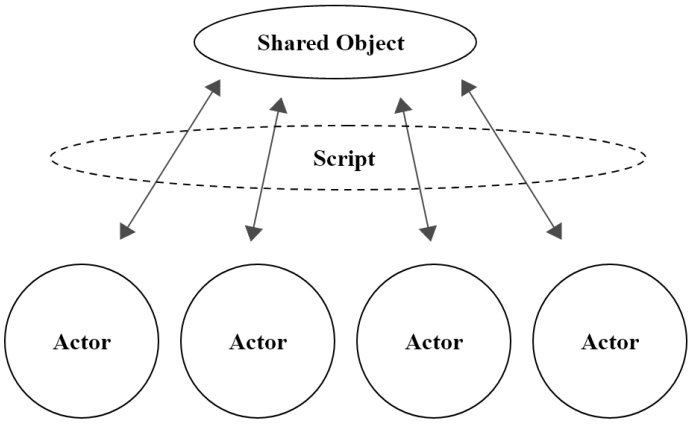


Figure 3.3: Co-operation. Model derived from Baykal and Eriksson (2020).

Co-construction

Lastly, we have co-construction (Also called *reflective communication*). This is a

high form of collaboration where group members actively questions both the direction of the motive and the means of work to reach the goal(s). It can best be explained by Engeström, Brown, Christopher, and Gregory (1997).

> *"By reflective communication we mean interactions in which the actors focus on reconceptualizing their own organization and interaction in relation to their shared objects. Both the object and the script are reconceptualized, as is the interaction between the participants."*
> – Engeström et al. (1997) as cited in Bardram (1998).

In other words, actors on this level question and/or reconceptualize both the shared object and the scripted roles. In doing this, the actors are actively monitoring and changing each other, their roles, and their motives/goals as they keep going on.

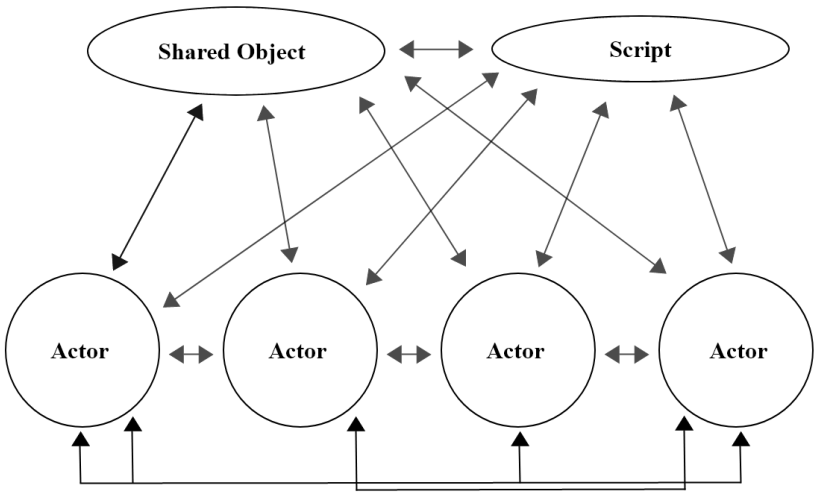


Figure 3.4: Co-construction. Model derived from Baykal and Eriksson (2020).

3.3.3.3 The Dynamic Transformation between Levels of Collaborative Activities

One should note that the levels of activity (Co-ordinative, Co-operative, Co-constructive) do not exist alone and isolated from the other levels. The levels of co-ordination to co-operation and co-construction are merely analytical categorizations of the same collaborative activity. That is, an activity should be analyzed in all three lenses between co-ordination to co-construction. There may be qualities of the activity that fit more than one of these categories A co-ordinated activity can be transformed into a co-operative activity and vice versa, and a co-operative activity can be transformed into a co-constructive activity and vice versa. Bardram (1998) presents a visual model of this process (See Figure 3.5). Upward transformations (Co-ordination to co-operation or co-operation to co-construction) happen as a result of reflection of the means of work or of the object of work. This could come as a result of a shift in

how a task is focused or broken down into subtasks. Downward transformations are caused by resolving contradictions and problems, and stabilizing the aim of work to be embodied at a resolution of lower level.

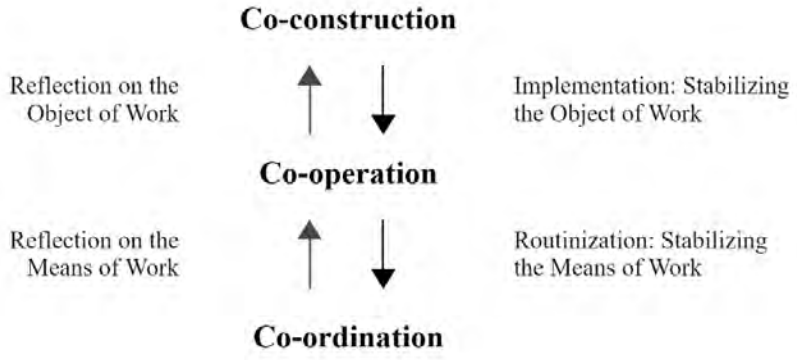


Figure 3.5: Model derived from Bardram (1998)

Following are some comments regarding the 4 types of transformation.

Reflection on Means of Work
The transformation from co-ordination to co-operation may happen as a result from a *co-ordination* breakdown or a deliberate re-conceptualization of the way the work is dealt with currently. That is, the means of work is questioned and may have to be re-considered. This may come as a spontaneous result as well.

Routinization
In the opposite direction, collaboration can become stabilized to form more of a *routine* in the workflow. In this way, the co-ordinated work is re-established within a group to form clearer boundaries of how the work is distributed and the rules guiding the work, as well as a clarification of the mediating tools for the work. This is a transformation from co-operation to co-ordination.

Reflection on Object of Work
The transformation between co-operation and co-construction is a higher-level reconstruction of the object when it becomes apparent that the object becomes unstable for the collaborating ensemble. Again, this could be the result of a *co-operation breakdown* or a re-conceptualization of the object of work.

Implementation
Just like routinization, implementation is directed towards stabilizing the work for the collaborative ensemble. Here, on a higher level, the stabilization process revolves around sorting out controversies and discussion around the objective of the group. That is, finding out what really is the *object* of the collective subject. This involves answering questions such as "what are we doing, and *why*?" in order for the cooperation to proceed. So, while routinization stabilizes the means of the work, implementation stabilizes the *object* of the work.

3.3.3.4 Collaborative Activity Theory Summary

Much like how the general Activity Theory divides activities in three levels (Activity, Action and Operation), Bardram (1998) divides collaboration in three levels (Co-ordination, Co-operation, and Co-construction). These have clear connections to each other. Activities correspond to the motive of the subject, and co-construction relate to the construction of objectives (collective motives) in a group. Bardram (1998)distinguishes between motive and objective with the small difference that objective is in the form of a collective subject and motive in the form of an individual subject – in this context, they can be used interchangeably.

Similarly, actions have a hierarchical similarity to co-operation in that they both relate to the formation or realization towards a goal state. Co-operation is the work towards a shared goal, and actions are the work towards the goal. Lastly, operations and co-ordination are both the lowest level of analysis. They both correspond to micro-level behavior and focus on the unreflective, automatic cornerstones that build up our doings. As Bardram (1998) put it: *"Coordination ensures that an activity is working in harmony with its surrounding activities"* (Bardram, 1998, p. 36).

The Activity Theory and Bardram's three levels of collaboration could be helpful as topics and considerations for an upcoming framework about collaboration in games. Especially interesting are the distinction of the quality of collaboration in teams and how they can vary, and how these can be tied to different levels of activities (macro versus micro level).

3.3.4 Defining Collaboration in Games

Judging by the research presented above, it becomes clear that a single and comprehensive definition of "collaboration" does not exist. Some researchers use collaboration and co-operation interchangeably, while others make clear distinctions between these two terms. Some researchers place collaborative aspects on different conceptual levels of effective 'co-doing', ranking some ways to do things together as higher or lower than other ways. Put simply, the terminology and its meanings vary significantly between sources.

Rather than ascribing to one of the existing definitions of collaboration, this thesis will derive a definition of collaboration that encapsulates how the proposed framework uses the term. Therefore, a definition is included in Chapter 6 Results.

4

Methods

This chapter describes and references methods useful for design processes such as this thesis.

4.1 Wicked Problems

Tackling problems in the area of design is no simple endeavor, as it is not necessarily possible to prove a design. Rittel and Webber (1973) divides problems into two categories: tame and wicked ones. According to Rittel and Webber (1973), wicked problems are not falsifiable and can thus not be judged as such, partly because it is not possible to define exactly what the wicked problem really is in the context, that is, the wicked problem cannot be properly formulated due to its ambiguity. Tame problems are those that are definable, and for that reason, also falsifiable.

In other words, wicked problems are those problems that have so many extraneous variables that controlling for all of them would be practically impossible. Rittel and Webber (1973) provides an example by stating it would not be feasible to build a freeway first and see how it works and fix it after unsatisfactory performance. At the same time, it is practically impossible test the freeway under all scenarios and with all car models and so on. Somewhere, a decision has to be made. Compared to for instance mathematics or natural sciences where concepts can be proven, design and things to be made and used are therefore generally seen as wicked.

4.2 Design Process

Discussing wicked problems, Gaver (2012) goes on explaining how design related research often cannot have an a priori solution as each situation is unique on its own. Design problems are naturally underspecified and can thus not solely rely on the traditional scientific method of testing hypotheses. One way to meet this under-specification is the use of an iterative process. In an iterative process, things are repeated for the purpose of "exploring, fixing or refining a design or the work product of any other lifecycle activity" Hartson and Pyla (2012). In other words, the design process itself involves stages of prototyping and testing which gives designers possibilities to change and refine the product before release.

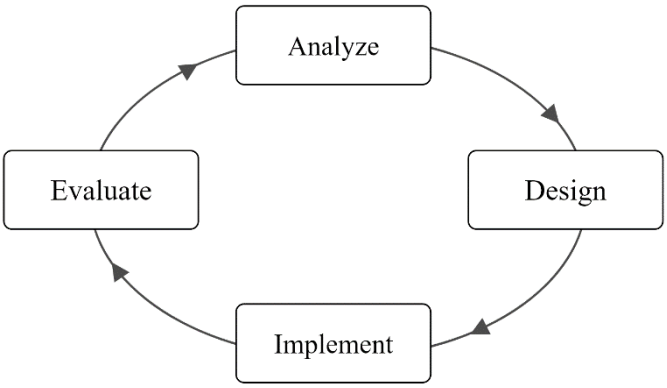


Figure 4.1: The design process *the Wheel*, derived from Hartson and Pyla (2012)

Hartson and Pyla (2012) introduces the wheel as an iterative process consisting of: 1) Analyze, 2) Design, 3) Implement, and 4) Evaluate (See Figure 4.1). As it is an iterative model, the four steps can be iterated repeatedly until the practitioner is satisfied with the result.

1. In the analysis phase, requirements are extracted. These requirements are used as input for the next design phase (Hartson & Pyla, 2012).
2. In the design phase, ideation and thinking is involved to come up with solution possibilities that could meet the requirements. The exploration of design ideas may lead to a set of ideas to take on further and implement, and test (Hartson & Pyla, 2012).
3. In the implementation/prototyping phase, the design ideas are created, or formed into their own entities, prototypes. These prototypes can be made in many ways and at many levels of fidelity but can be used just as an exploration tool or for further testing. If a prototype is deemed interesting enough, it may be moved to the evaluation phase.
4. In the evaluation phase, the idea is to test the prototype product either for verifying the requirements put in the analysis phase, or for further refining the product. If it is deemed more work needs to be done on the product, it moves to the analysis phase for a set of new requirements to be set.

The model is similar to a model for action research by Wadsworth (2011) which also presents four stages, but as a process meant for research. These are 1) Plan Change, 2) Act, 3) Observe, and 4) Reflect (Wadsworth, 2011). See figure 4.2. These stages are less explained in detail but do share some clear resemblance to *the wheel* presented above.

4.2.1 Game Design: The Playcentric Design Process

In what the author calls a Playcentric Design Process, Fullerton (2019) outlines an iterative process for designing games (see 4.3) with many similarities to that of the wheel from Hartson and Pyla (2012). After setting player experience goals (a form

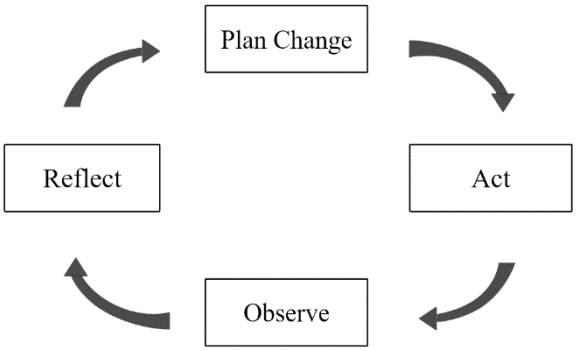


Figure 4.2: Model for action research, derived from Wadsworth (2011)

of design goal formulated as a statement for what the player(s) will experience in the game), the designer enters the main iterative phase of: conceptualising an idea (that could fulfil the player experience goals); formalising the idea into a playable version (in writing or a prototype of some fidelity); playtesting the formalised version to see how well they fulfil the player experience goals; and evaluate the results. If the design shows that the idea does not work, then the iteration restarts completely, whereas if the idea shows promise but should be adjusted for better results the designer can move to modify the formalisation and test again. Once the idea and its implementation work successfully, the iterative process can be considered finished for this idea.

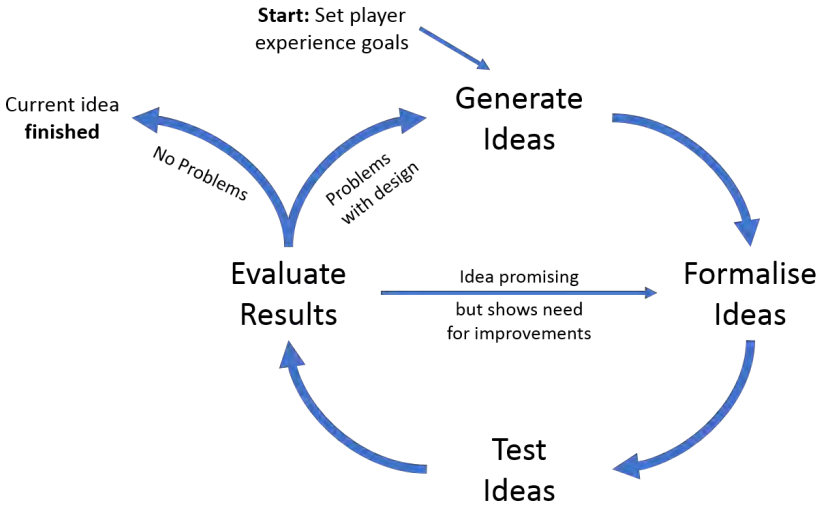


Figure 4.3: The Playcentric Design Process, derived from Fullerton (2019)

Rather than considering the game a single idea, this iterative process is intended to be performed on many ideas—essentially for all the various game elements like artwork, gameplay setups, and so on (Fullerton, 2019). On a more macro scale, the game goes through a seven step development process of conceptualizing; iteratively prototyping (first with physical prototypes, then digital); presenting the concept

to an investor (if required); writing a design documentation which specifies a more finalised version of the ideas that will enter the final game; iteratively producing (developing) the game; and quality assurance, where no new features are added but playtesting instead focuses on usability and accessibility.

4.3 Methods for Manifesting Ideas

This section contains information on methods for ideation and manifestation of ideas.

4.3.1 Prototyping

To make the most of a designer's time while the ideas and their formalisations are still new and unexplored, Fullerton (2019) puts heavy emphasis on making several physical prototypes even of digital games. Physical prototypes, Fullerton (2019) argues, gives gameplay centre stage rather than the technology that might otherwise be a hassle to first implement and a barrier to making changes. Therefore, sticking to physical media until the prototype is both playable and fun allows for faster iterations with more control and less overhead, so that the digital prototype can focus more on its quality of implementation rather than also worry about the quality of the underlying gameplay.

This line of argument goes hand in hand with that of Martin and Hanington (2012), which considers prototyping "the tangible creation of artifacts at various levels of resolution, for development and testing of ideas within design teams and with clients and users". Low-fidelity prototyping—like paper prototyping or proof of concept for form and scale—is highlighted for its ability to give timely feedback, whereas high-fidelity prototyping is useful in later evaluations with higher sophistication. Furthermore, Martin and Hanington (2012) notes that fidelity is more of a spectrum rather than low-fidelity versus high-fidelity; a perspective that matches the prototyping of the playcentric design process of Fullerton (2019).

4.3.2 Rapid Iterative Testing & Evaluation (RITE)

> RITE is a powerful formative usability inspection method that helps teams identify and remove major problems in an interface early in the design process before costly prototypes are built.
>
> Martin and Hanington (2012)

RITE stems from the gaming industry and is an efficient way to quickly cover many possible usability issues in medium-to-large-complexity environments (Medlock et al., 2002). Rather than, like in traditional usability tests, testing all participants first to reach a conclusion, RITE proposes to immediately change the artefact upon finding and issue and continue doing so until 5 trials runs in a row are successful.

This is especially useful to guide decisions thought a design solution space. Since

each iteration change is a direct answer to the previous usability issue found, no usability reports are needed (Martin & Hanington, 2012).

4.3.3 Design Workshop

Design Workshops are an efficient way to involve stakeholders in a formative or summative session over a short amount of time (Martin & Hanington, 2012). It is most common in the exploratory stages of research. By letting a distribution of teams co-design, several ideas and concepts can quickly be generated for further analysis or discussion.

A design workshop can take many forms, but will often entail several activities, plans or sessions where concepts are generated or discussed. Although allegedly labour intensive, it is a worthwhile investment due to their strength in collecting a broad spectrum of insights.

4.3.4 Weighted Matrix

To help prioritising between one's generated ideas, Martin and Hanington (2012) suggests the Weighted Matrix, which ranks ideas based on an agreed-upon criteria to identify how well each idea seems to perform for each criterion.

1. create a criteria that represent the characteristics of a successful design within the project specifications.
2. give each criterion a numeric weight representing their relative value compared to the other criteria, and set them up along one axis of a table (typically the vertical).
3. On the other axis of the table, set up the ideas to investigate.
4. For each cell in the table, rate the corresponding idea on its merits to the corresponding criterion.
5. Finally, for each idea sum up its ratings on each criterion multiplied by the respective weight. These scores will be an indication of how well an idea is expected to perform overall compared to the other ideas.

Although still subjective and thus not a definite decider on which concept to pursue, it redirects attention towards considering the ideas on their design goal merits rather than personal opinion.

4.4 Methods for Investigating Artefacts

This section contains method for investigating products and artefacts.

4.4.1 Formal Analysis

In analysing existing games, one can follow the Formal Analysis approach presented by Lankoski and Björk (2015). Formal analysis (of games) centres on the context-

independent study of the game as an artefact—rather than a specific instance of the game or how specific players play it—investigating what elements make up the artefact and what role they have in determining the gameplay. For this purpose, Lankoski and Björk (2015) provides a small vocabulary of what they call primitives: components, actions, and goals.

- *Components* are, in essence, all the individual entities defined by a game that has values and can be manipulated (by players or the game itself) (Lankoski & Björk, 2015). A component may contain other components or define the game space by specifying the boundaries within which they (or other components) can be manipulated. A variable not clearly associated with any component, such as a high score, can also be considered a component to make it distinctive in the analysis.
- *Actions* describe the interactions within the game, highly similar to how Sicart (2008) describes game mechanics—although they might not be related to an agent. They can be divided into player actions, component actions, and system actions.
  - *Player actions* are actions initiated by players (Lankoski & Björk, 2015). These might be actions related to player-controlled components but they could also be interactions like constructing components that the player then has no control over.
  - *Component actions* are actions that are perceived to come from the components of the game itself. This requires that "one is willing to ascribe the component agency", and that "this typically depends not only on the action performed but also on the representation of the component" Lankoski and Björk (2015).
  - *System actions* are actions not perceived to originate from neither the player nor the components themselves. Whereas player actions and component actions could be considered subsections of game mechanics as described by Sicart (2008), system actions are not done by an agent but rather the game as a whole. Although neither a player nor a component controls a system action, the action may affect either or both.
- *Goals* are specifications of what players (should) strive for while playing a game, both in the short term and in the long term. Goals can be large or small, and goals may contain sub-goals that contain sub-goals. Goals may also be used to explain agency from the game or from the players. When a goal has been met, a reward may be given. These can take different forms, such as in game components or values in the game state (such as points), but also just be about progressing to the next level. Goals may be part of goal-structures, that is, the success of one goal is dependent on reaching another goal before. There may also be obligatory goals, which are goals that are obligatory to fulfil in order to properly progress in the game, and non-obligatory goals. Non-obligatory goals may help in reaching the obligatory goals but may consequently require some extra effort or shift in focus.

In order to provide a formal analysis, one needs to play a game *"carefully and repeatedly to distinguish primitives in the game and, later on, the principles of design"* (Lankoski & Björk, 2015). This repeated, in-depth play uncovers what design choices were made for each component and what their implications are for the game at large. Depending on the interests of the researchers, one may analyse the games at different levels of description—especially since the game could be too complex to warrant a full description and analysis. Lankoski and Björk (2015) distinguish between 3 levels of descriptions; each level higher in concept requiring describing those below it.

1. Describing primitives and their relations
2. Describing the principles of design
3. Describing what is the role of the primitives and principle of design in the game.

In order to maintain reliability and validity, one should make sure to provide rich descriptions of the gameplay that is analysed, so that other researchers are able to follow the researcher's description and result and reasoning. Consistency in terminology, transparency into potential researcher bias, and extensive playing of the game is also highly important.

4.4.2 Skewing

Skewing is a method used when one has a framework to work around, by shifting, changing or turning properties of an artefact (Lundgren & Gkouskos, 2013). In doing this, different results for the artefact in whole may help a designer find solutions that might overwise be overlooked.

The idea is to have an interactive artefact to redesign and pick a suitable framework as a steering instrument in how the design is ought to be. The framework can alter things according to the framework in a structured manner, which is one of the method's strengths. Lundgren and Gkouskos (2013) argue that skewing can help spark creativity by providing new way to look at things in an unusual manner. However, it may be hard for some people to use skewing as it needs a suitable framework to work with, and a solid understanding of that framework and the chosen artefact to reach skewing's full potential.

4.5 Methods for Gathering Insights

This section contains methods for gathering data and insights.

4.5.1 Interview

Interviews are a common way to gather first-hand information from key stakeholders or participants to collect their opinions and perceptions of various topics (Martin & Hanington, 2012). According to Wadsworth (2011), an interview is a conversa-

tion of a face-to-face meeting. While some would mean that it is possible to perform interviews from distance (Martin & Hanington, 2012), it is nonetheless a type of conversation with purpose (Preece, Sharp, & Rogers, 2015) with the aim of extracting information of accounts of experience, attitudes, perceptions and opinions.

According to Preece et al. (2015), an interview can be either structured, semi-structured or unstructured. Structured interviews have a predetermined set of questions to cover, similarly to a questionnaire. Structured interview may be good when one has a very clear understanding of the topic researched as they are standardized. This standardization however makes is easier for comparison as well as in general less time-consuming (Preece et al., 2015). Un-structured interviews, on the other hand, are less controlled and for that reason usually reach considerably more depth. As no questions are predetermined, they usually end up wherever the conversation goes and what appears interesting *in situ*. A mid-ground between these two types are the semi-structured interviews. Semi-structured interviews combines components from both unstructured and structured interviews, leading to a set of topics of questions to be asked during the interview, but where there is still leeway for exploration of new concepts during the interview. This way, the interviews are somewhat structured as to ensure certain topics are covered, but still have some flexibility to reach new findings.

4.5.2 Focus Group

A focus group is a form of interviewing technique where several participants are prompted for discussion under the help of a moderator (Eklund, 2015). Eklund (2015) defines Focus Group as *"in-depth group discussions focusing on a particular topic of interest or relevance to the participants as well as the researcher"* and states that it is common within Focus Groups that participants have all or will all be involved in a particular situation or experience, such as watching the same television show or playing the same game. Focus groups can cover a comprehensive and diverse set of topics while also maintaining the effectiveness and focus of a small group (Preece et al., 2015).

More specifically, the idea of focus groups is to bring in the social and interactional aspects between participants, as there could be some meaning of the dynamic between them. Just like in a society, people express ideas and opinions and compare their knowledge, and by structuring a focus group in this way, participants may let out their ideas more naturally and freely.

4.5.3 Questionnaires

Questionnaires are efficient self-reporting tools to collected information about users and participants about their thoughts, characteristics, feelings, attitudes and perceptions (Martin & Hanington, 2012). A questionnaire can be designed in various ways, both qualitatively and quantitatively, but central to all questionnaires is to the phrasing of the questions. Depending on the situations, one would want to phrase them in an open-ended or closed manner, and careful consideration should

be put to not guide the answers too much. According to Martin and Hanington (2012), questionnaires may be used in isolation but is also common and good way to triangulate with other methods such as observation and experiments, this to reach personal insights that may be hard to find in observatory ways.

4.5.4 Controlled Experiment

Controlled experiments is an empirical method aimed at investigating cause and effects in a controlled environment (Martin & Hanington, 2012). An experiment groups different conditions and tests independent variables on dependent variables to see how the independent variables may affect the dependent variables (Martin & Hanington, 2012). Participants may be grouped into different conditions altogether (so called, inter-subject comparison) or be made to participate in all conditions (so called, within-subject comparison) (Waern & Back, 2015). The difference between the groups are that the dependent variables may have been changed or adjusted, but the dependent variables do not change. In doing this, researchers may find interesting findings in cause and effect relationships, and how A may affect B.

One weakness with controlled experiments, however, is that they are resource heavy – requiring multiple version to be made if one is to evaluate for instance interactive video games (Waern & Back, 2015). Furthermore, interactive games have been described as second order designs (Salen & Zimmerman, 2004). Waern and Back (2015) makes a point that a game can be played in several different ways which may drastically affect how the session is experienced. This makes a clear confounding factor to consider in the medium of games, and controlling for all variations would not be feasible, especially since the different variations of play may entirely alter the gameplay context. In other words, controlled experiments may be good to perform for specific parts in games that need specific insights – but investigating games as a whole, with all the wickedness included, may be too volatile for controlled experiments to handle.

4.5.5 Experimental Game Design

> [I]t is a way to, through designing, understand more about design principles for games.
>
> Waern and Back (2015)

Waern and Back (2015) discusses how designing experimental games can be applied as a research method, essentially being an approach under design research applying principles from research through design. The core requirements to make design experimentation valid research methods is some level of rigour, and a goal that is of some higher purpose than that of improving the specific game.

The experimental game design approach often distinguishes significantly from the controlled experiments more typically used in other fields of research. Waern and Back (2015) motivates this by noting how the small differences implemented to support controlled experiments can have vast implications for the behaviour of the

gameplay and that players might therefore adapt behaviours suitable for an entirely new context than before. Tying these changes in behaviour back to the small variation is unreliable, the authors argue, since there is no guarantee that performing the same variation would give the same effects in the context of another game.

Instead of statistically determining the effect of small variations, experimental game design centres on gaining insights from a design process Waern and Back (2015). The researchers design a game which investigates the research question, and let the insights gained through the design process inform underlying principles of designing games for such purposes. Proper documentation of the game and design process is key for reliability and validity of the results, and the insights should not centre on the game itself but on the exploration of the design space of game design.

Compared to conventional game design, focus lies less on making the best game possible and more in investigating something new or perhaps problematic (Waern & Back, 2015). (Game designers might of course also approach their designs in this way as a form of artistic expression.) These design experiments could be evocative, investigating the design space of game design through which behaviour and experiences the design choices make in the players, or explorative, investigating new or under-researched genres of games or ways to play them.

4.5.6 Conversation Analysis

> Conversation analysis is less interested in interpreting the content of text that have been explicitly produced for research purposes, for instance interview responses. Rather it is interested in the formal analysis of everyday situations.
>
> Flick (2009)

In other words, it is the analysis of natural conversation in natural settings. It stems from an ethnomethodological approach to study social interaction. In doing this, it aims to encapsulate all parts of interactions as point of interests involved in producing situational intelligibility and effectiveness of utterances between interlocutors (Flick, 2009). Less focus is on the specific content of the conversation and more on the formal procedures of the conversation, and how things such as turn-taking take place in it (Flick, 2009). A particular focus lies on how interlocutors form adjacency pairs, that is, how contributions made in a conversation are followed up upon. Another focus is how interlocutors repair turn-takings or small utterances that may end up stuttering a conversation.

Usually, conversation analysis involves a video or audio recording of conversations to be further analysed. This material is transcribed, possibly using a certain framework in order to follow a standardized and comparable framework. Selected parts are then picked for detailed analysis.

4.5.7 Expert Review

Within this thesis, we use the term expert review to denote a practice of requesting feedback on content from external persons with related experience, such as re-

searchers in the field or practitioners in the industry. This is a generalisation of expert evaluations as practiced in UX, where UX experts are invited to analyse and give feedback on design prototypes (Hartson & Pyla, 2012; Preece et al., 2015).

4.5.8 Literature Review

A literature review is a thorough process of reviewing other people's work and contribution in a field (Martin & Hanington, 2012). Literature reviews can be utilized to get a comprehensive understanding of an area, which helps contextualizing the following design process. In this way, performing a literature review early in a process could help guide the project in a giving direction.

4.6 Methods for Extracting Insights/Identifying Parallels

This section contains methods for extracting insights from data or drawing parallels between insights.

4.6.1 Content Analysis

Content analysis is described by Martin and Hanington (2012) to be the *"systematic description of form and content of written, spoken, or visual materials expressed in themes, patterns, and counted occurrences of words, phrases, images, or concepts."* A Content analysis is a method to gather data and process its content in qualitative themes, categories or codes.

There are two types of content analysis: inductive and deductive. In inductive content analyses, the codes are derived from the systematic reading of a set of materials, where categories and codes are gradually established for further analysis. In deductive content analysis, these codes or categories are already pre-determined and the researchers look for instances that exemplify the categories.

The data generated from content analyses can be either qualitative or quantitative. Either occurrences of units such as words, phrases, images or concepts that can be counted, or a more general result is produced with common themes and patterns emerged from the data are noted.

4.6.2 Affinity Diagramming

Affinity Diagramming is a qualitative method aimed to organise insights into hierarchies to show common structures and themes (Preece et al., 2015). By clustering common themes together based on affinity, it gives designers and project members a processed and common ground-inducing material grounded in data from research, which helps the team make future decision and understanding the field together. Additionally, affinity diagramming helps extract concepts or implications from research to be considered on its own (Martin & Hanington, 2012).

4.6.3 Concept Mapping

Concept Mapping is a method that allows practitioners to efficiently interpret and find connections between concepts to form a mutual understanding of a chosen domain. It allows for a large number of contents to be connected with each other and made sense of in relation to each other (Martin & Hanington, 2012). Concepts are usually connected with a linking word (usually a verb). Martin and Hanington (2012) argues that a linkage of two or more concepts forms a proposition. As propositions emerge, one may find already learned knowledge, but may also some new relationship may also emerge. While the number of concepts could vary, a set of 15-25 concepts should be strived for as too many concepts may make the identifications of relations (linking words) too complicated (Martin & Hanington, 2012).

4.6.4 Grounded Theory

Contrary to what may be implied by its name, Grounded Theory (GT) is a method and not a theory, aiming at grounding new theories. It is a data-driven and inductive approach, in which gathered data is referred to within the process (Hook, 2015). In GT, a hypothesis is not formed. Instead, an iterative process of data collection and analysis is undertaken, which slowly moves into a sort of saturation (Thornberg & Charmaz, 2014). The process of GT, though iterative, can generally be explained in the following steps (derived from Hook (2015)):

1. Gather data and analyse simultaneously in an iterative process. Data can be almost everything that is relevant, from interviews, literature, images, games or even game manuals or other data from other methods. Specifically which data collection method(s) to use is open, and depends on the research problem (Thornberg & Charmaz, 2014).
2. *The coding process:* Code to generate codes and concepts. Code until a theoretical saturation is reached. Coding means to name segments of data with labels, which categorizes or summarizes the account of that piece of data (Thornberg & Charmaz, 2014). According to Thornberg and Charmaz (2014), coding helps researchers see even familiar concepts under new light, gaining distance from their own biases and assumptions.
3. *The conceptualising process:* Bring codes together to form concepts. Similar codes are grouped together.
4. *The categorising process:* After the concepts have been made, the concepts are grouped to form categories. Categories are examples of phenomenon. The aim of forming categories is to move from many concepts to fewer categories (Hook, 2015). After forming these categories, the aim is to relate the categories to each other and narrow down to a set of core categories.
5. *The theorising process:* Find relationships between the core categories and other categories and concepts to form the new theory. New data may be added here as further data, which is called closed coding or selective coding as this newly added coding will be inserted into the newly existing theory rather

than basing a completely new one.

While there is a general consensus from many GT practitioners to not perform a literature review to avoid forming preconceptions when conducting an active GT process, there has been criticism of its approach to not be possible, as we will always have some form preconceptions and ideas (Hallberg, 2010). Hallberg (2010) further criticize the standpoint that all important aspects of an area will show itself repeatedly between different GT-practitioners, arguing that maintaining "theoretical sensitivity through constant comparisons (e.g., constantly comparing incidents to incidents, incidents to concepts, and concept to concept)" could still engender good GT content. Dunne (2011) notes a polarisation of researchers for and against the conduct of literature reviews in GT studies and argues that abstaining from reading prior to data collection may even detract the overall quality of the research. Noting this polarisation, it is important to understand how conducting a literature review together with a GT process may affect the results. McGhee et al. (2007) argue that it is possible to involve literature influences in GT by maintaining a high level of reflexivity.

5

Plan

This chapter introduces the initial plan and the revised plan for the thesis project. It also contains a short discussion leading up to our research question.

5.1 Pre-Study

Before indulging in the formation of the framework, a pre-study/literature review was conducted covering the topics of collaboration and collaboration in games. The main set of studies involved in the pre-study revolved around games-research papers related to Baykal and Eriksson (2020) and Depping and Mandryk (2017), or collaboration in other fields such as CSCW and CSCL such as Kirschner et al. (2018). The papers were mainly acquired via the Chalmers Library search engine, or acquired from games related research via Chalmers University of Technology. As interesting studies were collected, citations and references from the papers were used to further cover relevant research.

Initially, the intent was to embody elements from the new framework in a new collaborative game for 4-in-1 tabletops, continuing the work of Barendregt et al. (2017) and Baykal and Eriksson (2020). As such, the pre-study also included sources on designing for co-located gameplay. However, with the changing circumstances brought on by the covid-19 pandemic outbreak, the decision was made to not develop for 4-in-1 platform since testers would be unable to comply with health and safety regulations of interpersonal distance. Nevertheless, the insights into what co-location means for collaboration at large was documented in the Co-Location property in the Collaborative Games Properties collection (see Appendix C).

5.1.1 Formulating Research Question

Whilst reading/reviewing papers, a perceived gap in the field was found. Firstly, while often addressed, it still appears that there is no universal consensus among researchers of what *collaboration* really entails. Some would differentiate between different levels of collaboration, some would compare it to competition, and some would leave the term unaddressed, using for instance the terms collaboration and cooperation interchangeably.

At the same time, while it appeared researchers and practitioners would vary in their vocabulary and term usages covering collaboration in games, a sense of saturation of speaking about similar concepts with different names, would emerge. For instance, many of the allocated resources, such as Azadegan and Harteveld (2014), El-Nasr et al. (2010), and Zagal et al. (2006), propose different levels, or types, of collaboration/cooperation. However, they each vary slightly in focus and meaning - but the overall findings of different studies did not seem to contradict each other too much.

A central part of this thesis work is thus to extrapolate the concept of *collaboration* in games, and what factors that seem to affect it. Rather than just taking one of the existing definitions of collaboration in games, the aim of this thesis is to get a holistic understanding of collaboration and games using a variation of sources. The aim is to include a definition of collaboration as a part of a framework outlining ways to design around collaboration.

A research question can thus be formulated as:

> ***Research Question:*** *What considerations should be made when designing multiplayer gameplay that support, encourage or improve collaboration? What properties should these games have to fulfil these purposes?*

5.2 Planning

This thesis has followed a modified version of the theory-driven research process described by Olsson (2015) where we first inductively defined a research model — our framework — from theory, which was then used to deductively investigate its quality and iteratively improve it in terms of clarity, applicability and generalisability (see Figure 5.1).

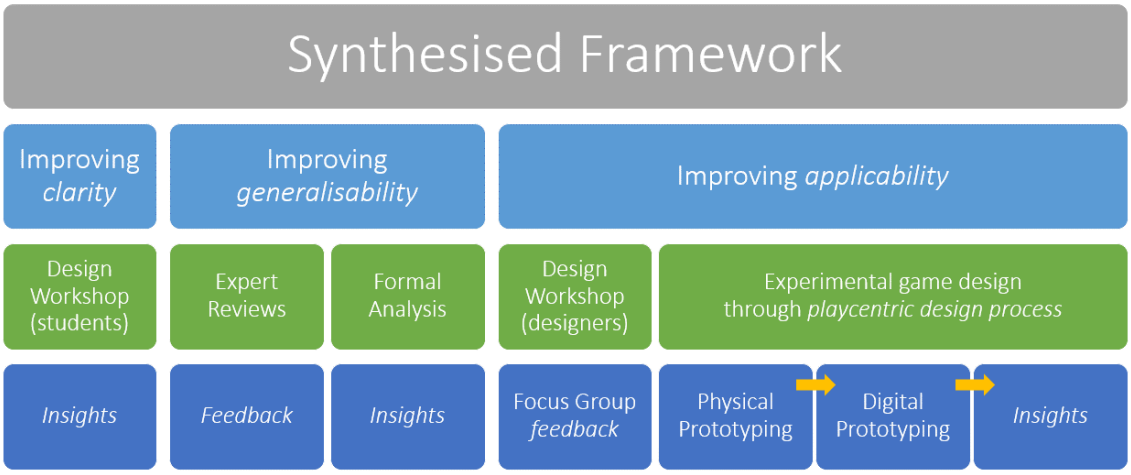


Figure 5.1: A breakdown of the planned process.

The process plan was initially split into 5 phases, centering around 4 iterations

of the framework (see Figure 5.2). It concerned the development of two primary artefacts: a collaboration framework which is the central part of this thesis, and an experimental game design to gather insights on the applicability of the framework. Below is a chart demonstrating the initial plan.

Figure 5.2: An overview of the thesis plan. The various colours indicate work prior to an iteration of the generated framework.

Phase 1.1 (Week 1-4)

- Set up process plan for thesis as a whole
- Perform literature review/pre-study to gather enough theory for synthesising a first version of the collaboration framework (*framework 0.1*).

Phase 1.2 (Week 5-6)

- Inductive Content Analysis on Collected Material, forming categorisations with the aid of Affinity Diagramming
- Concept mapping on the categories to make up foundations, building up *framework 0.1*.
- Write draft as *framework 0.1*

Phase 2 (Week 10-11)

- Perform a game design co-workshop with people who have experience in game design studies to gather insights on framework clarity.
- Analyse existing collaborative games to see if framework can be applied to describe games known to be collaborative.
- Use findings from co-workshop and game analysis to revise into *framework 0.2*.

Phase 3 (Week 11-12)

- Hold another workshop with researchers and/or industry people to gather insights on the framework's applicability.
- Start conceptualising game ideas and start lo-fi prototyping game concepts.
- Use findings from workshop and prototyping to update framework into *framework 0.3*.

Phase 4 (Week 13-15)

- Finish prototyping of game, including a few user tests.
- Update framework into *framework 0.4* based on findings from later prototyping and user tests.

Outside any of the phases

- Expert review: If possible, send the current version of the framework to a researcher or industry person working with games to gather feedback on the framework's content and design.
- Design documentation: Write about the game so that it can be included in the final thesis.

The plan was later revised into effectively 3 iterations instead, where iteration 2 and 3 would be combined to form version 0.2 of the framework. See Figure **??**. The revision was conducted as the creation of the first version of the framework took more time than expected.

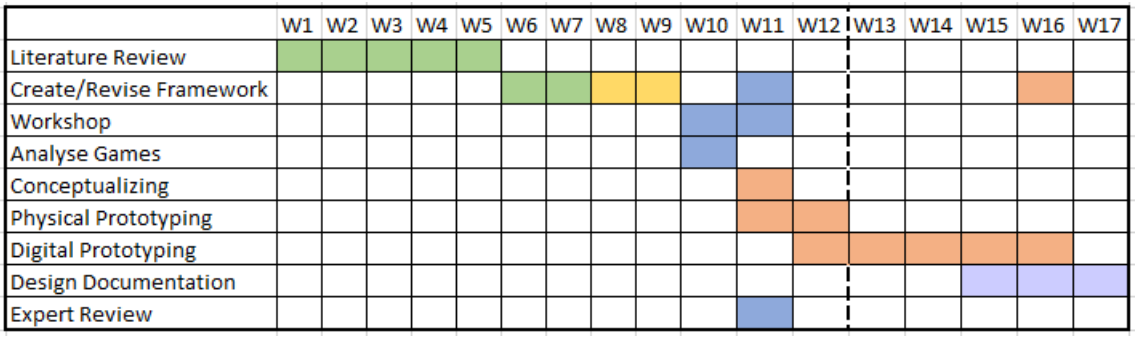


Figure 5.3: An overview of the revised thesis plan. The various colours indicate different phases.

In Chapter 7: Process, the implemented process is explained in more detail.

6

Results

Before we move on with the contents of this chapter, we ask the reader to pause. And realise that this chapter is out of order.

It is unconventional to provide the results before describing the process, but we have done so due to somewhat unconventional conditions. Since the product of this thesis is a framework of two rather text-intensive documents, yet the process has been iterative with several iterations of their contents, it would hardly be manageable for the reader to be provided with the entire text of the framework for every iteration. At the same time, textual changes do not show up well on a photograph. Our solution has been to restrict ourselves in each iteration to only presenting what *differed from the final results*, and how it had changed from the iteration prior. For the reader to be able to parse the iterations, then, they would need to see the result with which they are compared.

The conduction of this thesis has produced a framework that can be divided into two parts: the Reform Journey model (laid out in this chapter) and the Collaborative Games Properties collection (briefly described in this chapter, then included in full as Appendix C). The Reform Journey model is our way to explain how a group refines their collaboration through small "reforms" leading to higher performance and stronger mutual understanding between group members. The Reform Journey model uses three levels of communicative elaboration to explain how group members move from less to more similar understanding between team members. Additionally, the Reform Journey model includes a discussion on the topic of what collaboration is.

The second part of the framework, the Collaborative Games Properties compendium, is a set of properties in games that relate to the Reform Journey model. Intended as a reference manual for game designers, it gives examples of gameplay-related elements (called *properties*) that seem to spur different types of collaborative behaviour, and relates those properties to the Reform Journey model. A total of 40 properties were created through a Grounded Theory synthesis of existing material in game design and games research.

6.1 The Reform Journey Model

The Reform Journey model is a design model for structuring a collaborative gameplay experience. It provides an instance of collaboration with a gestalt and categorizes inter-group interactions into three categories, each with different collaborative qualities. Most importantly, however, it proposes an outline of how group members strive to *reform* to continuously improve the collaboration.

For a game designer, awareness of how the player interactions move between the three categories enables them to create affordances for the collaborative qualities that best suits their design goals. Similarly, it can reveal if a game lacks support for one of the categories, which might constrain the players' ability to collaborate in the intended manner. Furthermore, awareness of the gestalt of the collaboration, and the way a group continuously strives to better it, can help a designer set up their challenges and gauge how the players rise to meet them.

The Reform Journey model includes a multitude of concepts: *agenda*, *scripts*, and *fit*; the three *interaction modes* named *act*, *involve* and *evaluate*; *reforms* such as *evaluating*, *synchronisation*, and *reactive actions*; and *(work)load* in terms of *task load* and *communication load*. The remainder of this section treat each of these concepts and outline how they interact with each other—starting with a discussion on how this thesis, and the Reform Journey Framework, defines *collaboration*.

6.1.1 Defining Collaboration

As discussed in Chapter 3, there is a lack of consensus on what "collaboration" means. Therefore, one part of the process has been to specify a definition of collaboration that works for this framework.

In its everyday sense, collaboration is a broad and slightly ambiguous term as it can be seen from many different angles. Indeed, even the goal behind collaborating may differ vastly, which sheds light on its fluid nature. Some may mean that collaboration is simply the accumulation of increased performance in group work – but that only explains that groups of individuals have the potential to reach better performance than a single individual, not how. Being collaborative may imply an ease of being able to understand one another. Members of a tight-knit group find it easy to understand each other and thus are more predisposed to collaborate. But focusing on that does not explain the reasons to collaborate at all, merely that they would be more likely to do it.

What seems to be the least common denominator, however, is the activity of performing something—some *work*—together with other individuals. Additionally, it is apparent from the arguments above that collaboration seems to have some form of traits of quality, where we can claim that some instances of collaboration are "better" than other instances of collaboration based on how well the work is performed and how cohesive the group is. Finally, should the work to perform (or the conditions to perform it under) change, there seems to be some aspect of collaboration

that qualifies how apt the group is at adapting to the new situation and recreating a good (well-performing) collaboration under unfamiliar circumstances. Adaptability can be seen as a combined effect of the two, since it pertains to how good a group is at performing a large variety of tasks, which will be eased by a strong cohesion.

We mean that signs of collaboration can be manifested within all three of these areas: *performance*, *cohesion*, and *adaptability*. An increase in any could lead to better collaboration. As such, this framework uses the following definition of collaboration:

"Collaboration is the activity of performing work together, and can be assessed in terms of performance, adaptability, and/or cohesion."

6.1.2 Agenda

As a group comes together, it implicitly creates an *agenda*: an agreement on what is to be done and how the group works towards it. It is based on four components: a set of shared goals to achieve, a set of collective accumulated knowledge, a social code, and a set of shared references. These four components all inform how the agenda is set and what it pertains.

- *Shared goals:* are defined by the overlap between the goals of individual group members. It gives the agenda a target to achieve and directs the group to work in a more unified direction towards its resolution.
- *(Collective) Accumulated knowledge:* refers to the total assembled (relevant) knowledge within the group. It is the basis for a total "knowledge space", an abstraction of all accumulated knowledge within a group. It sets the boundaries of what a group collectively may know. More knowledge leads to higher possibilities of forming better suiting agendas.
- *Social code:* delineates how individual players can behave while remaining aligned with the agenda. It is formed by culture, the game rules, and the game state and forms a standard of how players should treat each other, an etiquette.
- *Shared references:* is the perceived shared understanding and presumptions between group members that helps inferencing concepts and ideas between individuals as they communicate. It can be explained as the overlap of their accumulated knowledge and social codes. Shared references are important as they give team members a sense of mutual reference values which can be used for more efficient interaction. They help the group outline the capabilities of its members and creates expectations of who the group members are and how these members relate to each other, aiding the planning of how the group works towards their goal.

Informed by these components, the agenda determines a target to achieve and sets up how the group members are working towards it—essentially a subset of elements within the four components collected into one entity. It creates a priority for the group, what is important and what the group is striving for. The agenda can outline roles so that individuals have different responsibilities in achieving their shared goal,

create a pipeline for how a known problem or challenge is to be addressed, or set expectations of what new information is relevant to communicate to the group.

The agenda results in a combination of explicitly decided ways of working, directives, and implicit ways of working, norms, the latter created by expectation or emergent learnt behaviour. One way of thinking about them is that the directives form the contract of an agreement (to collaborate), while the norms are the unwritten rules the group is expected to work within.

In many ways, collaboration is manifested in its agenda. Agenda can therefore be seen as an important component to understand collaboration. Therefore, we would like to add the additional, alternative, definition of collaboration.

> *"Collaboration is the activity of performing work together. An instance of collaboration is formed by an agenda, which is affected by a group's shared references, shared goals, their total accumulated knowledge, and social code."*

6.1.3 Script

Each individual has a script, which is the way they respond in a given context. It is formed by their interpretation of the agenda, but also from the individual's previous experience and knowledge. In other words, the script is the individual's take on the agenda, and is tied directly to the individual player in the group. When players enter collaboration, the agenda (through its directives) can impose adjustments to the script by forming new ways to respond given a context/game state. For example, where the script of a player working alone would need to solve every issue that comes up on their own, when collaborating the script might alter so that they can pass certain issues over to another group member better equipped to handle it.

Due to the individual nature of the script and the collective nature of the agenda, each group member might interpret the agenda somewhat differently—especially when it comes to the agenda norms—based on their own exposure (or lack thereof) to what the agenda pertains. This difference in interpretations can become a major issue to the collaboration, as is described below in the discussion of fit.

6.1.4 Fit

Fit, or fitness, is a way of explaining how well agendas and scripts correspond to meeting the demands of a context. A well-fitted agenda or script aligns better for the opposition it meets, and a group with a well fit agenda/scripts should therefore come further in their efforts. If the agenda is unfit, current directives and norms may not suit the problems or tasks that players face; similarly, the script may not suit the problems or tasks as well.

To become better at collaboration in games is, then, to continuously improve the fit of the agenda and script. As the scripts of group members adjust to the directives from the agenda, a better fit of agenda by extension increases the fit of the scripts.

Revisiting the ideas of *performance* and *cohesion* from the definition of collaboration (Section 6.1.1), increasing the fit of the agenda can be done in two ways:

- *Task Performance:* How effective the directives and scripts seem to be at reaching the target of their activities. A group with a high fit in performance has a great understanding and "accurate" interpretation (accumulated knowledge) of the current and expected future game states, and know how to work them in their favour. Knowledge of each other's knowledge and skill is also a type of knowledge that can increase task performance.
- *Group Cohesion:* How well directives and scripts seem to work well for individuals in the team to work and understand each other. A group of individuals with a high fit in group cohesion has a well-defined social code. It allows them to understand each other better but also interact with each other with less hassle.

A group of individuals with a high general fit in agenda and scripts has a strong set of shared references, ensuring that directives, norms and scripts align well between group members. In other words, the interpretations of the agenda align well between scripts.

6.1.5 The Interaction Modes

The Reform Journey model categorizes collaboration into three interaction modes *act*, *involve* and *evaluate*, which outlines how the group interact with each other to collaborate within the current gameplay/game state.

6.1.5.1 Act

When *acting*, the group members are in an active, performance-focused, solitary mode. Informed by their own script, and evaluating it towards their interpretation of the agenda, they focus on enacting their individual contributions to the overall collaboration. Note that this mode has no inherent relation with spatiality—two players can act right next to each other if they are working on different tasks or sub-tasks.

6.1.5.2 Involve

When *involving*, the group members reach out to each other to communicate or cooperate on task-specific matters. The motivation for this can be to update other players on how one's own work is going (and vice versa), to synchronise actions so that they are performed in a particular order or within a specific time frame, or because a task requires more than one person to solve and thus inherently involves two people throughout its performing.

6.1.5.3 Evaluate

When *evaluating*, players identify a misfit between how their agenda is expected to work and how it works in practice—or a difference between their scripts has been

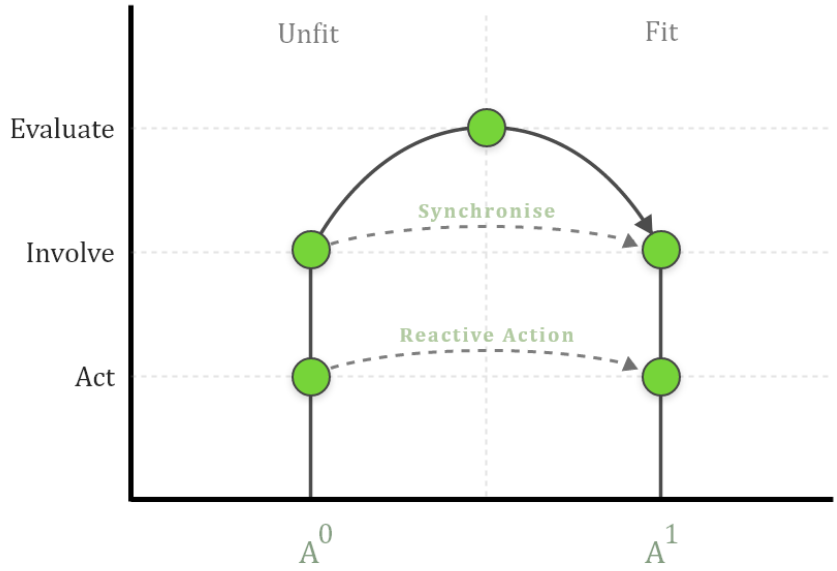


Figure 6.1: The Reform Journey Model: Showing a reform from unfit to fit via *evaluate*, and the two alternative reforms in Synchronise and Reactive Action

noticed. This pushes group members to reconsider their approach and activity. The misfit, a perception of a large enough unfitness, is enough to justify a thorough discussion that can lead to a redefinition of scripts and agenda to see if they can or must be reformed to enable a better fit.

6.1.6 Reforming the Agenda to Increase Fit

It would now behoove us to elaborate further on the ways in which group members can execute a *reform* to increase fit. The most distinctive way to do so is by *evaluating* (see section 6.1.5.3), an approach in which the agenda is explicitly reformed based on the discovery of a misfit significant enough to deliberate. The misfit could be derived from any combination of the four components that inform the agenda (the shared goals, the (collective) accumulated knowledge, the shared references, and the social code), and is essentially a discrepancy in how those work in actuality versus how they were expected to work.

- A discrepancy of shared goals involves a discussion of their target and the tasks required to meet it. The reform needed lies in investigating alternative routes, questioning whether the tasks are effectively reaching the target and if the target accurately fulfils the purpose. It could also mean investigating whether a goal is shared by all the members.
- A discrepancy of accumulated knowledge originates from a misinterpretation of either the game state or of what a task results in. As new information is learned, the alterations or corrections might lead the group to draw new conclusions about the game state, making them reinterpret their situation.

- A discrepancy of shared references is a misunderstanding in what was assumed common knowledge, or in expectations of how the other members will *act*. This relates to agenda norms expected to exist by some but not by others, or scripts whose interpretations of the agenda and game state are not aligned. Thus, group members have inferred different expectations on how the group and its members should *act* and realigning these expectations will be the focus of the reform.
- A discrepancy of social code necessitates reflection on how the group members treat and relate to each other. It originates either in changing circumstances or misbehaviour.
  - A change in circumstances can make the previous social code less relevant. The resulting reform will centre around if group members should start treating each other differently, like sacrificing one player character for the success of the group or not.
  - If a group member misbehaves regarding the social code, the group might pause their actions to discuss what happened, what consequences it has or should have, and how the group moves from here. Unlike the change in circumstances, where the social code is reconstructed due to irrelevance, here the social code is more relevant than ever.

At the end of evaluating, the group may come to the conclusion that the agenda need to be, or have the means to be, reformed. In this case, the group might have been unable to identify any better solution and would have to stick with the current. Whether the agenda changes or not, the script reformed or reinforced at the end of evaluation and thus would be considered a better (or optimal) fit for the problem at hand until further knowledge is acquired.

In addition to *evaluating*, there is a possibility that fitness is affected from the "bottom up" by introducing changes in the scripts, which will create alterations in the norms of the agenda. The Reform Journey model identifies two ways this may happen: *synchronisation* (while *involving*) and *reactive actions* (while *acting*), each given a dedicated section below. Synchronisation and reactive actions are about temporary changes in script which over time might crystallise into new norms within the agenda. They are small alterations brought on by habits which allows for small and agile alterations of the agenda without the mentally intensive process of *evaluating*, but since they create implicit norms rather than explicit directives they hold an innate risk to create new mismatches between players where there weren't any prior.

6.1.6.1 Synchronisation

Synchronisation occurs when an individual *involves* others to synchronise their own tasks and actions in accordance with others by making situational readjustments to their script. This could be due to the current situation or game state. These readjustments are about temporarily aligning relevant parts of the scripts to apply to the current instance of a task, and many of the readjustments fade once they

have been used. However, over time, some readjustments will linger to eventually crystallize parts of their scripts, implicitly forming contextual norms and directives despite the changes never reaching *evaluate*. The surviving readjustments may stay as parts of the individual's own script, but can splash over to the agenda if it is brought to attention to the group. If it is not, it may pose a risk of reducing cohesion fitness as group members are not aware of a change of different player's perception of agenda, directives, and norms.

The difference between *involve* and *synchronise* is that involve only means to reach out to others in some way to exchange ideas or information. Synchronise is a type of *involve*, but it also means that the involve is done for the reason to relate and readjust one's own action. A phrase of *involve* could be to shout "Turn left!" while a synchronisation could be to readjust one's own position in relation to the other and shouting "I'm to your right!".

6.1.6.2 Reactive Actions

Just like synchronisation, a *reactive action* is a situational readjustment of action and script to align with the doings of another actor. However, compared with synchronisation, the player does not consult the other part in their readjustments of action or script. It is a type of *act* directed towards another actor or player. The goal behind a reactive action is to quickly make an adjustment to better fit with what the other group members are doing, possibly because there is no time or opening to even elaborate an *involve*.

Similar to synchronisation, continuous moments of reoccurring reactive actions may crystallize into the general script and agenda to implicitly form norms. However, the risk is even bigger here for later misfits of cohesion (in the agenda) as the whole *act* is done without consulting other actors or players. It therefore runs a higher risk of going unnoticed. This risk may however be reduced if it is brought to the table on a later occasion, or if the other player notices the gestalt of the reactive action through an overlap of shared references. The difference between an *act* and a reactive action is that the reactive action is addressed towards another actor or player. Normally, an *act* is focused on one's own actions or doing.

6.1.7 The Reform Journey: A Series of Reforms

The Reform Journey model proposes that, for the duration of the collaboration, the group members dynamically move between the three interaction modes of *act*, *involve*, and *evaluate*. For most of the time, players typically shift between *acting* and *involving* to execute their agenda through their scripts. Here, *reactive actions* as well as *synchronisation* might produce small changes in fit, though the more elaborate changes happen due to an *evaluation*. The group *evaluates* when they encounter a challenge or misfit where they must investigate their agenda, leading to significant leaps in fit and the consolidation of what might have previously (at best) been norms into directives.

Figure 6.2: A visualisation of a continuous updating of agenda versions. Each jump towards a new agenda is one reform in terms of *evaluating*, *synchronising* or *reactive actions*.

In a way, increasing fit can be seen as a type of optimization problem: Each time a change in fit occurs, the agenda increases in performance or cohesion and, by extension, so does the scripts of the members. Sooner or later this series of reforms will reach a local optimum where the group has stabilised how they work together based on their understanding of the game state and context. At this point, *evaluation* will not be necessary unless a significant discrepancy will need to be identified in the directives or the norms of the agenda.

6.1.8 Moving between the Interaction Modes - A Workload Perspective

How, then, does a player rationalise moving between collaboration modes in the reform journey? For example, Kirschner et al. (2018) note that for a task to motivate collaboration between individuals, it needs to be designed in a way so that is not too easy for one individual to solve by themselves . In other words, collaborative activities should enforce utilization of emergent qualities based on the collaboration of teammates. Having individuals of high skill or high knowledge in a relevant area will naturally lower the need for others and consequently lower the exchanging of communication. It is one thing to just work alone with an activity, and something else to maintain communicative activities between individuals as well as working on an activity.

Effectively, this creates a distinction in load imposed by collaborating with others versus working alone. We can call these *individual load* and *teamwork load*. Individual load is the load that comes from performing a specific action or task individually, the *task load*. Teamwork load is the combination of the task-related load split between group members and *communication load*, the additional load put on the player by communicating and coordinating tasks with group members. If the potential individual load for a scenario is perceived less than the potential teamwork load, then it is not worth making the activity a group activity (See A in figure 6.3). It is, in other words, not worth *involving* others. Instead, you are likely to *act*. There is also no need to *evaluate* the task as neither of the two options surpass the reevaluation

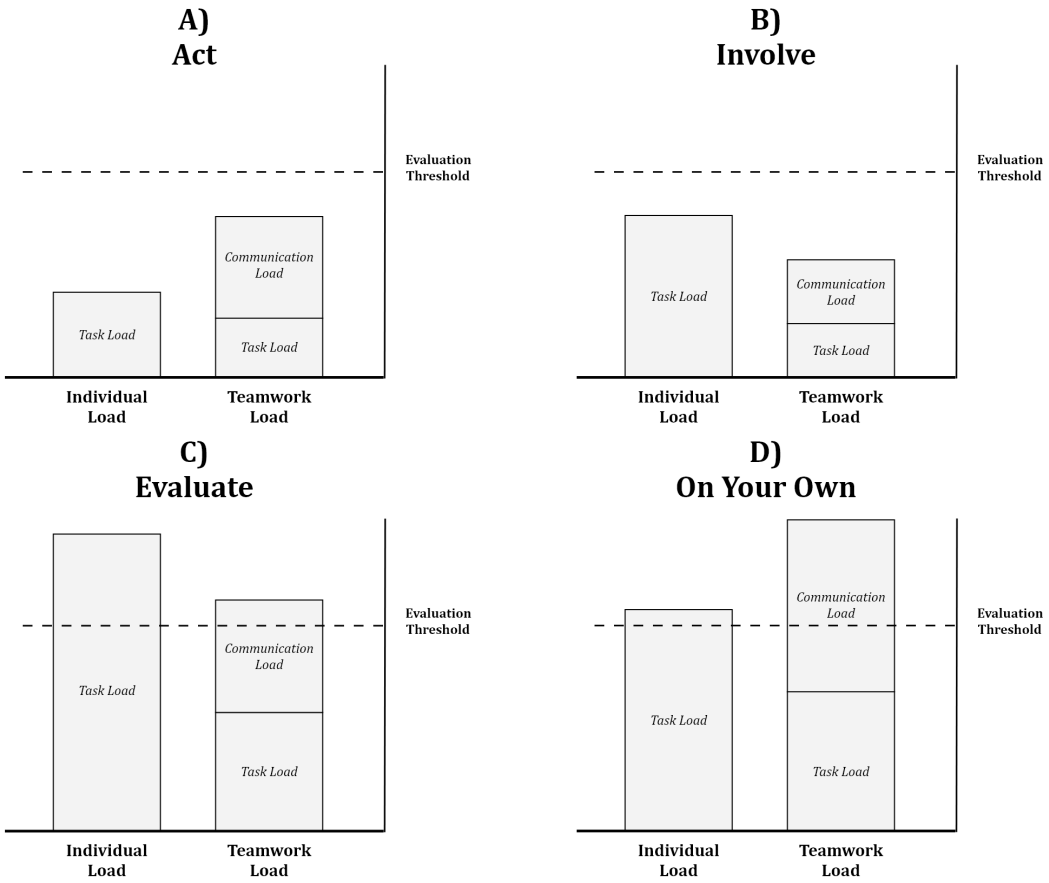


Figure 6.3: A compendium of conceptual models for A) *act*, B) *involve*, C) *evaluate* and D) *on your own*. On the x-axis: collaboration type (Individual, Teamwork), on the y-axis: Load. The *evaluation threshold* marks a limit where the thought process may require a more rigorous mental effort such as *evaluation*.

threshold. If both load types surpass the threshold, it may be more necessary to *evaluate* the agenda to form more fit scripts and directives. However, in this case it is not necessary. If teamwork load would surpass the *evaluation threshold* but not the individual load, it makes even less sense to make the activity a group activity.

On the other hand, if the combined load from communication and split tasks for teamwork load is lower than the total task load from individual load, then it is worth investing in teamwork. In this case, it makes sense to involve other team members (See B in Figure 6.3). By involving others via communication and splitting the task load, the overall work becomes easier. In this scenario, it is worth making the activity a group activity.

If both individual load and teamwork load exceed the *evaluation threshold*, that is the moment the task is hard enough to justify questioning or adjusting the agenda: *"Is this the best thing to do right now?"* In the case under, the total teamwork load imposed is lower than the individual load (See C in Figure 6.3). This makes it more

worth make it a group activity requiring communication. The overall task is also challenging enough to justify reevaluation.

Lastly, we have the scenario where both load types exceed the *evaluation threshold*, but where the individual load is lower than the teamwork load (See D in Figure 6.3). This is a chaotic scenario where group members could benefit from *evaluating* with each other for a better fit, but the situation allows for neither efficient teamwork nor efficient individual work. The individual is too busy dealing with their own duties—dealing with their own script—that attempting to involve others would only make the load worse. Since the script adjustments made here are entirely unrelated to what other group members do, the adjustments will have no relation to creating a better fit; any progress—or regress—in fit will be incidental. Thus, this scenario does not rationalize collaborating.

6.1.8.1 Note: Workload is Contextual

A quick note, workload is a heavily contextual topic, and workload and varies between both individuals and environments. The usage of workload in this framework is not intended to be viewed as an absolute numeric, rather we use it on a more general level to describe how effort and workload needs to be invested to perform actions. Instead of exact thresholds and numeric comparisons, we see workload more from a relationship perspective, where one task can be deemed as "harder" on the workload than another.

That being said, we do touch upon some of the individual aspects of workload which can affect a player's needed effort to perform certain actions. This is one of the topics addressed in our properties compendium (See section 6.2). For instance, **mastery** and **player capability** are both properties that reduce load levels. To some extent, the designer can use different properties and thought patterns to facilitate and afford the landing of one type of interaction mode. For more discussion of the collaborative games properties, see section 6.2 The Collaborative Games Properties, or see Appendix C for the full collection of properties.

6.2 The Collaborative Games Properties

The Collaborative Games properties compendium includes 40 properties in alphabetical order, that have been linked to collaborative aspects in games. The collection is an auxiliary tool to be used together with the Reform Journey model; all properties are written so that they relate to the Reform Journey model, including the content about agenda and its underlying structures, and other properties. All properties have also been tagged in groups of 1) interaction mode, 2) agenda substructures, and 3) fit towards performance, cohesion, and/or adaptability. An example of a property can be seen in Figure 6.4, while Table 6.1 contains a summary of the full list of 40 properties. Every property is then fully described in Appendix C.

The properties can be used to afford certain types of interaction modes. For example, **repeated play** is a way for a designer to afford reaching the *evaluate* interaction mode. Depending on the qualities of the game, different properties may be differently effective - and some properties are more related to some properties than others. For this reason, it is still important that a designer proceeds to playtest and iterate on his or her game concept to ensure that they have reached their desired effect.

6.2.1 Collaborative Games Properties and Gameplay Design Patterns

The nature of these Collaborative Games Properties have some similarity to the Gameplay Design Patterns (GDP patterns) introduced by Björk et al. (2003) in that they are abstracted, reoccurring elements in existing games that have been analysed for how they are used in previous designs and how they could be used in future designs. Unlike GPD patterns, however, the Collaborative Games Properties centre around a singular ideal: that of designing for collaboration in games. Where GPD patterns are more varied and often generalist, the Collaborative Games Properties invoke the perspectives of the Reform Journey, its agenda and its interaction modes.

To maintain that focus on collaborative experiences, and to allow for a designer to utilise its content without needing to master the significantly larger collection of GPD patterns, the Collaborative Games Properties are not written as GPD patterns but rather allow the Reform Journey Framework to be utilised as a standalone framework. That said, it is the author's experience that the Collaborative Games Properties integrate well together with GPD patterns, as can be seen in the formal analysis of the game *Overcooked 2* (see Section 7.3.2 and Appendix B).

Nevertheless, there are several GPD patterns that resemble some of the design elements described by these proposed Collaborative Games Properties. For the interested reader, Table 6.1 (page 63) includes a column of gameplay design patterns that could to some extent relate to the respective property. Bear in mind, however, that these links have been made *after* the properties have been created; neither of the property or GDP pattern(s) that have been linked encompass all the elements of the other. Unless otherwise noted, all GPD patterns are from GDP3 (n.d.).

6.2.2 The Anatomy of a Collaborative Games Property

To help formalise the reading of the Collaborative Games Properties collection, each property is structured in a similar manner. Below is a description of how properties are presented in the collection, where key components have been annotated (see figure 6.4) with a corresponding number in the lists below.

At the top of each property is a black bar, where concepts from the Reform Journey Model have used as tags to indicate how the property relates to the model:

(1) What interaction modes (*act*, *involve*, *evaluate*) the property may afford or manipulate.

(2) The traits of collaboration quality the property might afford (performance, cohesion, adaptability).

(3) Which of the aspects that inform the agenda (***accumulated knowledge***, ***shared goals***, ***shared references***, and ***social code***) the property affects.

This allows a designer to scan the highlighted terms to see if the property is relevant for their current needs.To provide further aid in this process, table 6.2 (page 66) lists all the properties by each of these tags. It should be noted that these are more guidelines than rules: the categorisations themselves have not been user tested within the scope of this thesis, and a creative designer might find a way to spin or combine properties so that they relate more to other tags.

Two boxes of text makes up the core of each property, explaining the idea behind the property and giving insights into how a designer might apply it or the consequences of so doing.

(4) Is the name of the property.

(5) An overview of the property at a conceptual level, allowing the reader to gain an overview over its ideas.

(6) The brown box holds additional information that relates more to application of the property, giving advice or exploring idea in more depth.

Lastly, within the text of the property there is some formatting done to further highlight some important terminology in the discussion.

(7) Any references to other properties in the collection are highlighted in ***bold italic***. When referenced, some properties sometime show up in other conjugations that better suit their grammar of the sentence. For example, ***synchronisation*** might show up as *"... as the players* ***synchronise****"*.

(8) To make discussions about the interaction modes stand out, they are formatted in Small Caps and coloured black.

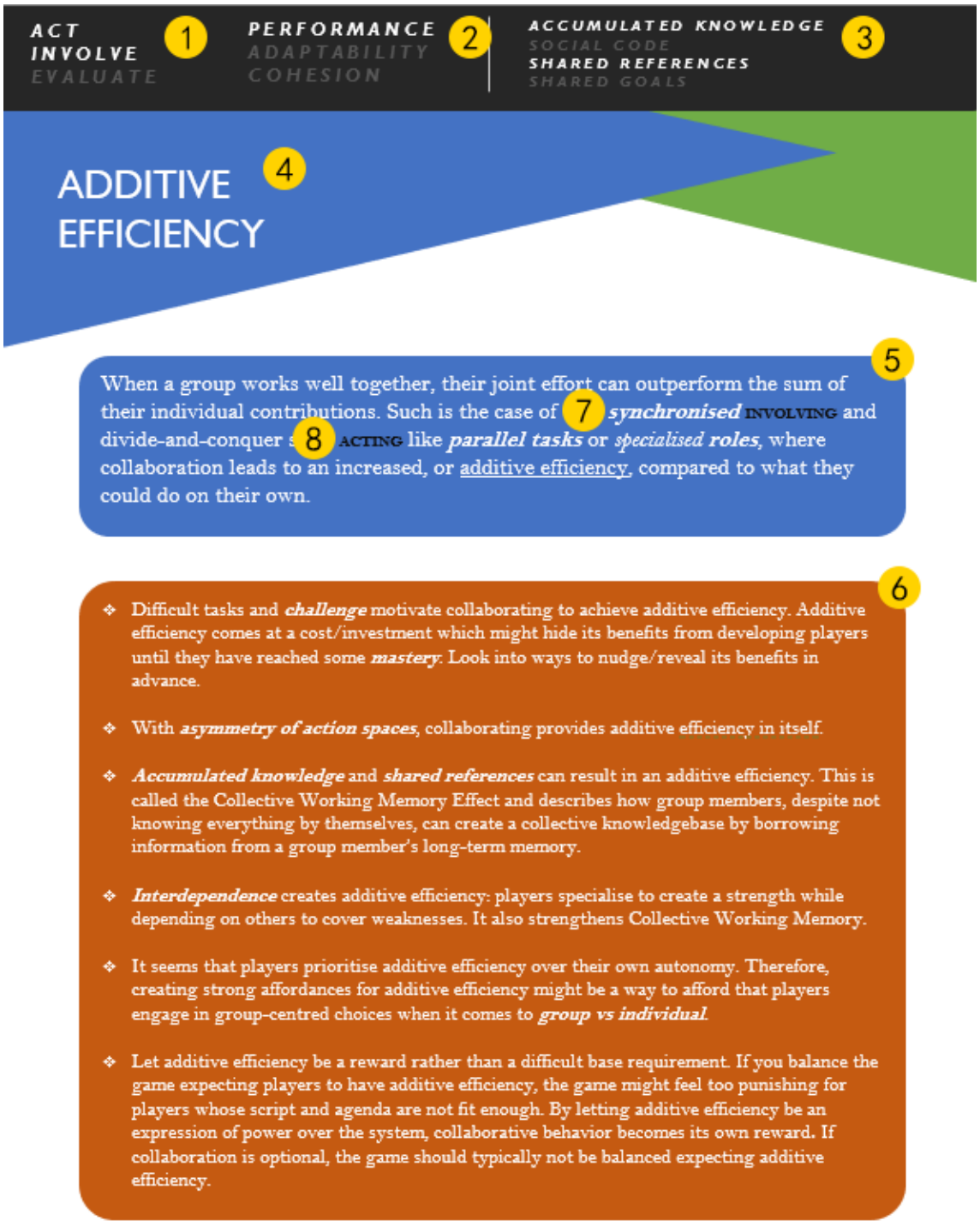


Figure 6.4: A capture of the property additive efficiency, with annotations. The full list of properties can be found in Appendix C.

Table 6.1: A summary of all Collaborative Games Properties, including a column of related GDP patterns from GDP3 (n.d.) (* = Björk and Holopainen (2004)).

Property	Summary	Related GPD patterns
Accumulated Knowledge	The total pool of knowledge of the group, whether they know it or not. Sets the boundaries of the agenda.	Strategic Knowledge, Complex Gameplay
Additive Efficiency	When a well-working group outperforms the sum of their individual contributions to the team since they build on the effects provided by each other.	Facilitating Rewards, Temporary Abilities
Asymmetry	When one player can do what another player cannot do and vice versa. Unlike with ***interdependence***, players are not necessarily reliant on the asymmetric features of each other to succeed.	Asymmetric Gameplay, Asymmetric Goals, Enforced Agent Behavior, Privileged Abilities
Betrayal/ Traitor	The deviation from the shared agenda to benefit oneself at the expense of the group at large. Traitors deviate already from the onset of the collaboration.	Betrayal, Traitor
Challenge	Related to the concept of workload by providing innate difficulty for the task.	Challenging Gameplay
Changing Conditions	A significant change in how the game works, creating discrepancies within the agenda to incite reforms.	Evolving Rule Sets, Varied Gameplay, Varying Rule Sets
Co-Actions	Actions or tasks that cannot be performed by a single player, requiring players to *involve* in order to perform the action at all.	Collaborative Actions, Team Combos
Co-Location	Whether or not the players are physically present at the same location.	Player-Player Proximity
Communication	The exchange of ideas and knowledge between individuals. The way this is handled in game significantly affects how players *involve* and *evaluate*.	Communication Channels
Community	A large group of individuals that do not necessarily have a relation with each other, but shares a culture, which makes them able to relate to each other.	Factions
Contribution to Group	The feeling that a member's participation in the group brings meaningful benefits, making players more prone to *involve* and lessens the likelihood of betrayal.	Loyalty, Team Accomplishments, Value of Effort
Dependence	Gameplay which requires one player to rely on another player in order to fulfil their goals and reach an end state. Can be unidirectional dependence, co-dependence or ***interdependence***.	Symbiotic Player Relations

Property	Summary	Related GPD patterns
Dilemmas	Difficult choices with high points of tension, where no option is clearly preferable over the other. Creates strong grounds for *evaluating*.	Dilemmas*, Risk/Reward*
Distribution of Power	If power is the ability for players to fulfil their goals and enact their intent upon the game, distribution of power concerns the balances or imbalances of that ability between players.	Player Balance, Social Roles, Social Rewards
Emergent Collaborative Behaviour	Unexpected—or at least unrequired—forms of collaboration within games.	Altruistic Actions, Dynamic Alliances*, Uncommitted Alliances*, Player-Defined Goals
Emergent Structure	When a group consolidates specific ways of behaving, creating a pipeline for how things are done. Can include the creation of house rules.	Player Decided Rule Setup (a suggested pattern on GDP3 (n.d.) not yet implemented)
Enforced Structure	Set boundaries or constraints which forces players to behave in a desired way.	Enforced Agent Behaviour, Exaggerated Perception of Influence, Framed Freedom
Group Identity	An expression for the distinguishing character or essence of the group, allowing players to identify with the larger group.	Togetherness
Group Presence	The experience of being present with others and being together.	Togetherness, Parties
Group Vs Individual	The dilemma where helping the group may hurt the individual player and vice versa. Can push a group to *evaluate*.	Internal Conflicts, Incompatible Goals, Social Dilemmas, Player Agency
Helping	One player receives help from another player.	Altruistic Actions, Helplessness
Interdependence	A form of ***dependence***: Group members depend on each other for features that are exclusive to that player; none of them can complete their goals without each other.	Symbiotic Player Relations
Mastery	An increased level of skill, knowledge and ability generated through learning the game.	Gameplay Mastery
Mutual Experiences	Experiencing something together as a group, which becomes a shared memory.	Mutual Experiences (Bergström et al., 2010)
Parallel Tasks	Distributed tasks done synchronously, fairly coordinated.	
Planning	Teams structuring how they will work together ahead of performing the work.	Tactical Planning
Player Capability	A player's extra-game abilities which affect how they can engage with the gameplay.	

Property	Summary	Related GPD patterns
Reactive Actions	One player makes personal adjustments to their own *acting* to better fit with how other group members *act*.	(Delayed Reciprocity)
Repeated Play	Repeated play allows teams to return to a game state or level for more than one try, which lends more opportunities to refine the fit of the agenda and scripts.	Meta Games, Replayability
Roles	A partitioning of responsibilities or actions.	Social Roles, Role Fulfillment
Shared Goals	The overlap between the goals of individual group members, giving them a common target to achieve.	Mutual Goals, Player-Created Goals
Shared Punishment	Having the consequences of individual players' actions escalate to affect the group at large.	Shared Penalties
Shared References	The perceived shared understanding and presumptions between group members; what they know—or assume—is known by all participants.	
Shared Threats	The utilisation of an out-group or external factor to define an in-group through juxtaposition.	Beat the Leader
Social Code	Delineates how players should treat each other and behave in general whilst remaining aligned with the agenda.	
Synchronisation	Players *involve* to make aligned adjustments to their individual scripts, for the purpose of creating a better fit for the current situation. These may crystallise into more permanent changes to the norms of the agenda.	
Team Dynamics	Concerns the relationships between group members, how they perceive and relate to each other.	Player Balance, Team Development
Tempo	The utilisation of real time in the game, affecting the pacing of gameplay.	Lull Periods, Real-Time Games, Stimulated Planning, Time Pressure
Urgency	A need to perform a task or fulfil a condition within a limited room for action. May be tied to real time through tempo, but isn't necessarily so.	Time Limits, Action Caps, Budgeted Action Points
Vicinity	Players that keep a diegetic proximity to each other are rewarded with additional features, abilities or other forms of additive efficiency. Affords and rewards *involving* but implicitly limits the group's flexibility to *act*.	Access Rewards, Temporary Abilities
END OF TABLE		

Table 6.2: A listing of all Collaborative Games Properties, grouped by which Reform Journey terminology they have been tagged with.

Term	Related Collaborative Games Properties
Act	Additive Efficiency, Asymmetry, Emergent Structure, Enforced Structure, Mastery, Parallel Tasks, Player Capability, Reactive Actions, Roles, Shared Goals, Tempo, Urgency
Involve	Asymmetry Additive Efficiency, Asymmetry, Challenge, Co-Actions, Co-Location, Communication, Contribution to Group, Dependence, Dilemmas, Distribution of Power, Emergent Collaborative Behaviour, Emergent Structure, Group Presence, Helping, Interdependence, Mutual Experiences, Player Capability, Shared Goals, Shared Punishment, Shared Threats, Social Code, Synchronisation, Team Dynamics, Tempo, Urgency, Vicinity
Evaluate	Accumulated Knowledge, Betrayal/Traitor, Challenge, Changing Conditions, Communication, Distribution of Power, Group vs Individual, Planning, Player Capability, Shared Goals, Shared Punishment, Shared Punishment, Shared Threats, Tempo, Urgency

Performance	Accumulated Knowledge, Additive Efficiency, Asymmetry, Challenge, Contribution to Group, Dilemmas, Emergent Collaborative Behaviour, Helping, Interdependence, Mastery, Parallel Tasks, Planning, Player Capability, Repeated Play, Roles, Shared Punishment, Tempo, Urgency, Vicinity
Adaptability	Betrayal/Traitor, Changing Conditions, Distribution of Power, Emergent Collaborative Behaviour, Enforced Structure, Repeated Play, Shared Goals, Synchronisation, Urgency
Cohesion	Asymmetry, Betrayal/Traitor, Co-Actions, Co-Location, Communication, Community, Dependence, Distribution of Power, Emergent Collaborative Behaviour, Emergent Structure, Group Identity, Group Presence, Group vs Individual, Helping, Interdependence, Mutual Experiences, Planning, Reactive Actions, Roles, Shared Goals, Shared Punishment, Shared References, Shared Threats, Social Code, Synchronisation, Team Dynamics, Vicinity

Accumulated Knowledge	Accumulated Knowledge, Additive Efficiency, Asymmetry, Challenge, Changing Conditions, Mastery, Parallel Tasks, Planning, Player Capability, Repeated Play, Roles, Shared Punishment, Synchronisation
Shared Goals	Betrayal/Traitor, Challenge, Co-actions, Contribution to Group, Dilemmas, Interdependence, Parallel tasks, Planning, Shared Goals, Shared Threats
Shared References	Additive Efficiency, Asymmetry, Challenge, Changing conditions, Co-location, Communication, Community, Dependence, Emergent Collaborative Behaviour, Emergent Structure, Group Identity, Group Presence, Group vs Individual, Interdependence, Mastery, Mutual Experiences, Planning, Player Capability, Reactive Actions, Roles, Shared Goals, Shared Punishment, Shared References, Shared Threats, Synchronisation, Team Dynamics

Term	Related Collaborative Games Properties
Social Code	Betrayal/Traitor, Challenge, Communication, Community, Contribution to Group, Dependence, Dilemmas, Distribution of Power, Emergent Collaborative Behaviour, Emergent Structure, Enforced Structure, Group Identity, Group vs Individual, Helping, Interdependence, Parallel Tasks, Planning, Player Capability, Shared Punishment, Shared Threats, Social Code, Synchronisation, Team Dynamics, Urgency, Vicinity
END OF TABLE	

7

Process

This chapter introduces the execution process throughout 4 iteration cycles until reaching the final framework product. The process execution follows the plan found in Chapter 5: Plan.

7.1 Iteration 1: Compiling the Base Framework

In the first iteration, the primary focus was to establish a framework which synthesised what existing literature and game design experience was collected in the pre-study. Following the Grounded Theory method (see Section 4.6.4, the multitude of concepts, findings and advice were structured into a collection of categories. Some of these categories were used to inform a general framework called *the Reform Journey*, while the others were formulated as *design tools* (Later renamed to *properties*) and given descriptions of how each relate to *the Reform Journey*.

7.1.1 Using Grounded Theory

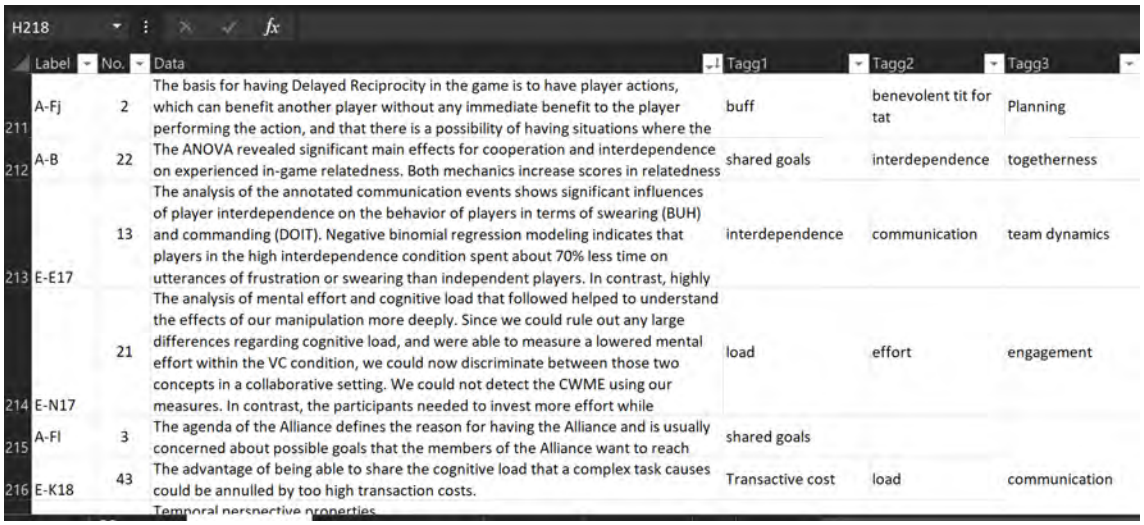
As described in Section 4.6.4, Grounded Theory can be divided into five process steps: data gathering, coding, conceptualising, categorising, and theorising. Although using Grounded Theory might be interpreted as a deviation from the original plan to use Content Analysis (described in Section 4.6.1), it was concluded that Content Analysis has significant similarities to the coding, conceptualising and categorising steps of Grounded Theory process. In other words, it could be argued that the Grounded Theory works as a holistic process whereas Content Analysis is a method executed as part of a larger process. We consider that the description of how the framework was developed benefits from the more holistic process of Grounded Theory rather than focusing on Content Analysis.

7.1.1.1 Grounded Theory Step 1: Gathering Data

The primary data gathering consisted of the preceding pre-study of sources within games research and design. A total of 27 sources were gathered for the process: six recorded talks relating to cooperative games hosted at previous Game Developer's Conferences (GDC Vault, 2020), two books on game design, one PhD thesis, and 18 academic papers related to our thesis subject in various ways.

7.1.1.2 Grounded Theory Step 2: Coding

The set was coded using a Content Analysis-esque approach where interesting findings were extracted from the corpus into a data set in Microsoft Excel. Each data point was then labeled with 1-4 labels, representing a commonality in theme or concept. In total, the formed data set contained 917 data points tagged with an average of 2.8 labels per data point, resulting in 203 unique labels.



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	Label	No.	Data	Tagg1	Tagg2	Tagg3
211	A-Fj	2	The basis for having Delayed Reciprocity in the game is to have player actions, which can benefit another player without any immediate benefit to the player performing the action, and that there is a possibility of having situations where the	buff	benevolent tit for tat	Planning
212	A-B	22	The ANOVA revealed significant main effects for cooperation and interdependence on experienced in-game relatedness. Both mechanics increase scores in relatedness	shared goals	interdependence	togetherness
213	E-E17	13	The analysis of the annotated communication events shows significant influences of player interdependence on the behavior of players in terms of swearing (BUH) and commanding (DOIT). Negative binomial regression modeling indicates that players in the high interdependence condition spent about 70% less time on utterances of frustration or swearing than independent players. In contrast, highly	interdependence	communication	team dynamics
214	E-N17	21	The analysis of mental effort and cognitive load that followed helped to understand the effects of our manipulation more deeply. Since we could rule out any large differences regarding cognitive load, and were able to measure a lowered mental effort within the VC condition, we could now discriminate between those two concepts in a collaborative setting. We could not detect the CWME using our measures. In contrast, the participants needed to invest more effort while	load	effort	engagement
215	A-Fl	3	The agenda of the Alliance defines the reason for having the Alliance and is usually concerned about possible goals that the members of the Alliance want to reach	shared goals		
216	E-K18	43	The advantage of being able to share the cognitive load that a complex task causes could be annulled by too high transaction costs.	Transactive cost	load	communication
			Temporal perspective properties			

Figure 7.1: A screenshot of the collected data set with tags.

After this, we attempted to start grouping our code tags to form clusters, or concepts. These clusters were thought to help us identify interesting patterns for later processing. However, while indulging in this activity we realised it was hard to form meaningful content as the codes themselves gave little insight on what they meant. We realised this was because we essentially tried to skip step 3 and started categorizing less processed data. Upon realising this, we proceeded to a more defined step 3.

7.1.1.3 Grounded Theory Step 3: Conceptualization

Using Microsoft OneNote as a dashboard, each unique tag code received its own tab including data sets of all material related to the tag. As many of the code sets were large, the biggest being communication with a total of 118 data points, they were worked with individually to form concepts and statements.

Upon working the data set and reviewing its content, low-occurence codes (those with under 18 occurrences) were either disregarded or combined with larger categories, reducing the total amount of unique code tags to 48.

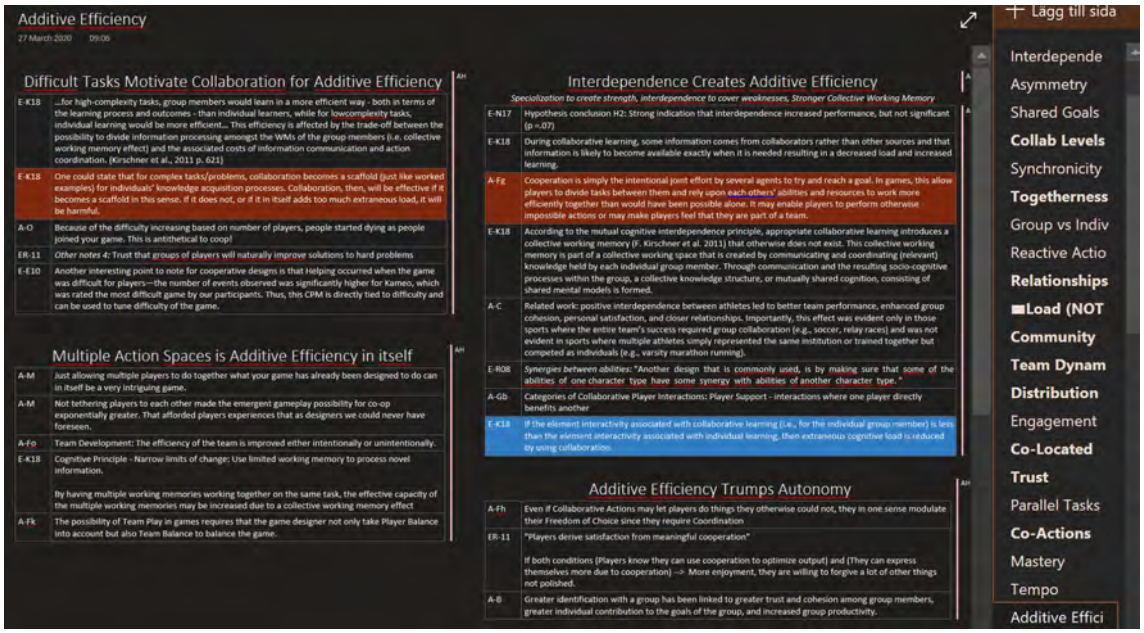

Figure 7.2: A screenshot of some of the statements and concepts under the code tag "Additive Efficiency"

7.1.1.4 Grounded Theory Step 4: Categorization

As the previous steps had naturally processed the data and formed rigid concepts, the resulting material could easily be seen as categories themselves. Our use of multiple tags on the same material in step 2 rendered us able to find the connections with similar topics much easier as the connection was tagged on up to 4 places already. This may have been a deviation from a more traditional Grounded Theory process and may have resulted in the process being more time-consuming, but it did help up pre-process some of the categorizations as the connections had already been drawn in step 2.

7.1.1.5 Grounded Theory Step 5: Theorising process

Somewhat during step 3 and 4, but especially on step 5, we theorised how the created concepts and categories related to each other. Using each other for discussion and feedback, the first draft would on numerous occasions be updated to make sense both in terms of clarity and content based on our interpretation of previous work. We eventually came to a unified understanding and creation of two discernible items: a reform journey and a "toolkit" of components which seem to affect the reform journey for closer collaboration between individuals. The findings were written down and deliberately formed so that what was produced could work as a draft for the framework itself.

7.1.2 Using Concept Mapping

While we were processing our data using the Grounded Theory process, and especially in the last step of theorising, we often consulted the tool of concept mapping - drawing lines between categories that seemed to be related. The concept mapping helped us draw inferences of how certain concepts were related, which helped us forward in our theorising process.

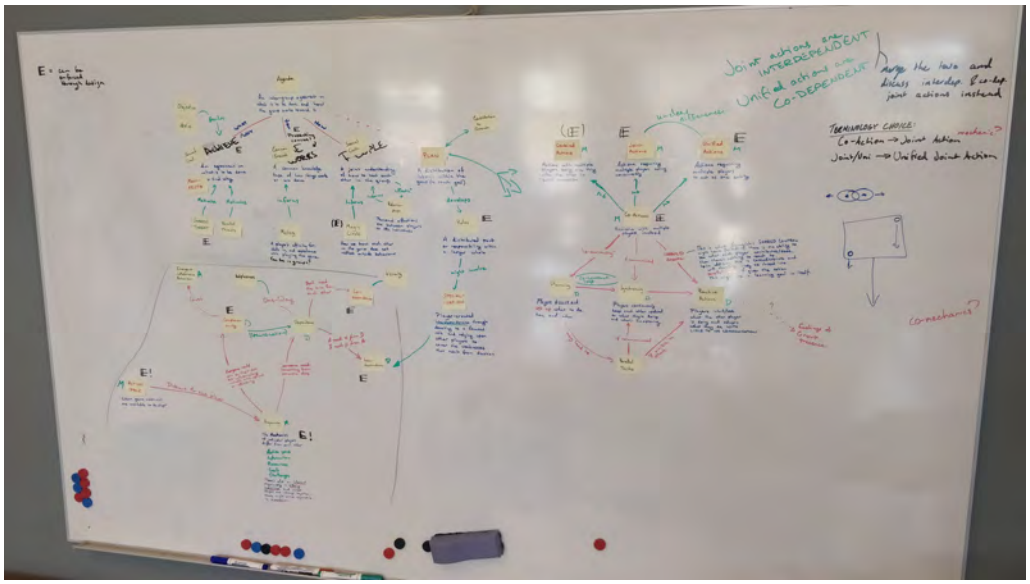

Figure 7.3: A zoomed out version of a concept mapping session.

7.1.3 The Reform Journey: Iteration 1

The reform journey is a model that describes the transitioning of a team's "fit" for working with a task together, and forming "scripts" to work towards a common "agenda". By moving up and down between communicative elaboration in three levels, individuals' scripts are updated to fit better with their understanding of the agenda, or the agenda as a whole may possibly be reconsidered to completely change the direction of the crew's activity.

For more detailed information about the formation of agenda and scripts, see subsection 7.1.4 The Toolkit: Iteration 1.

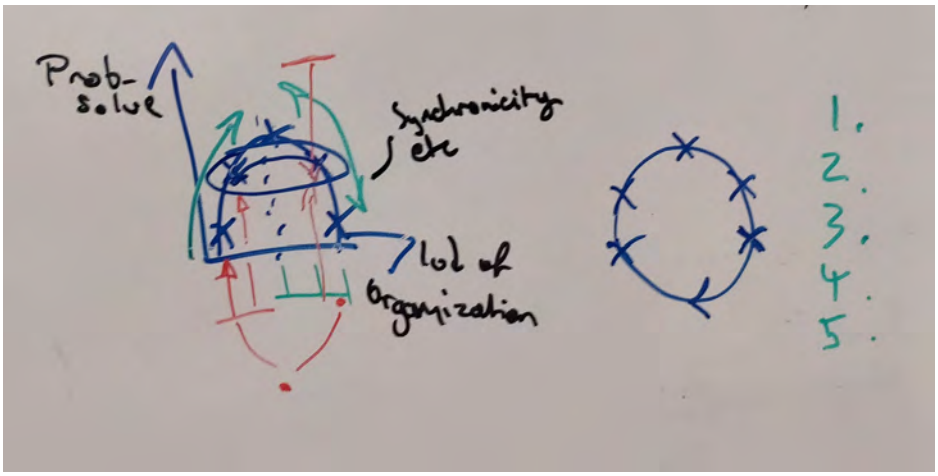

Figure 7.4: A quick sketch of the idea of a "reform journey".

At this moment, the created theory was still rather tentative and subject to change, and parts of the theorising had not been fully written down in detail. For example, the reform journey model had still not solidified the accompanying workload models, nor the concepts of reactive actions and synchronisation (that is, skipping the *reevaluation* and/or *involve* level for a quicker fix of local fit). We knew that we wanted to include the concept of communication having a mental cost on load, but had not stabilized the way we wanted to communicate it. In figure 7.5, an early draft is portrayed. The main difference between that version and the final one presented in Chapter **??** Results is that it has two thresholds, and that it has yet to juxtapose group effort versus individual effort.

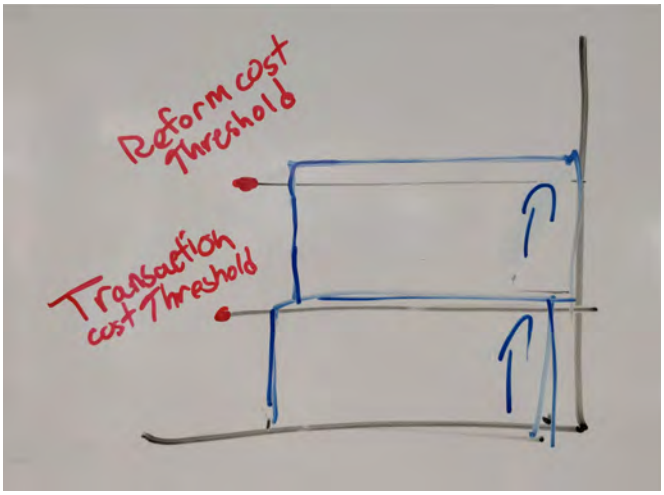

Figure 7.5: An early visualisation of "thresholds" of load that needed to be imposed to reach a need to start transacting or reforming.

Perhaps the most important takeaway from this iteration cycle is that we outlined the transitioning between two states of collaboration, which gives us the opportunity to think of comparisons between the two states in terms of how they seem to relate

and live up to different parameters. In the case of the reform journey, we wanted to describe ways that made people start *involving* each other, and *reevaluating* with each other so that they could increase their fit. For this, we created a toolkit with various "tools" that seemed to spur team members to reach these levels of (communicative) elaboration, see section 7.1.4.

7.1.4 The Toolkit: Iteration 1

The second generated item, the "toolbox" was a collection of "tools" of how to design around the transition journey, later named the "reform journey". By using these tools, the designer affords a group of individuals to either *act*, *involve*, or *reevaluate* with each other. The tools were created based on the collected findings from the literature study and grounded theory process. For the full collection of tools, later renamed to 'properties', see chapter 6 Results .

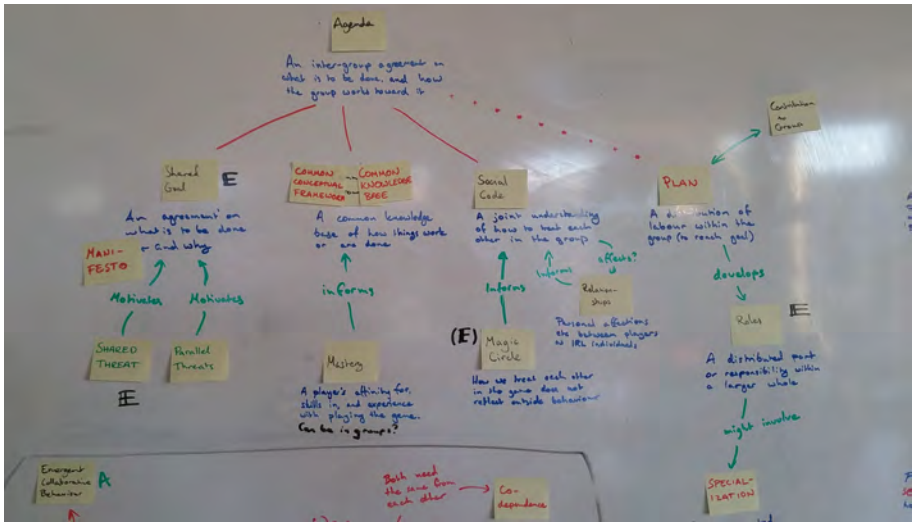

Figure 7.6: An early sketch of how certain categories seemed to be related. On this, components that seem to build up to an "agenda".

The conceptualising and theorising of tools was processed through the grounded theory method from codes to categories. While processing our data, we slowly built up a structure that seemed to revolve around an "agenda" – that is, a sort of common understanding of a group's direction and where and why the group is headed that way. However, the exact contours of the agenda had not yet been defined, though it was one of the categories developed in the coding, conceptualising and categorising processes of the grounded theory process. Upon further theorising, using concept mapping, we started to see connections between shared goals, common ground, and social code, and the agenda, all of which are concepts generated in step 3 of the grounded theory process. The model had thus started to take shape, though the exact boundaries and definitions had not been fully developed yet.

The script was also loosely brought up as an important aspect, though this too had no finalized definition. What we knew was that we wanted it to correspond to a set

of jurisdictions and norms of how things are ought to work given certain contexts, and how to for instance solve task X and in what way.

7.1.5 Defining Collaboration: Iteration 1

At this stage, we had yet to finalise a specific definition of "collaboration", though we steadily moved towards a shared understanding of the concept. Collaboration-related codes were prevalent in the coding process of step 2, both directly and indirectly. The apparent theme of various data sources indicated that for collaboration to take place, individuals and group members needed something in common to work towards, and an acknowledgement of group members' strive for the same goal. In addition to this, we perceived a number of factors through our "tools" that seemed to be able to influence a group's ability to reach specified goal. So, while we had not developed a clear definition of collaboration, we had started to develop a clear gist of what seems to affect it.

7.1.6 Comments on Iteration 1

As can be seen in the above subsections, the content of the model was in this stage still very preliminary, with fuzzy boundaries and sometimes less clear concepts. This was something that was put more effort in in the later iterations, as the focus of this iteration was to in the first place outline what concepts and categories seemed to be the most interesting and relevant.

7.2 Iteration 2: Re-evaluating Agenda, Script, and Fitness

Continuing with the results from iteration 1, our goal was now to make our framework increasingly presentable. We started this cycle with a feedback session with our supervisor, gaining some insight on some aspects in strong need for clarification. Some parts were again reconsidered and pinned down further using concept mapping to either simplify or streamline our thought processes. We end this iteration cycle with a more refined framework presented using a PowerPoint Presentation.

7.2.1 Feedback session

As we now had material to show, albeit still quite conceptual and preliminary, we decided to expose our findings for our supervisor to form our coming work. As can be seen in subsection 5.2 Planning, one of the three cornerstones of our work was to work on the clarity of the synthesized framework. We therefore wanted to know how others perceived the framework's clarity. Going ahead, we received feedback on some formulations in the framework and a need to further clarify the idea behind the agenda and script, and especially on the agenda. We agreed, and decided to iterate the generated framework re-frame the framework as a whole with increased discussions and concept mapping.

7.2.2 Concept Mapping

Going back to the drawing table, we again started discussing and concept mapping many parts of the framework, re-visiting most of the generated categories to try and see them from a different angle. Particular effort was put to make key components of the framework more distinct and easier to understand. As our primary audience for our framework would be designers, we wanted to move away from some of the more research-heavy jargon sounding words generated, which led us to rename for instance transaction cost to communication load. Effectively, they work more or less the same, but could be perceived as less academical.

The continued work also generated a revised component of the workload aspect of collaboration presented in section 7.2.5 The Toolkit: Iteration 2. The new iteration makes a clearer focus on the juxtaposition of working as an individual or working towards a group, but also a distinction between load on group level versus on the individual level. The main difference compared to the previous iteration was that the previous viewpoint did not address how for example one team individual may be high in load whereas another may be low in load. In iteration two, we underline that it is always an individual that has a load on the perceived situation - and that what is afforded for one team member may not be afforded for the other team member.

Eventually, this also made it clearer to theorise around the workload aspects of our model, and we landed on revising the two-threshold level of Figure 7.5 to more distinctly include conceptual individual charts. The new model, again, compares

the perceived needed load imposed for working alone versus working together with the group

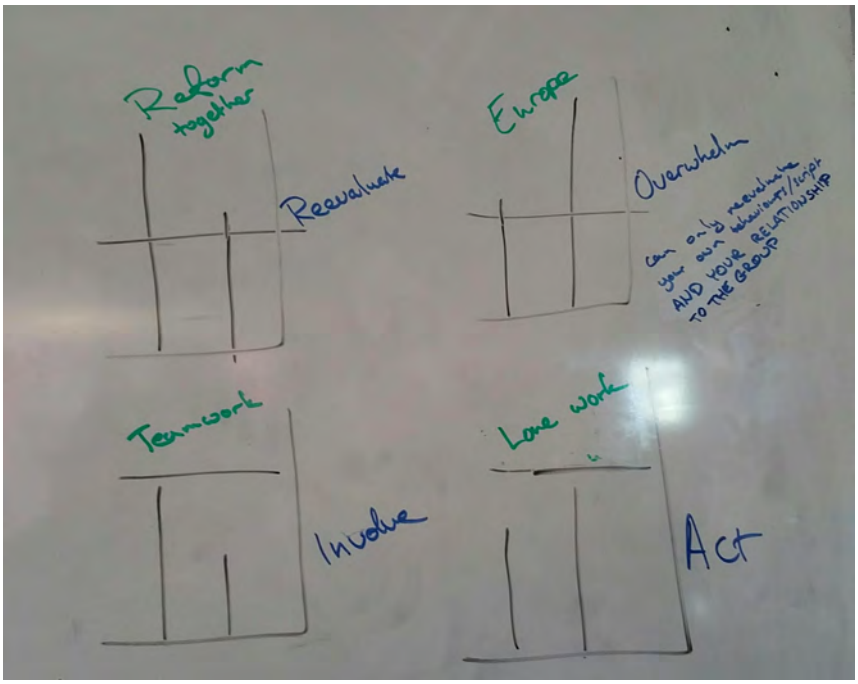

Figure 7.7: A visualisation of the 4 affordance states identified. In addition to *act*, *involve*, and *reevaluate*, we also identified what we would later call *"on your own"*, which is a state which is challenging enough both on an individual level and on a group level to break the "reevaluation threshold", but where it is still easier to work alone rather than trying to collaborate and communicate with others.

7.2.3 PowerPoint

As the revised framework had made some changes both in content as well as well as some terminology changes and phrasing changes, we wanted to make the framework more easily digestible for new readers. The previous iteration resulted in a dozen A4 pages of the Reform Journey and tools. While perhaps not too much to indulge into if one has time to do so, we wanted to make a lighter way to find out about our framework, so we started to consider alternative ways to present the framework rather than just plain text with some figures. As the plan was to hold a workshop in the next iteration, we decided to update the framework in the medium of a PowerPoint presentation, as we could then use that presentation for our workshop.

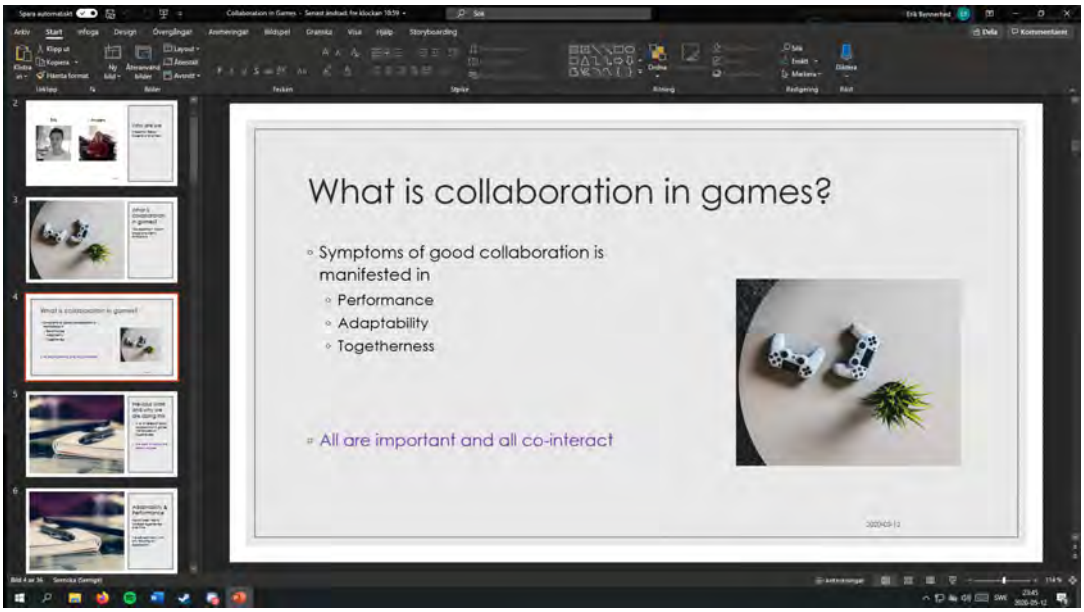

Figure 7.8: A slide about "What is collaboration" seen from the PowerPoint client.

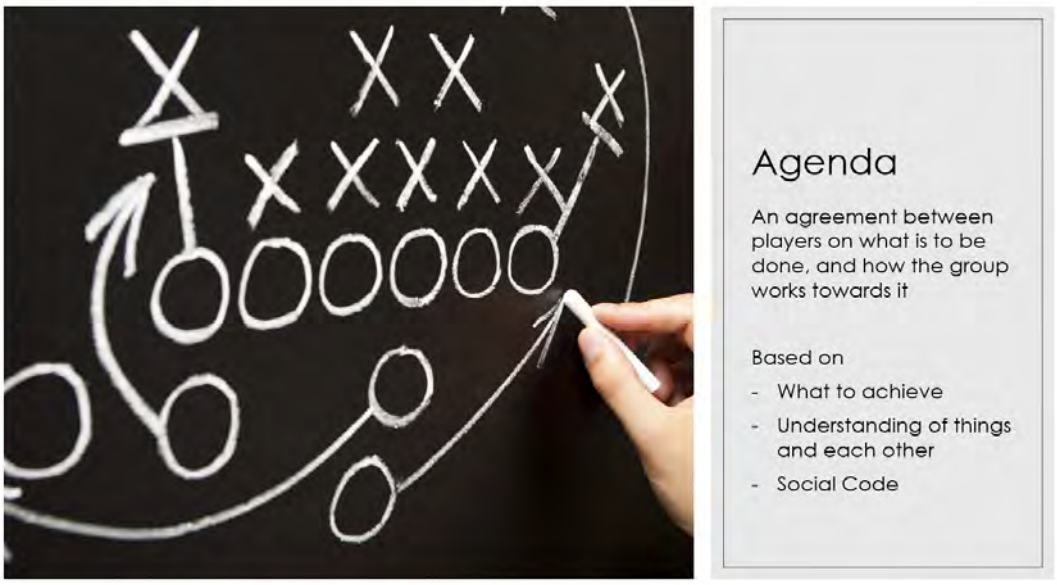

Figure 7.9: A slide from the PowerPoint presentation about agenda and its components.

7.2.4 The Reform Journey: Iteration 2

In this stage of the process, the concept behind the reform journey would be developed further. In its core, the model stayed the same but received some additions to the previous version. Focus was made to make things clearer, more distinct and more solidified. The idea behind fitness (Fit/Unfit) was upgraded to be included in the model to better visualise a transition from less fitness to more fitness. In

addition to this, the model was updated from a round curve as shown in figure 7.4 to a distinct move first in the reevaluation state as shown in figure 7.11. This to emphasize that team members or pairs can fluctuate between states of *act* and *involve* but not move particularly much towards more fitness unless they also *reevaluate*.

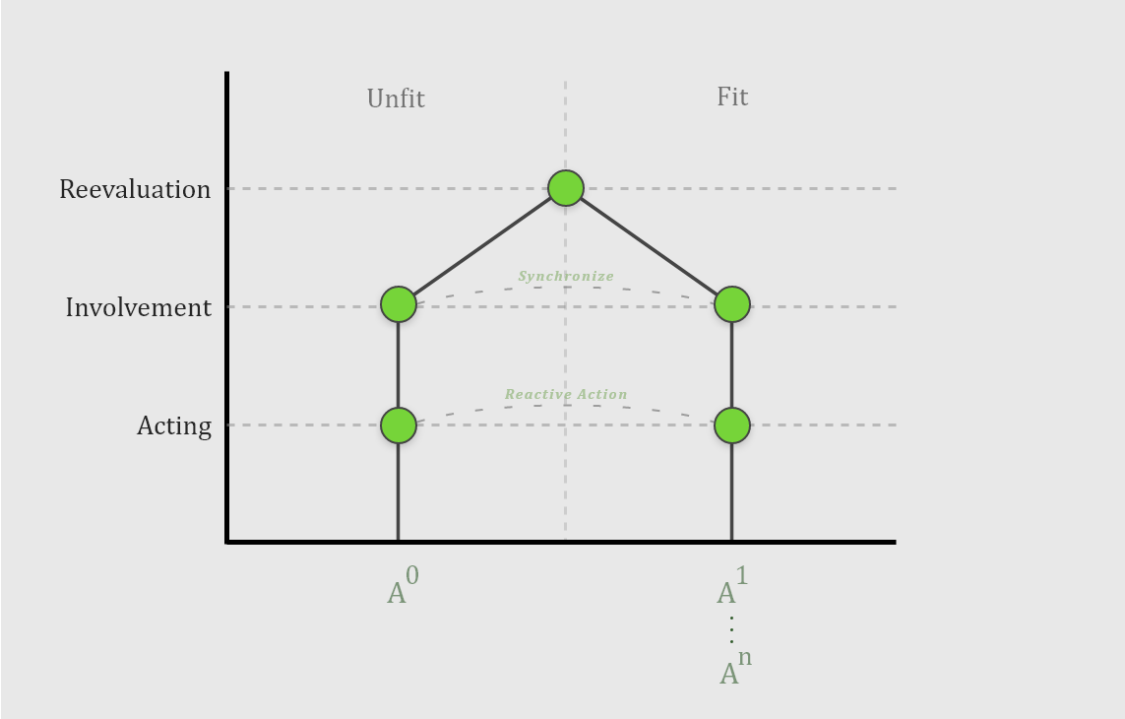

Figure 7.10: The updated journey model, as presented in the workshop PowerPoint

However, one clear addition in this step is the formulation of *synchronize* and *reactive action*. These two were previously only found in the toolkit set but were brought to more attention in iteration 2 as they explain the less elaborate and conscious forms of moving towards a somewhat better fit without clearly consulting other team members - that is, even with no clear *reevaluation* it is possible to slowly move towards a better fit by one member re-actively acting on somebody else's actions (Such as re-adjusting one's navigation slightly to stay behind a team member's movement), or by *involving* others quickly to synchronize actions (Such as expressing "Go right! Go right!"). These solutions are often less elaborated or negotiated and may need to be revisited for discussion later. They can increase the situational fit, but they also run the risk of creating discrepancies in things such as common ground, lowering the fit of agenda as other team members may not be aware of the situational change, especially for the less elaborate variant of them two, reactive actions. However, by giving members room to reflect on these actions (reactive, synchronization), they may have the opportunity to standardize their scripts and check with each other, consequently strengthening their common agenda.

Regarding the agenda, the feedback session led us to reconsider the definitions and explanations of the script and the agenda, as we too found them a bit fuzzy in terms of where the boundaries were. In the previous iteration, agenda was explained mostly

as a shared understanding of what needed to be done and script was explained as a set of norms and jurisdictions of how group members should execute tasks. It was also indicated that only the script could have a real script.

In iteration 2, both the agenda and the scripts can have different levels of fitness, as compared to iteration 1 where only the script had a fit. Conceptually, we had now started to identify a more rigid version and definition of agenda and script. In iteration 2 it was the following:

> **Agenda**: An agreement between players on what is to be done, and how the group works towards it. Some elements, called *agenda jurisdictions*, are explicitly agreed upon whereas other elements, called *agenda norms*, are implicit and are formed by expectations of each other.

The agenda is build up by a team's *collective knowledge*, *shared references*, *shared goals*, and *social code*.

> **Collective knowledge**: The total assembled knowledge within the group, some of it overlapping between members, some of it not. The overlapping knowledge sets the boundaries of the possibilities with the agenda.
>
> **Shared references**: The shared understanding and presumptions about what each group member knows: For example: A knows that B knows how to do X - and can therefore refer to B when X is needed. This can help clarifying communication.
>
> **Shared Goals**: Goals set that overlap between players; if both/all players want the same thing to happen. This can provide a shortcut for creating the shared intent of the agenda.
>
> **Social Code**: Expectations on how group members treat each other; etiquette, rules of conduct. Can be afforded by outlining the framing of the game-play and is affected by the current game state.

These 4 agenda-related areas all help guiding the direction of the script via the agenda, but the script is also formed be the individual's knowledge, goals and experiences as well. The script is defined as under.

> **Script:** The way an individual is to respond to a given context. Is set by experience and is modified by the agenda

Lastly, the workload aspect was (heavily) refined in this iteration stage. One issue with the previous version was that it did not address workload for an individual versus the workload for a group. Here, we make a clear statement that workload should mostly be seen from an individual perspective, and that a situation may afford one type of collaboration for one individual and a different type of collaboration afforded for another individual. Principally it is possible to try and observe a collective workload, but as that workload emerges from individuals it would be better to get a more detailed focus by looking at single entities. Asymmetric tasks

may well result in clear differences in perceived workload, despite a team working towards the same goal or task. Another reason the model was changed was the addition of *communication load* rather than just task load. Communication load is the amount of mental workload or effort required to communicate with others to either *involve* or *reevaluate* with each other. We mean that when it is clear for an individual that the perceived load imposed to indulge in an activity oneself is lower than communicating with others, we are indeed affording a state of *act*. Working with the team consist of load both from their would be required task but additional load is imposed depending on the circumstances and previous experiences. There are aspects such as shared references that help alleviate some of that communication load, and in many ways the individual task may possibly become easier itself but the communication required may in total make a team effort become harder, still.

If the relationship is vice versa, that the perceived load imposed for working with a team is lower than working alone, we afford *involve* as the individual now perceives it easier to work together. This is important, because it indicates that for a task to be meaningful to start *involving* with, it needs to be challenging enough in the right way, and a designer should focus on making activities easier to do with a group than alone, if the designer wants to induce *involve*. Next we have *reevaluate*, and those are the situations in which there is a need for a reevaluation due to the amount of load imposed, though it is still easier to consult the group compared to trying the challenge alone. It affords reevaluate because the load has surpassed the reevaluation threshold, meaning that there is a need to reconsider. Lastly, we have *on-your-own* which we found when we started comparing staples under and over the reevaluation threshold. We mean that these are the situations in which one may personally be very overwhelmed with thought processes oneself, but consulting team members seems even more challenging. This leads to a "on your own" moment for the individual, where they have to individually reevaluate the situation.

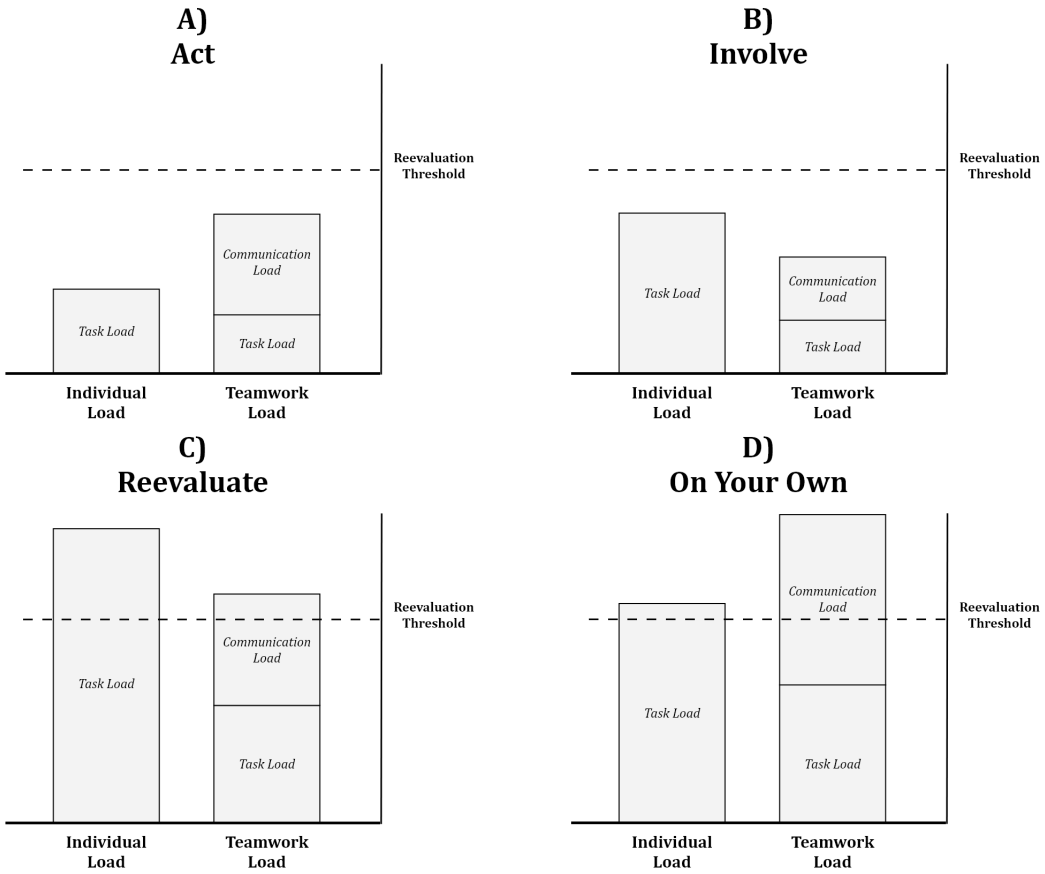

Figure 7.11: A collection of the 4 models afforded

7.2.5 The Toolkit: Iteration 2

In iteration 2, the toolkit was expanded mostly in terms of an expansion of content. With the help from the multiple code tags from the coding phase from the grounded theory process, we started to see more and more connections between tools. This created an annotated document with a total of 37 tools (Which were later renamed to properties) spanning 23 A4 pages in Microsoft word.

At this moment, the tools created were not sorted but were instead presented in the order they were written. This was something that came to be updated in later iterations.

7.2.6 Collaboration Definition

We had now started to pin down a common understanding of the concept behind the term "collaboration", largely thanks to a more robust definition of the agenda. In many ways, the agenda was built up as a product and analysis of all the allocated tools/properties via the grounded theory process. As we started to find aspects that seemed to build up to collaborative behaviour, it also naturally gave us the seemingly

important aspects that could be argued to be relevant for collaboration. As can be observed in Figure 7.12, we started to see a pattern that many times, an argument of "better collaboration" seem to relate to at least one of the areas *performance*, *adaptability*, and *togetherness*. The clarifications on what aspects were important in the formation of an agenda also seemed to help us pin down important aspects for collaboration, as in many ways our framework sees a better fit agenda as a sign of collaboration.

By deriving from both our tools/properties and the agenda definition, we landed on that meanings of increased collaboration often implies to, as portrayed in figure 7.12 an increase in at least one of the areas: *performance*, *adaptability*, and *togetherness*.

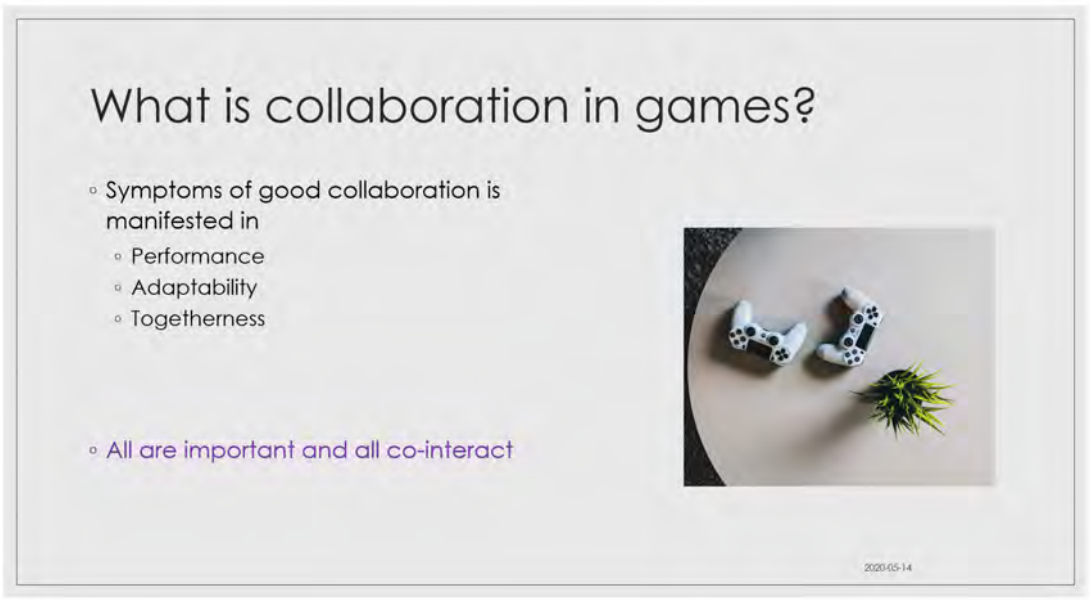

Figure 7.12: text

At this moment, we were happy with this framing and fidelity of collaboration, as we found it to incorporate meaningful components without being too specific nor too general+. Our findings from the data show us that collaboration can indeed be seen as many different things but it can at least be seen to correspond to one of the ones presented above. Rather than attempting to formulate a more specific definition, and risking to cut of important aspects of it, we instead settled with presenting components that seemed to be relevant for collaboration.

7.3 Iteration 3: Involving Others - Refining Usability through Workshop and Interview

As we had now stabilized our framework into a more refined entity, we wanted to expose our framework to potential users to deem its clarity and usability. As according to plan, in this iteration, we held a workshop with participants using our framework to gain insights and feedback from their usage, and performed an analysis of a collaborative game to gain insights of how it could be used to describe existing games.

7.3.1 Remote Workshop

The way we wanted to primarily investigate and iterate our framework on was to hold a workshop with people acquainted with the TDA580/TIA098 Game Design course held at Chalmers University of Technology or Gothenburg University (The Department of Computer Science and Engineering, 2019), this to ensure that all participants were at least partially familiar working with games and prototyping game ideas. The idea was to present the framework to the participants and see if they could take in the framework to make collaborative game concepts. Due to the circumstances circulating around the COVID-19 outbreak, it was decided that the workshop would be held remotely. For this reason, extra effort was put to make our framework presentable for remote acquisition. We decided that the best way to do this would to create a PowerPoint version to present our framework, as presented in Section 2.3: Iteration 2.

The workshop was held using a private channel in the software Discord created by Discord Inc. (Disord Inc., 2020), which is an online platform for gaming communities. Recruitment for the workshop was primarily done by posting on the course pages of the university intranets of Chalmers University of Technology and Gothenburg University. The plan was the hold the workshop in 90 minutes in order to increase the likelihood of recruitment and lessen the effort and time needed to participate. A total of 6 participants were recruited.

One of the test leaders streamed their screen while presenting the framework using the PowerPoint created in Iteration 2. After which a short break of 15 minutes preceded the next moment of the actual workshop. The presentation took 45 minutes, and the following workshop took 45 minutes.

Before the ideation sessions started, the presenter introduced three tools from the framework toolkit, later renamed properties. These were: **Tempo**, **Interdependence**, and **Reactive Actions** (For reference, please consult the workshop toolkit document found in Appendix C). Next, all participants were given a workshop document (Appendix C) which included shorter explanations of key concepts from the Reform Journey, and in total 9 tools, including the 3 ones presented.

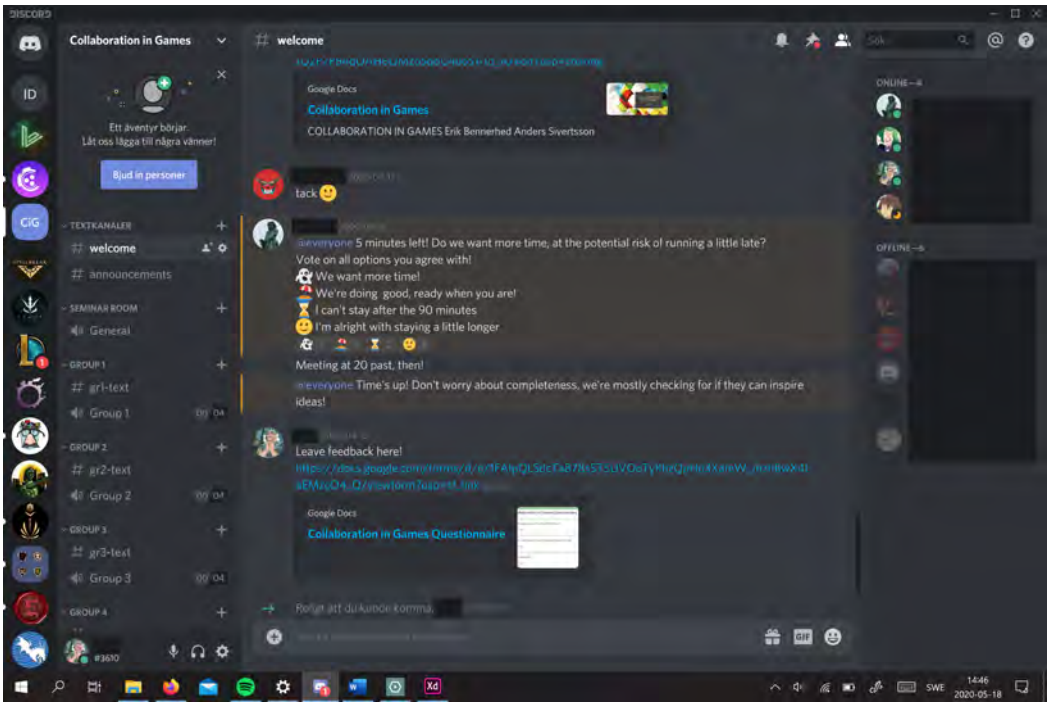

Figure 7.13: The Discord channel used for the remote workshop

The participants were then asked to team up 2-by-2 in sub-channels of the Discord channel and were asked to ideate game concepts with the help of the Reform Journey and 2 tools of the tools provided, in which one needed to be one of the 3 presented in the PowerPoint. It was expressed that this part was voluntary, and participants were free to leave if they wanted to, though no one did.

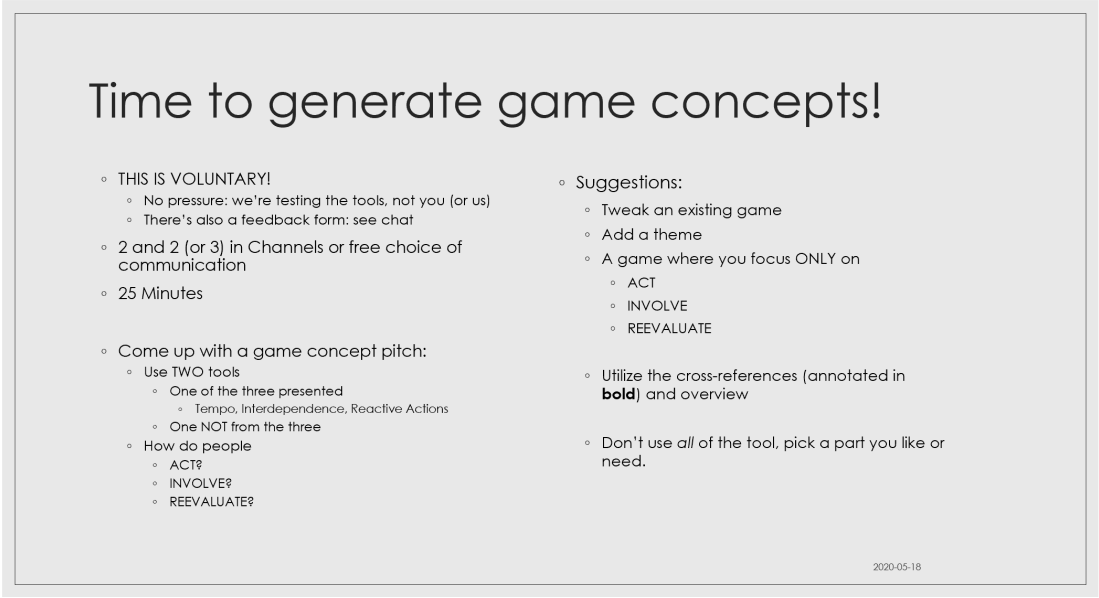

Figure 7.14: Instructions used for the ideation session during the workshop

The participants were first given 25 minutes, though upon agreement with the participants during the ideation process, it was extended to 35 minutes. After 35 minutes, the participants presented their ideas and were given opportunity to comment the framework and its clarity. Participants were also let known that they could leave feedback anonymously from a questionnaire to be sent after the completion of the workshop. Notes were taken and processed for future iterations. For details and findings from the results, see section 7.3.3.

After all participants had presented, they were thanked for their participation and let go. The questionnaire presented below was later sent as a link in the Discord channel, and they could freely fill it in any time they wanted from a week forward.

7.3.1.1 Insights from the Workshop Session

The primary findings from the workshop was that the framework seemed to work especially well for analysing existing games and game concepts. It seemed to work especially well for use on matter that already existed. This was made apparent as many of the presentations would often refer to other games and explain what it lacked in terms of a Reform Journey for fitness - and this would also be explicitly told as a point during the post-presentation discussions. Larger focus was put onto the tools and relating one's game concept than the Reform Journey model (*act, involve, reevaluate*), though this could have been due to the presentation structure of presenting the tools last. It was also expressed that the tools were interesting as themselves, and one could possibly see possibilities to create specific frameworks on some of the tools themselves. Furthermore, since only pictures of a single reform were shown, one participant found it unclear whether or not the Reform Journey describes an iterative process with several reforms. Lastly, it appeared to be hard for some participants to see a clear distinction between synchronization, reactive actions and re-evaluation. This could however have been due to the way the workshop presented it, as we toned down its role in the presentation to keep the workshop within time limits.

Overall, participants found the framework easy to understand and concepts clear - though perhaps a bit large to be able to digest within 90 minutes. They would have wanted more time to invest to be able to thoroughly get a grasp of both the tools and Reform Journey.

7.3.1.2 Follow-Up Questionnaire

To complement the workshop, a simple non-mandatory questionnaire was created and shared with the participants to *act* as an inbox where participants could give anonymous feedback, letting them expand on their thoughts and ideas if they did not find the time during the workshop, or if they came up with further thoughts at a later stage. Responding to the questionnaire was not mandatory and not part of the workshop. The questionnaire asked questions about the clarity of the framework, the content of the framework, and left a free spot for any type of feedback. All questions were free-text answers.

A total of 3 unique anonymous participants responded to the questionnaire. At large, the results from the questionnaire seemed to correspond with the findings of the workshop. Some expressed a confusion of the term "tool" as it was not expressed clearly what the boundaries behind a tool was, and that tools indicates that they can be used to create games from scratch by their own.

One particular positive point which was conveyed in the questionnaire was that it was liked that the framework was divided into the core concepts of the model (The Reform Journey) and a separate entity as a tool. It was expressed that it felt easier to analyse games by utilizing the Reform Journey + Tools setup than using MDA graphs as the Reform Journey and Tools gave better overview.

7.3.1.3 Feedback Session with one Workshop Participant

A week after the workshop, we met with one of the participants who had continued to reflect upon the framework and had requested a verbal feedback session rather than filling in the questionnaire. This person was the most experienced of the participants, including experiences of teaching game design to university students.

The discussion involved whether collaboration should be constrained to the game context in itself, or if we were also including the surrounding context of the real-world participants. Restricting the investigation to the in-game context—within the magic circle of games (Salen & Zimmerman, 2004)—would be easier to define but would inevitably be incomplete, since the relationships and dynamics between the real-life people outside will affect what happens within the game context. Similarly, the participant wondered whether the agenda was to be considered merely within the context of the game or if it would span all elements of collaboration, since that would affect what the agenda pertains to. For example, a player can be motivated from three different levels:

- What the rules tell us we should aspire to do
- How we respond to the events and the game state, as well as the in-game behaviours of group members
- What we know and how we treat each other outside of the game on a social, real-life level.

We consider these levels three different levels of *framing* of the agenda, similar to how Linderoth (2012) discusses framing and *upkeying* and *downkeying* (i.e. shifting to a frame of larger or smaller scale). With the inclusion of **shared references** and **social code**, as well as how fit can relate to either *cohesion* or *performance*, we consider our definitions of collaboration and the agenda broad enough to be able to expand to such *upkeyings* without much alterations, and simultaneously able to *downkey* them to describe a more specific subsection of a game, like a level or a specific game state. Indeed, this scalability from activity to action to operation is a core characteristic of activity theory, and since our model is based on the activity theory expansions outlined by Bardram (1998) it retains much of the same scalability. For example, the practice of playing a game and sharing a **mutual experience**

with someone can be the intent of an agenda (focusing on long-term *cohesion* and **togetherness**), as can a temporary alliance between two players in *King of the Hill* with the singular **shared goal** to take down the current king together, after which all bets are off (focusing on short-term *performance*).

Like in our observations from the workshop, several comments were about how the Reform Journey and Tools helped in analysing and understanding collaborative games, but that they were not ready-to-implement solutions that you could just stick onto a game idea after which it would automatically become a collaborative game. Instead, this was likely more useful for experienced designers who already have a (re)design goal in mind, who could use the framework to identify pain points in a current design and then browse the toolkit for inspiration (rather than solutions) for how to redesign the pain point.

For such purposes, the framework could become more usable as a reference manual rather than its current, more educational or academic presentation. Similarly, the current version used a lot of jargon and concepts for the reader to keep track of, and the participant wondered if a designer would really need to learn all of it from the start. Perhaps the reader could be introduced to a more condensed overview first, with a more rigorous framework to reference when the need arises.

Together with the insights from the workshop itself and the following questionnaires, this feedback made us conclude that the overall contents of the framework was proving rather solid, not having taken much criticism except for being somewhat jargon-filled. Instead, most comments and observations pointed towards a bit of a mismatch in how the framework was presented or towards whom it was directed, and adjusting them we deemed was mostly a question of how to present the framework and designing more of a user experience around reading or referencing it. Since we had thus far focused more on identifying its contents, this critique of the framework was reasonable and quite valid.

7.3.2 Game analysis: Overcooked 2

To further investigate how well the current version of the framework did in practice, we attempted to describe the pre-existing collaborative game *Overcooked 2* (Ghost Town Games, 2018) using our framework. The idea was to reevaluate how the Reform Journey and the Tools could guide a formal analysis of a (collaborative) game, noting which aspects the framework can cover and where it struggles. As a relatively small part of a significantly larger project, the analysis was not performed to the extent of a truly context-independent formal analysis. Rather, the following game analysis can be seen as a preliminary formal analysis, focusing less on exhaustive listings of the game primitives and more on examining how the Reform Journey and Collaborative Gameplay Properties works as a vocabulary for formal analysis of collaborative gameplay.

To inform the analysis, we played the game for two sessions for a total of approximately 4 hours, playing as four co-located players on a Nintendo Switch game sys-

tem. The authors then outlined the gameplay primitives and inspected them in an extended discussion between the authors, where we investigated the techniques by which said gameplay primitives were applied to generate and stimulate collaborative play.

So as to not bloat this section with an entire analysis, we have included the process of performing the analysis and the insights gained in this chapter. The analysis itself can be found in Appendix B; whilst not necessary to get the gist of the next section, reading it at this point will provide more context for how we came to the conclusions below.

7.3.2.1 Insights from Game Analysis

Overall, we found that the Reform Journey and the Toolkit were helpful in analysing the collaborative elements of *Overcooked 2*. This further supported the observations we made from both the workshop and the interview, where participants found it easy to identify how collaboration worked in games that they were familiar with—and to identify where those games might struggle. Our more in-depth analysis shows that this notion holds past first impressions and continues to be helpful in a more detailed analysis. The Reform Journey helped us identify how different forms of collaborative behaviour were utilized in the game, and the Tools helped us pinpoint where and why those collaboration forms emerged. Tangentially, our experience of utilizing gameplay design patterns as a shorthand for explaining some of the functional (non-collaborative) elements of the gameplay suggests that the two frameworks can be simultaneously implemented and interact mostly unrestricted by each other.

The biggest insight in terms of scope that *Overcooked 2* gave us was the introduction of an *urgency* element of gameplay. Urgency is about the requirement to perform a task within a limited subset of the action space, lest the task will be considered failed. This limitation can either be a time-pressure during which a task must be performed (usually in real-time games), or a limited number of actions or turns. In real-time games such as *Overcooked 2*, we theorize that the timed urgent tasks override the *Evaluation threshold* by placing it at an even higher load requirement; players rationalise that it's better to do something unfit rather than stopping and losing precious time to potentially create a more fit agenda. When the Level ends, however, the players start *evaluating*, showing that they did indeed pass the *evaluation threshold* without entering the *reevaluate* collaboration form.

As such, urgency shows that groups can delay *evaluating* until at a later stage when the **tempo** is lower and therefore better affords *evaluating*. In these situations, the players sacrifice the level of details they remember to keep up momentum, despite being admittedly unfit. That said, we should also keep in mind that the framework is about *affording* the collaboration forms, not *enforcing* them. As such, it might always be the case that players should theoretically prefer being in one collaboration form rather than the one they are currently in, without that being reflected in practicality.

Furthermore, *Overcooked 2* highlighted was the distinctions between the three ways to alter fit: **reactive actions**, **synchronisation**, and *evaluating*. Whereas **reactive actions** are personal adjustments to one's individual script to better fit with the group, the distinction between **synchronisation** and *evaluation* was a more difficult nuance to pinpoint. We concluded that **synchronisation**, being *involving*, was about multiple people adjusting their scripts together via micro-adjustments to the current application of a more general principle or agenda jurisdictions without questioning the agenda itself, and that a change in fit here is about these micro-adjustments crystallising into new agenda norms by merit of repetition or intensity. Meanwhile, *evaluation* is a deliberate macro-adjustment, creating a meta-discussion about the activity or action in a generalized context rather than focusing on a single execution. *Evaluation* can also redefine the agenda or its jurisdictions, which trickles down into alterations in the scripts of those involved—whereas **synchronisation** is script-oriented and only indirectly affect the agenda through the creation or alteration of agenda norms.

Other than that, we noted some elements that should be added to existing tools (like **asymmetry of access**); others motivated the addition of three new tools: **Changing Conditions**, **Repeated Play** and **Urgency**.

7.3.3 Alterations to the framework based on Iteration 3

From the three distinct processes made during iteration (phase?) 3, our insights were gathered and discussed, resulting in a list of changes to be made to each of the aspects of the framework. Since only the authors of the framework were to be exposed to the framework during iteration 4, we deemed that alterations in presentation (rather than content) would not affect our utilization of it in iteration 4. Therefore, changes to the Reform Journey and the Tools were not implemented in textual form as an iteration; rather we constructed our lists of changes like *erratas* to be fully integrated in the text itself by the next overhaul of the framework in Iteration 4.

7.3.3.1 Reform Journey - Erratas

The Reform Journey is to be updated:

- The framework works best for analysing (and evaluating) existing games or game prototypes, rather than creating completely new ones. This was made especially evident from the feedback session, but also from the workshop and questionnaire. Make it clearer that this is where the strength of the framework is, and re-structure the framework to emphasize this.
- Synchronize and Reactive Actions are important terms. Results from the workshop indicates that they may need to be revisited and clarified, especially in relation to *reevaluate*. Take a look to see if they can be clarified.
- The workshop revealed that it was not made very clear for all that the journey of fitness is an iterative and re-occurring process. Make a model to show that the journey is technically endless.

7.3.3.2 Tools - Erratas

- Data from the questionnaire reveals that the term tools can be misguiding as it sounds like they will create a game all on their own. We have discussed to call them patterns, but refrain from using that term as there already is a framework in games using that term. Instead, we have landed on calling them "properties" as it does not indicate as much that they are to be used to build something completely new. When analysing however, it is easy to see them as "properties".
- We realized when parsing through our data set and concept mapping in iteration 2 that we had somehow missed the property of **Mastery**, despite having known it. As such, we added it back in.
- It was made apparent from the feedback session that the set of properties may be hard to parse efficiently, especially if one is looking for something special, such as a specific property/tool that can answer for a lack in for instance *involve*. Come up with a way to make this process easier.
- Three new properties were created based on the insights from analysing *Overcooked 2*: **Changing Conditions**, **Repeated Play**, and **Urgency**.

7.3.3.3 Defining Collaboration

Through extensive discussion regarding all the findings from this phase, as well as previous data, we had slowly diverted more and more towards having a general take on a definition for collaboration. Collaboration, by our means, is about forming and utilizing an agenda - but this agenda comes naturally from working together. Good collaboration have high fit agendas.

The findings from this phase do not particularly alter the content of our understanding of collaboration per se, but through discussion we have landed on taking the closest sub-categories related to the agenda - as we see working together is having an agenda:

"Collaboration is performing work together for increased performance, adaptability, and/or cohesion."

7.4 Iteration 4: Acting it Out - Refinement and Remarks from Practical Application

For the last phase, our goal was to put the framework into practice to see if it was usable to make games with, as was included in our plan (See Chapter 5: Plan).

7.4.1 Reconsidering co-located 4-in-1 Tabletops

With the ongoing outbreak of Covid-19, things were changing rapidly, and an increase of restrictions from country to country could be seen. This pattern gave us some concern, as our intended platform to develop our game on was on a 4-in-1 Tabletop system as with other games in CITE. While a 4-in-1 Tabletop system is an interesting and exciting way to develop games on, we felt that the co-locatedness of the 4-in-1 Tabletop setup could potentially become an issue in a future playtest, as we were not sure if further restrictions of meetings between people would be implemented in Sweden (where the project was undertaken). And especially tabletops could become problematic as players often reach over close to each other and are touching the same surfaces. After a long discussion, we decided on leaving the idea of creating a game for a 4-in-1 tabletop system and instead alter our focus on creating a more general type of game. The decision was already strongly considered in the early stages of iteration 3, but was definitely put to action in this iteration. This marks a clear deviation from our initial set goal to develop a game specifically for a tabletop setup, and was not an easy decision. Thankfully, our framework seemed to fit quite well on a more general level - so we could alter our focus to other games than just tabletop. Continuing forward, we thought of our game ideas as multiplayer online games, or possibly couch co-op video console games.

7.4.2 Ideation

We wanted to ideate game ideas by utilizing the framework as much as possible and started our ideation session by collecting all available properties into separate yellow sheets and putting them in a plastic holder. We then picked two at random and tried to ideate game concepts that included elements from both properties picked. If we felt we did not have enough, we picked an additional one. We did this 6 times and came up with 7 different game ideas. The property pairs were the following:

1. **Vicinity** & **Communication Channels**
2. **Additive Efficiency** & **Helping**
3. **Roles** & **Shared Symbols**
4. **Distributed Power?** & **Reactive Actions**
5. **Group vs Individual** & **Shared Punishments**
6. **Co-location** & **Reactive Actions**
7. **Co-location** & **Reactive Actions** - Take 2.

Figure 7.15: The yellow sheets with properties used to randomise pairs of properties to ideate on.

7.4.2.1 Vicinity & Communication: A Little Less Conversation

This game idea plays with the ***communication*** *channels* to draw people into vicinity. In short, the idea is to design a number of tracks with obstacles for 2 players to overcome using their voices. When one player speaks into the microphone, each player's character is drawn by a force towards the direction of the other players. Players would meet obstacles that need discussion and planning to overcome, but talking too much while performing activities may drag them too close too much to each other resulting in them losing, which may afford them to talk in those moments they can.

By utilizing a graph with the three levels of *act*, *involve* and *evaluate*, we listed how ideas of game components that related either of the interaction modes. The idea was that players would *evaluate* as they need to plan ahead so that they can *act* without talking (too much). They also need to *evaluate* to find ways of how to synchronize without talking. In terms of *involving*, it is afforded in moments where they do need to get close to each other, such as for climbing, balancing, jumping, and saving. Another type of *involve* could be to be quiet at other times for discrete co-actions (that need careful positioning). Lastly, *act* can be afforded through reactive actions to for instance co-actions where players cannot talk.

7.4.2.2 Roles & Social Code: Youreaucracy

The idea of Youreaucracy was to imagine letting a team of players through a dungeon of levels, in which for each level down the dungeon, the players encounter rituals where they gain items and curses that corrupts their abilities towards both negative and positive directions. For most encounters, the corrupted curse would land only on one of the players present in the team and it would be up for the players to decide on who takes it. The idea was that over time, this setup would result in a large portion of **specialization**, creating emergent ***roles***. Additionally, the specialization would open up for possibilities of ***interdependence***. Players would be afforded to

evaluate their situations upon each new curse, as that could vastly change the way players could play with each other. It also touches upon the topic of ***social code***, as players need to negotiate how they distribute negative and positive effects among each other.

Initially, we did find it hard to connect the game idea to *involve* and *act*, as the properties taken were rather *evaluate*-heavy to some extent. This was a finding worth noting. However, after some time we realised that the game concept was mostly developed on the macro-side of things, and the more micro-heavy perspectives more connected with *involve* and *act* was still up for consideration. In realising this, we thought for a while and concluded that the base setting would result n players having different abilities. These abilities could be made as required co-actions requiring two distinctly specialized players to add up their actions to overcome obstacles. For these obstacles, players would need to *involve* the other player to synchronize their actions well enough. Lastly, as players become specialized, it may be possible that only them can answer against certain opposition. If given limited action space or increased ***tempo***, *act* can be afforded.

7.4.2.3 Group Identity & Helping: Rat-Raft

Rat-Raft was a game we ideated using the properties ***helping*** and ***group identity*** which quickly inspired an idea. The core game concept with Rat-Raft was that players would play as small rats who had sailed on a wrecked boat after stealing food from humans and would now need to survive an upcoming and dangerous and rapid water-stream, steering their raft and repairing it as they went on.

The theme seemed to fit the property set-up very well, because we could quickly build on new components and ideas that enriched the game concept, and indicated that the game idea had a lot of interesting opportunities. Firstly, the most important thing with the game would be to survive on water by utilising a floating object, a sort of raft. The raft makes a natural gathering point for all players. However, the stream would show to be a harsh place for rafts to survive, as rafts would be prone to often crash into stones and "cliffs", consequently ripping the raft apart. The rats may, however, repair their raft (Well, somewhat) by picking up debris in the water and "hammering them" onto the raft to keep it afloat. But staying in the water for too long can be dangerous, and some rat players may need to be saved by another player if they linger too far away from the raft. They may be saved by team members throwing lifebuoys at them, and dragging them to the raft.

Next, the raft can be steered somewhat to turn away from obstacles that could destroy it. Players steer the raft by standing on it and placing themselves close to the edge on the side they want to turn to. The more players who stand on one side, the faster it will turn towards that area. This way, the players form a type of ***additive efficiency***. However, the raft may still end up crashing with obstacles. There is thus a need to balance steering the raft in the right direction but also to gain new parts to continuously build on the raft in any direction. A large raft on one axis also makes the steering easier as the raft can turn more steep - but this also makes

the raft a bigger target which makes it more prone to crash into obstacles. Lastly, the stream fluctuates in nature with some hectic parts and some very peaceful ones, allowing for some oversight and planning. While in these moments, players will have time to see ahead and make adjustments to their raft, picking parts apart and re-building the raft to for instance fit into a thin passage.

The idea to have players collectively build something was also an early idea which stems from the ***group identity*** property that having shared objects or symbols strengthens group identity. By letting players together build a raft, it becomes theirs and only theirs. Each part of the ship and its debris parts become a *shared symbol*, strengthening a unique group identity for the group - especially the raft as a whole.

The game affords *act* by having them collect debris in the water as well as steering the raft. If enemies would be present, such as frogs who try sabotage the crew, shooting them down (or otherwise dealing with them) might be a type of *act* too. *Involve* is to be afforded via need to coordinate steering, or to rescue raft-friends in need with the lifebuoy. Lastly, *evaluate* is afforded through a number of means. Firstly, the pauses with less hectic water flow gives room for the team to plan ahead, and make adjustments. Secondly, The ability to build upon the raft in any direction gives opportunity for discussions on where to build and why - and if. Next, if the raft would crash into an obstacle, it could be possible to turn it around and rotate it in the water, completely revamping the way the raft may be steered, and where things are in relation to each other (Say, if catapults and other machinery would be present on the raft, they would now be misaligned). This possibility, together with possibly sudden changes is environment applies repeated possibilities for changing conditions.

7.4.2.4 Distributed Power & Reactive Actions: Magic DDR Team Dance!

This game idea is about a crew of dancing magicians, whose dance movements can be combined to build up combos that throw magic spells on enemies they meet. There are 4 styles of dances, each corresponding to their own element (Fire, Water, Earth and Air).

In order for the team to proceed the game, they will encounter monsters (accompanied by fitting background music) that can be killed by one or two of the dance styles - but these monsters will come in numbers and in various degrees of mixing between elemental weaknesses. The dance styles have a set of basic dance patterns that allow members and the game to switch the type of magic cast. While in a style, individual players can introduce special dance patterns (Introduced in early levels), and other players can join in on that player's pattern to build up extra effects to gain a sort of ***additive efficiency***. Sometimes, the monsters will throw attacks at the players leading the player(s) having to respond to a decided set of step moves. The more members that join in on one of these defense dances, the more positive effects or less negative effects occur.

The game utilizes ***reactive actions*** by letting players join in on each other's dance patterns to build extra effects. As the dancing tempo will not always allow the team members to elaborate what they are doing with others, it also affords moments of *act*. However, at some moments it may be possible and necessary to *involve* one's actions to let team members know about upcoming enemies or one's own actions, possibly to ***synchronise*** team dance combos and other additional effects. *Evaluation* is afforded through moments with lower tempo or between tries, especially after meeting for instance larger enemies that need specific types of combos to overcome.

7.4.2.5 Group vs Individual & Shared Punishments: Picnic Ninja Ants

Picnic Ninja Ants is a game idea that revolves around stealing sweets and eating cakes and bakery from carefree human picnickers. However, if a human finds the presence of an ant, it will start to throw dirt/sand at them to make them disappear - or worse, use the anti-ant spray! Each picnic company brings a picnic blanket with an assortment of items, boxes, bags and toys that can work as hiding places for the ant players, or work as active objects that they can use. For example, a water gun could be used to "shoot" another ant player into a good hiding spot.

The game idea is that players take less damage from thrown dirt at them if they stand just next to each other. This creates a ***shared punishment***, but the effect is slightly diminished as they split the damage between them. On the other hand, when players group up so much, they run a higher risk of being exposed to humans and pets. The players have also gotten direct orders from their queen to get pieces of e.g. cakes, bananas, strawberries, honey ad so on, which works as the group's ***shared goal***. By setting clear and defined goals, a ***group vs individual*** moment regarding too individualistic play can be somewhat reduced.

The game affords *act* through tight movements of moving for hiding. ***Reactive actions*** are also possible to stay in line in those moments a team takes a ***shared punishment***. On the maps, players can utilize leaf shields that they can carry over their heads, leading to more visual protection, but them moving slower. This leaf could be carried quicker if more than one player carries it, but then they need to synchronize how they move with it. This way, *involve* is afforded. As the game proceeds, the terrain may shift and a human may move a box of snacks from one position to the other - or start approaching their hands near a team member - in which *involve* may be afforded to readjust the script to the situation. Lastly, as the game creates natural pause points before indulging in ninja infiltration activities, it creates room for *evaluation*. By making the amount of things to keep track of and variables up to a high, this need for *evaluation* can be afforded further.

7.4.2.6 Co-location & Reactive Actions: Spider-tank

This was actually one ideation session which did not result in a full agreement between us—though the core game concept was there. The idea was that a team of 2-4 players would play as operators of a "spider tank" in a sort of steam-punk world. The core game idea was to make players move from point A to point B, but

the players would only control some of the "spider tank"'s legs. We could however not agree exactly on the contours of how to steer the spidertank and what type of opposition the players would meet. Upon reaching a sort of stalemate, we decided to abandon the concept and focus restarting a new ideation with the same properties from scratch (See subsection 7.4.2.7).

That said, the attempt to create this game concept was not in vain, as we learned more about how **reactive actions** work. While trying to implement them, it became clear to us that **reactive actions** require some form of parallelisation (such as **parallel tasks**) to work, and that a designer can practically guarantee the emergence of ***reactive actions*** if they design these ***parallel tasks*** so that both players or ***roles*** have agency over the same variable. For example, if one player drives a tank and another handles the turret, both players influence where the turret is currently aiming - one by turning the turret itself, another by turning the tank upon which the turret is mounted. In these cases, the players are incentivised to continually readjust to each other in order to effectively perform their tasks. This leads them to perform ***reactive actions***—or, should the necessary adjustments grow too erratic, they will begin to ***synchronise*** with each other. This is an intriguing way for a designer to afford players to adjust their fit in occasions when *evaluating* would be less desired.

7.4.2.7 Co-location & Reactive Actions: VR:y Hot Potato - Food Delivery

One of the challenges of the previous attempt at making a game with ***co-location*** and ***reactive Actions*** (see Section 7.4.2.6) was the ***co-location*** part of the setup. Both ***co-location*** and ***reactive actions*** puts significant constraints on the action space in both a spatial and temporal manner. Additionally, the ***co-location*** part of that idea was not fully addressed - though the idea with Spider-tank was that they would work in a very small environment to allow them to, so to say, be close together in-game. Due to the ongoing outbreak of Covid-19 at the time of writing, we opted to ideate of experiences that could be said to be technically ***co-located*** while not necessarily physically ***co-located***, and landed on ideating a VR-game. A Multiplayer VR Setup allows players to get a feeling of being ***co-located*** while physically being apart.

The idea behind *VR:y Hot Potato - Food Delivery* is to design a game set in a Virtual Reality world, where a crew of circa 4 members are to deliver food to people in an imaginary city using parkour-like movement via teleporting and similar means. The hook is that players cannot teleport while they are holding the food, so they need to team up with others to deliver the food as efficiently as possible (as there is a time limit), by throwing the food as a frisbee and jumping around. They also cannot hold the food for too long as it is hot (The idea partly came from holding a "hot potato" that needs to be thrown around, hence the name "Hot Potato" in the title). The faster the food is delivered, the happier the costumers are. As players are delivering food, life in the city goes on as normal, so players need to avoid things such as walking pedestrians (Who happens to not care at all about hard-working

food-delivery labourers, and walk straight into what they're holding!), cars, animals, opening doors, among a number of other vertical obstacles that they may encounter. As players get further in the game, they get better and more profitable orders - but also harder deliveries. To spice up the game, deliveries may sometimes be on the crazy side, such as delivering to a window in a high-rise building, or a moving car - or to important people such as the prime minister who happens to be flying on an airplane above the city in the next 10 minutes.

This idea started out heavily relying on the idea of "passing an object" around such as in football, where a constant movement and readjustment of positioning (as a ***reactive action***) helps team get through enemy lines to score a goal. This simple structure affords *acting* via ***reactive actions*** in the way that people need to readjust themselves to a common object in order to efficiently traverse - in addition to the pure *acting* for avoiding obstacles. It is also possible that some *involve* and ***synchronisation*** is afforded, especially in moments where they may need to be two to overcome barriers. In terms of *evaluating*, it can be afforded by letting the team navigate through town using an in-game physical map with no pathways decided. Players thus need to decide on which path they aim to take before they start moving too much, or it may show that the approach they are taking is not enough... After all, who knows what lures in the City of Ninja Food Delivery?

7.4.3 Selection of Concepts to Further: Using Weighted Matrix

Once the ideation sessions had resulted in a multitude of concepts, it was time to select some concepts to continue exploring. To identify which ideas had the highest value for our needs, we built a weighted matrix where we could compare the merits of each concept (see Figure 7.16). The criteria we designed centred on what properties we agreed that a concept should have to be worth exploring within the context of this thesis:

- **Exciting to us:** The core idea should entice us, helping our motivation in soldiering through the development process.
- **Technically feasible:** With limited development time and experience, choosing an idea which we were confident that we could implement would be crucial.
- **Easy gameplay design:** The design choices that would be needed about the core gameplay could vary significantly, both in complexity and in sheer amount.
- **Easy level design:** Similar to technical feasibility, the scope of what was required in designing a level could make or break our ability to develop the game within the scope of this thesis.
- **Suiting the Reform Journey:** The main purpose of the concept that would be developed within the thesis is to exemplify how the Reform Journey can be applied and what implications that application has on the design and design process.

As can be seen in Figure 7.16, we also had envisioned a criteria called *Fun to Play*, intended to stand as a representative for the players' interests in what game would be worthwhile. However, this criteria was stricken while filling in the matrix since we felt that any claims on what was "fun" or not was only speculative at this early stage and would vary significantly between players and implementations.

To remain agile, we opted to give each criteria the same weight and focus our attention on each prototype rather than the criteria themselves. If the need would arise—it turned out it would not—we planned to revisit these weights to act as tie breaks. Similarly, we decided that we would rank each matrix cell on a scale from 0 to 5 individually, then summing up each cell. The intention behind summing up individual rankings was to democratise our scores, avoiding that one of us would dominate the discussion and therefore the selection. Our final results can be seen in the rightmost column of Figure 7.16. Since *Spider-tank* was abandoned in ideation (see Section 7.4.2.6, we did not include it in the weighted matrix.

The three ideas which scored the highest—*Rat Raft* (Section 7.4.2.3), *A Little Less Conversation* (Section 7.4.2.1), and *VR:y Hot Potato* (Section 7.4.2.7)—were deemed the most suitable for the thesis, and were cleared for the next stage of physical prototyping.

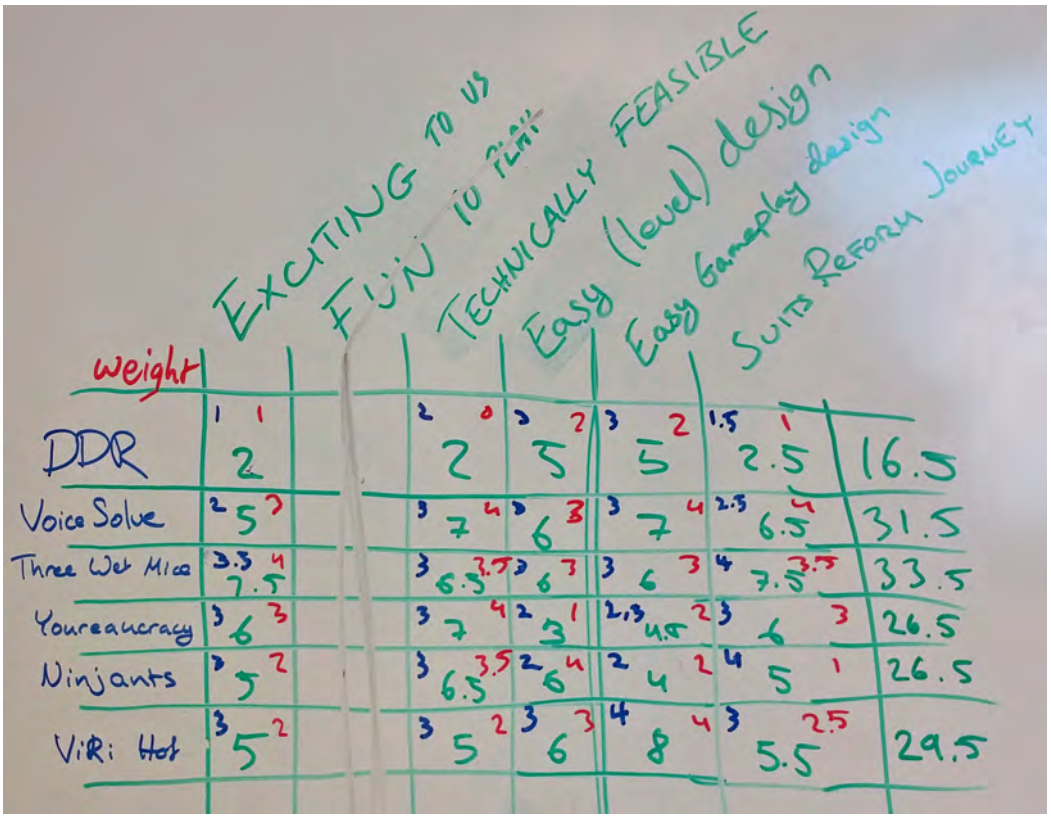

Figure 7.16: Weighted Matrix over our ideas and their scoring on our development criteria. Note that the matrix is transposed compared to those visualised in Martin and Hanington (2012) and that we went with an equal weighting of all criterias. The numbers in blue and red are our individual scorings; the numbers in green are the sum for each cell.

7.4.4 Physical Prototyping

Once we had converged down to three concepts, we dove into exploring them through physical prototypes. Our aim with these prototypes was to playfully investigate the development needs of each game, such as clarifying what game mechanics the player needed to execute the core gameplay we had ideated and what concrete requirements each idea had on their respective level design. At this stage of the process, we followed the advice of Fullerton (2019) by clarifying what formal elements—players, objectives, procedures, rules, resources, conflicts, boundaries, and outcomes—were present in the game and how they should manifest. This roughly equates to planning out the core MDA Mechanics and Dynamics of each game.

The physical prototyping itself was performed through a combination of sketching and moving around abstract physical tokens representing game elements like player characters, obstacles and items. For each game, we created a typical game state and used the prototype as a medium to discuss and experiment with how the game elements should interact with each other.

7.4.4.1 A Little Less Conversation

For *A Little Less Conversation*, prototyping focused on exploring level design and what perspectives—first person or top-down—a player should have. It had become apparent during conceptualisation and selection that our mental images differed on how these elements would work, which had implications for our interpretations of the gameplay. Through physical prototyping, we were able to examine and debate those differences and settle on a clearer, more coherent vision of the game.

The game would be built around two or three players: with an increasing number of players, new opportunities for interesting ways to navigate obstacles would open up—such as catapulting one single distant player towards and past a group of other players—but these opportunities would come at the cost of increased complexity in level design and playtesting (both in terms of recruiting testers and in analysing the data). Additionally, the more players were performing tasks in parallel, the higher the likelihood that one of them would need to *involve* the others, which could be punishing for the others. Three players were considered a good middle ground where some of the opportunities would open without the complexity snowballing too far.

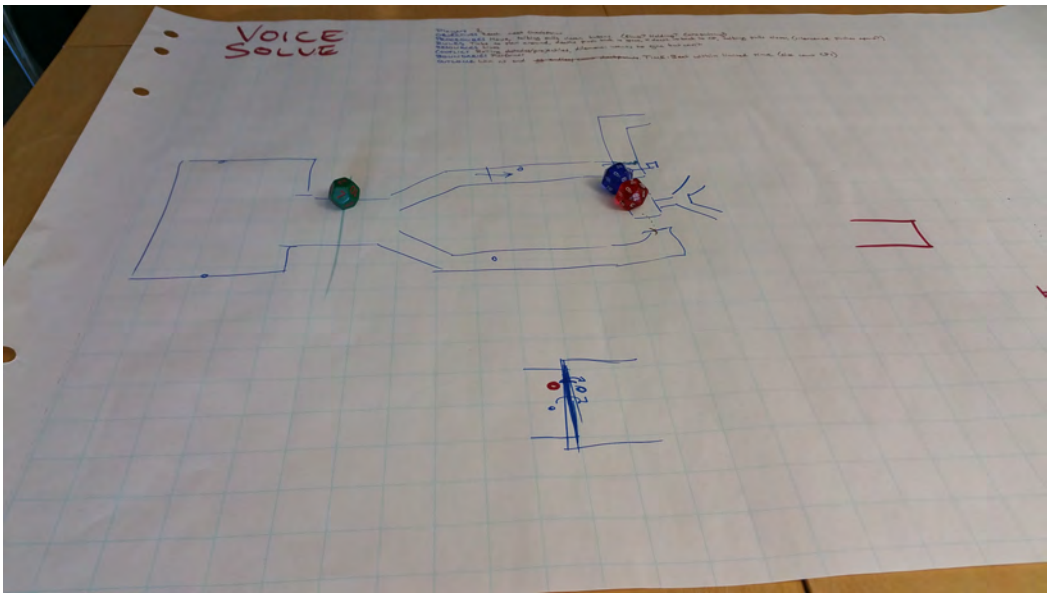

Figure 7.17: A capture of the paper prototype version of the game idea "A Little Less Conversation".

The objectives were straight-forward: a ***shared goal*** to progress from one check-point to the next by passing a set of obstacles. To make the outcome somewhat more interesting, we added a shared resource of lives as a ***contribution to group***. Until the group had lost all their lives, falling off or dying would have the player respawn at the spot they fell from—but once all lives were lost, all players would start over back at the check point. In a puzzle game such as this, we hoped that the respawn system would put players at a thoughtful balance, as it would simultaneously encourage players to explore their options and discourage reckless, brute-force

approaches from a player. Conflicts in the form of moving obstacles and projectiles could also spice things up, but the primary conflict is the ***dilemma*** of when to talk and when not to.

Rules-wise, we settled on the following core gameplay rules to guide potential future efforts in level design and gameplay design:

1. Talking pulls players closer to each other, launching them slightly into the air.
2. Players are allowed a number of deaths where they respawn on the spot. Upon reaching the limit, all players respawn att the last checkpoint and thus have to redo the level.
3. There is some form of regular 'ticks', either visually or auditory, that provides a measurement of time and allows players to plan around a unit of time.
4. At later levels, silence might push players apart as a contrast to the first rule.

As for the procedures, those are essentially the game mechanics (Sicart, 2008) a player needs to achieve the intended gameplay. In the case of *A Little Less Conversation*, these were: moving within the boundaries of the platforms; talking (and thus pulling others closer); and using objects to activate elements which affects other players. We also considered having players able to climb, hold onto designated objects (so as to not be pulled closer), and implementing the Dynamic compound game mechanic of catapulting a distant (light) player if a (heavier) cluster of players were talking and pulling them close. We discussed the potential for implementing these optional procedures through ***asymmetry*** *of action space*, which would open up for situations of ***dependence*** between the collaborating players.

7.4.4.2 Rat Raft

With Rat Raft, we had a strong overlap in how we envisioned it working and could therefore dive straight into exploring how the elements would interact, what the players could do and how this could varies with the ***changing conditions***.

Procedure-wise, as players navigate the raft and the river they were to be able: to move atop the raft (steering it in the process); swim in the water; climb up on the raft from the water; and build or reassemble the raft (a compound game mechanic which involves grabbing pieces in the water, connecting the pieces onto the raft, and breaking off pieces from the raft to enable connecting them elsewhere). As the speed picks up, or if the stream separates players from the raft, those on the raft should also be able to throw a lifeline towards their swimming companions, and then be able to pull them closer.

With so much to do, we envisioned that the game would be built around four players to be able to navigate all the game mechanics without consistently feeling utterly overwhelmed. With this many players and so much going on around them, we had to determine how we could help them keep track of each other (so that they could *Involve*) and simultaneously maintain their focus on the ***shared goal*** of ensuring the survival of the raft. Therefore, we introduced a treasure on the raft—a cheese—to

safekeep, and which the camera would follow instead of the players themselves.

Figure 7.18: A capture of the paper prototype version of the game idea "Rat-Raft".

As such, we now had multiple objectives stemming from the core concept: The raft should survive navigating through the terrain; the group needs to help each other stay within reach from the raft; and in the occurrence of the raft breaking apart, the cheese must be saved. This meant that we could define two ways to lose the game: either if the cheese fell into the water, or if the cheese and raft has left every mouse behind. The boundaries of the game became the edges of the river (we did not allow them any land access, the idea was that the raft was moving too quickly); that they could not stand or climb the stones (so as to avoid that they would speed past the camera and automatically die); and that they could not venture too far from the raft (technically the cheese), although they could steer the raft closer to reveal more of the stream in a direction.

This meant that the resources of the game was debris to construct the raft from, and the durability of the raft piece holding the cheese (nail that stuck it down). If we wanted, the nail could break off to allow the cheese to glide across the raft unless fastened with another nail gathered in the debris, and potentially upgrades such as projectiles or shielding could come floating as well.

At this point we could determine some additional rules for the gameplay:

1. Lose the cheese, lose the game.
2. Players who fall behind were to be put in a state of helplessness (see ***dependency***) where a lifeline was to be attached to the raft and another player would need to drag them all the way to the raft before they can play again, leaving the two of them exposed.
3. If all players would fall behind the raft, the game was lost.

4. Breaking off pieces could be done only along the edges—breaking off pieces in the middle would open for interesting constructions but would be more complicated to implement.
5. The raft was steered based on how the centre of all the mass atop it differs from the mass centre of the raft.
6. The heavier the weights atop the raft, the faster it was steered in that direction.
7. Since there was already plenty of opportunities for *co-dependence* (see ***dependence***), we deemed that there was little need for ***asymmetry*** to make players recognise the value of each other.

The obvious conflicts would be the obstacles to avoid, both in the shape of rocks or shores that would break the raft apart and in the different motions of the stream which might carry the raft off in an unwanted direction. But there would also be the dilemmas of picking additional debris or staying with the raft, helping your teammates or steering the raft to safety (a form of ***group vs individual*** conflict), creating a raft that helps the group get through the level, agreeing on steering in the same direction. If further conflicts would be desired, we could implement frogs which jump onto the raft which would make it always veer to the side.

In a completely finished game—way past the point of the thesis—we envisioned possible additional game mechanics (procedures) such as attacking frogs, shooting them at a distance with collected ammunition, spying ahead to enable better planning, and nailing the cheese back onto the board if it started to fall off. Additionally, we wanted the players to be able to break off the middle pieces, too, so that they would be able to create interesting builds or even "break away" a part that a frog was sitting on.

7.4.4.3 VR:y Hot Potato: Food Delivery

Like with RatRaft, we had a good deal of mutual agreement in how the game concept would work prior to prototyping it. Our focus would be on investigating what we would want for the map to have in terms of conflicts, and how to connect the different orders or levels. Already from the start, the necessary ruleset was more or less established:

1. Dropping the food on the ground for too long makes it undeliverable.
2. A player cannot use locomotion across the map while holding the pizza; instead, they are confined to the boundaries of their VR space.
3. A thrown pizza travels a certain distance, behaving like a frisbee with a curve through the air. It might get affected by the wind or other elements that might influence its path.
4. There is a time limit on the delivery before it gets cold, and a faster delivery is more reputable and might earn a tip.
5. Fast-moving objects such as cars might collide with the player, at which point they drop the pizza.

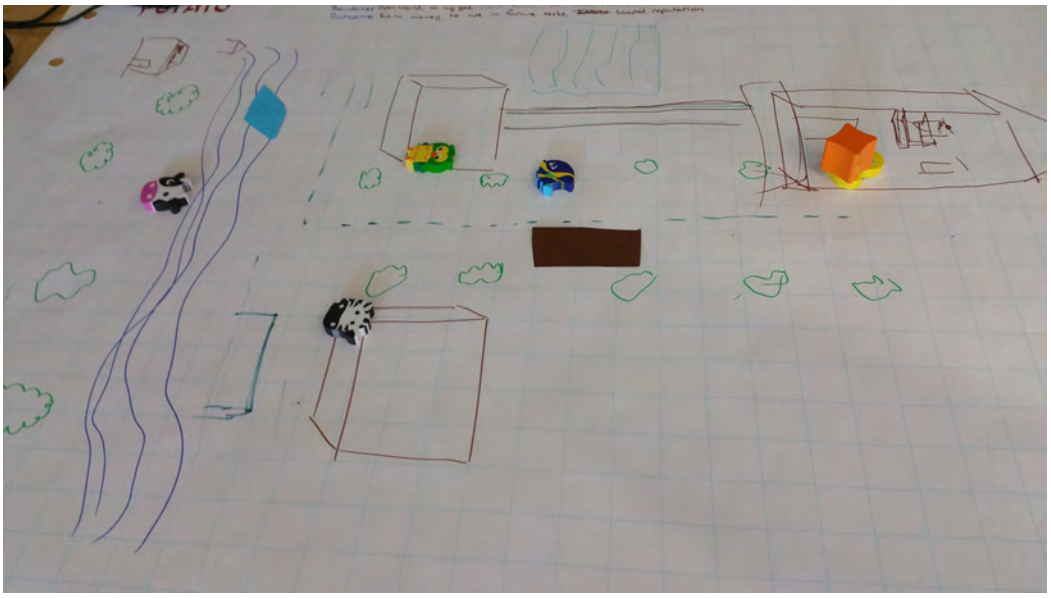

Figure 7.19: A capture of the paper prototype version of the game idea "VRy Hot Potato: Food Delivery".

We settled on the idea that the game should take place in an open world, so as to allow for players to learn the environment and gain ***mastery*** over the various routes between orders. As such, the boundaries would be fairly few. We wanted it to be possible to enter buildings as well, since it would offer an interesting choice of providing shortcuts which would be effective but risky due to their tightness. To keep interests up, we would have to up the ***challenge*** with several conflicts such as moving vehicles, people blocking the way, narrow and winding corridors, moving delivery points and hard-to-reach places.

With existing VR support, we would get a lot of interactions "for free", already implemented in the system. Picking up objects, using locomotion to transport through a map and the natural interactions that VR offers would already all be implemented—the two unique procedures we would need to keep track of would be climbing and throwing the pizza (where we would likely want more control than we would have by using the preexisting option of dropping something and simply letting the physics engine handle it). However VR would typically also *create an expectation* of such natural interactions to work, which would require us to make a lot more game elements interactive than we would have to in another medium, meaning that the open-world map could risk to quickly expand in scope.

The outcomes of a successful delivery could be measured in money to help future missions, and reputation to receive better—more difficult—clients. As such, we would have four different resources: the pizza and its durability, reputation to enable various clients, the money players earn which could be spent on unlocking alternative routes (such as bribing a gatekeeper or grabbing a taxi) or purchasing equipment, and limited-use equipment such as jet-packs and ropes to offer alternative forms of transport or other perks.

7.4.4.4 Selecting a prototype to develop

When the time came to select which of the three prototypes we should proceed with to the step of digital prototyping, it was already fairly obvious to us which one we would choose. Already in the weighted matrix, *Rat Raft* had scored higher than the other two (see Figure 7.16), which meant the other ideas would have had to significantly outperform it in the physical prototypes. Instead, *A Little Less Conversation* still left us divided on in enthusiasm for the gameplay idea, and *VR:y Hot Potato - Food Delivery* had the added difficulty of recruiting and multiple playtesters with VR equipment at home and co-ordinating them without a good ability to study them, which ultimately left *Rat Raft* with the edge.

7.4.5 Digital Prototyping of Rat Raft

Once we had settled on *Rat Raft* as our game idea to be implemented digitally, we proceeded into action. Since the pandemic had altered our conditions, we were no longer implementing our game on the 4-in-1 tabletop systems with co-located players. Instead, we opted for Unreal Engine 4, which had online multiplayer support pre-implemented into the engine (c.f. Epic Games (2020)) which was expected to speed up progress.

To manage development as time-efficiently as possible, we split up the game into distinct game systems that could practically be developed independently, trying to keep the code modular so that combining the various elements into a single project later would work as efficiently as possible. With limited previous experience in Unreal Engine 4, we knew that we would have to learn and implement a lot in short time—splitting the work seemed like the only manageable option. As such, we broke the game into the following systems to develop:

- A level with running water, river bank sides, and obstacles
- The networked player controls, including picking up and using debris
- The raft steering logic
- The construction system, with which the raft could be expanded and also handling breaking the raft apart
- The collision logic, handling the impact points and forces as well as how the raft would twist and turn after collision

To limit the scope of the prototype, we deliberately did not include the lifelines and helplessness, frogs or rat avatars—the game was still very early in its development cycle and we wanted to focus on ensuring that the core game mechanics of moving down the river, steering, and constructing the raft were performing as intended.

7.4.5.1 Implementing a River Level

In order to get a quick and testable approximation of the river level, we developed an endless runner with randomly generated obstacle patterns based on the tutorials of DevEnabled (2018) and added a series of modifications such as:

- Creating many additional lanes
- Making the movement between lanes continuous rather than discrete (so that the raft centre can be between lanes)
- Spawning in debris to be collected
- Adding a 'failsafe' so that not all lanes can be blocked at once
- Altering the camera angles, and disconnecting the endless runner from the player controls (since it is our raft that is moving through the endless runner rather than the players, who can move around in a much freer manner)
- implementing most functionality so that they could be adjusted on the fly by altering one or two variable values rather than having to dive into the code

This worked well to capture the basics of a river level and allowed us to generate as long of a gameplay session as we needed (or until they lost), since the level was theoretically endless. That said, the randomly generated stones meant the system could behave fairly different between game sessions, making it hard to gauge the difficulty level without multiple repeated internal testing sessions. Furthermore, the river would be fairly unchanging throughout play, only changing in obstacles. This meant we did not for example encounter a bend or a choke point where the riverbanks forced the players to reconsider their approach.

7.4.5.2 Implementing the Networked Player Controls

Throughout the development, effort was continuously spent on making sure that the implemented character controls worked well with the underlying network structures. Initially, things like grabbing objects, dropping them, and building them upon each other seemed to work well for the individual player. However, over time the networking programming and implementation with other systems proved to complicate most systems to a degree that it threatened to eclipse the development of the actual gameplay.

At the end of the day, we had to reconsider our approach and abandon our network system in favour of a local multiplayer solution instead. This was a tough but necessary decision to ensure that a working prototype would be available for playtesting.

7.4.5.3 Implementing the Raft Steering Logic

To implement the way the raft would steer based on the distribution of people atop it, we created a collider on top of the box that kept track of each player it collided with. From this list of players, we could derive an average world location, which could represent the location of their net gravitational force acting on the raft. By comparing the location of this net force with the current position of the raft's centre of mass, we determined the direction and offset and had these direct the raft's sideways steering. Additionally, the raft would steer harder to that side the more players were atop it; an approximation of the higher weight put on the raft.

7.4.5.4 Implementing the Construction and Collision Systems

We managed to develop a working construction system, where the pieces attached to each other to form a coherent whole. However, by the way attachment works in Unreal Engine 4, we could only attach each piece to one parent piece. As such, attaching the pieces worked well - but once any piece other than the very last one was disconnected, several other blocks would separate regardless if they were visually connected to other blocks or not since they were now lacking their single parent. At the end of the day, problemsolving and implementing it into the combined project grew too large and we ultimately decided to cut it from the prototype.

Because of this and how the level was set up to be an unrelenting endless runner, we deemed that the collision system was less applicable under these new conditions—especially if no breaking apart and rebuilding would be part of the prototype. Instead, we let the stones overlap with the raft, colouring them red as a visual feedback, and reduced the hit points of the raft.

7.4.5.5 Adjustments in the Combined Prototype to Account for Missing Features

Once we cut out the construction system from this early stage prototype, we knew that this would have multiple trickle-down effects on the system. Most importantly, while the *co-dependencies* (see ***dependency***) still afforded *involving*, both *acting* (to retrieve debris pieces) and *evaluating* (rebuilding the raft etc) would suffer since many of the features we had in those categories tied to the construction material. With *evaluate*, however, implementations of new affordances were deemed too time consuming so we predicted that this prototype would likely see less *evaluating* than originally expected.

To re-enable acting in the game, we decided to give the raft a hit point total, ever ticking downwards and being reduced significantly by and let the debris gathered

We also reduced the player count for the prototype from 4 to 2. This was done in part to accommodate the smaller list of game mechanics, making more players somewhat redundant, and in part because of the move to local multiplayer, where we were limited in controllers and expected to be similarly limited in available playtesters. Besides, it was deemed easier to adhere to the healthcare recommendations surrounding the pandemic with two players than with four.

7.4.6 Playtesting

Once the digital prototype was complete, we scheduled and performed playtests to investigate the merits of the prototype with players other than ourselves. The motives behind the playtests were twofold: in part, we wanted to execute a regular playtest as part of the design process of the game. But more importantly, we wanted to see whether or not our framework had accurately predicted how players would collaborate within the game.

Figure 7.20: An in-game capture of the Rat-Raft game prototype.

Following Fullerton (2019), we were in the early testing stages of the game design and therefore focused on structure (whether the basic gameplay was "fun enough" for third party players to warrant designing a game around it) and functionality (whether our game mechanics were intuitive, if they develop the expected behaviours and strategies on their own, and if players were emotionally invested). From our framework's perspective, we were looking for whether and when they would enter each of the collaboration modes, if this happened while under the predicted conditions, and if we could identify which collaborative games properties made appearances during their playing - and if these properties had the expected effects.

7.4.6.1 Preparing the Playtests

For the playtest, participants were recruited in pairs using opportunity sampling. A total of 8 participants were recruited, consisting of 4 pairs. Before each playtest, each controller was sanitised with hand-sanitiser and left to try for a few minutes before their entry.

Informed Consent-forms were also prepared (See Appendix A) and put on a table before their entry.

The test setup consisted of a table with a TV-screen on, with two Xbox 360 controllers. The controllers were connected to a Surface 4 Pro which was consequently connected to duplicate screens to the TV. This way, one of the test leaders could sit in front of the participants and observe both the participants and what happened on the screen (See figure 7.21). The other test leader would be positioned behind.

Figure 7.21: The playtest environment.

7.4.6.2 Executing the Playtests

Each playtest lasted around 20-25 minutes, including introduction, providing consent forms, and post-game interview sessions. The playtests' planned structure were the following:

- Introduction and Consent form: Around 5 Minutes
- Playing the game: 10 Minutes
- Post-game interview: Around 10 Minutes

The participants were let in and asked to sign the consent form if they agreed to participate in the playtest. Once this had been done, they were asked to sit down on one of the chairs and were told that both controllers had been sanitized. Next, the main test leader sitting by the table, made a brief presentation of the game and the core controls of moving, jumping, and picking up debris - and that the basic principle with the game was to make the raft survive for as long as possible. We were deliberately conservative with conveying too much information because we wanted to see if the setup would be easy for new players to grasp. Additionally, to avoid influencing how they would *involve* and *evaluate* with each other, we made the deliberate choice not to ask them to think out loud during playtests which Fullerton (2019) otherwise advises.

After going through the controls, the test leader asked the participants to start playing the game for 10 minutes as if they were at home playing the game for the first time in their couch at home. While the participants were playing, the test observer took notes on the framework aspects of the test while the test leader took more typical playtest notes that focused on the gameplay itself. The test leader was available to answer questions or inquiries if there were any.

Things which were looked after were signs of *act*, *involve*, and *evaluate* among other things such as how clear the game appeared to be.

After 10 minutes had passed, the play session stopped and thoughts and feedback was gathered using a semi-structured interview setup. The prepared topics to cover was:

- General impressions
- How did they feel to collaborate?
- Was it fun?
- How would they envision the game to be in a more finished state?

After this, the participants were thanked for their participation and let go.

Figure 7.22: A picture taken from behind (with participants' consent) during a playtest

7.4.6.3 Insights from Playtests

Throughout the 4 playtests performed, we noticed a number of reoccurring themes. Mostly, the perception of ***challenge*** seemed to be a very important factor to determine how much collaborative elaboration was undertaken. On the first playtest, participants did not seem to find the game too challenging, and thus did not seem to *involve* each other as much as we wanted. We then altered the game settings to make it harder which immediately gave more effects of *involve*, ***synchronise*** and even *evaluation*. For the following test sessions, we kept it at that level of difficulty - or even harder for one group who seemed to have played with each other a lot. This gave us insight of how important ***challenge*** is as a property if one wants to make sure to afford *involve* and *evaluate*. Just like the Reform Journey model predicts, if there is no reason for a player to involve the other player, he or she will not.

Only 2 groups seemed to properly *evaluate* between rounds, as the intention was to give them room to do so this way. This could have been for many reasons - one is that the randomisation of the map resulted in uneven scenarios which visibly could be seen as generating easier tracks than wanted. Once the map generated tracks that were harder, with moments requiring two players to stand on the same side of the raft at the same time, *involve* and follow-up *evaluations* were more prevalent. Not all groups did encounter these situations through randomisation of terrain within the 10 minutes of playing, which could explain why only two group thoroughly did *evaluate*. This taught us that randomised content or at least terrain may not be the most optimal component to include in playtests for ***challenge*** as test leaders cannot control for difficulty. At the same time, the games prototyped may be designed as endless runners which would need some sort of randomisation in it to work with - and if so, the randomisation algorithm would need to function fine as well. That would probably be possible in the long run, but it does seem to make testing take longer as one would need to adjust the difficulty level up and down, and that the line where ***challenge*** is may differ from player to player.

Other feedback gained was that it was very fun "coordinating actions" and people expressed they felt they got strong ***emergent roles*** as they continued playing. Those who did reach *evaluation* did express it was fun to theorize which strategy was the best, and try different solutions to see which worked the best. They also liked that it was hard. Some other results from the playtest sessions was that it was initially a bit hard for players to learn exactly how to steer raft. We deliberately did not explain the control scheme of the raft to let players explore and learn this together. After a while, all players learned all the controls with the exception of the additive force on the raft when two players stood on the same side of it. Once again, this seemed to correlate with whether or not they had reached moments a ***co-action*** effort of this sort was needed.

Lastly, there were some insights gained which seemed to relate more towards the use of placeholder assets within the game. Things such as wanting each character to be characteristically more different from each other to make them easier to discern, or having different personalities et cetera. We agree with those inquiries, the characters had two different colours but their bode types were identical which may have made the identification of one's character slightly harder. On the other hand, this playtest wanted to test the core game idea, which we did. In future versions of the game, dealing with topics such as these would need to be addressed.

Overall, the development of the digital prototype for Rat-Raft left much to yet be implemented - though we feel we were able to get the core idea of everything implemented. Perhaps this was for the better, as we were able to test the game in a less polished and "ready" state - which allows for earlier fixing and adjustments and more early insights. All participants expressed opinions that the game seemed to have a very good and stable ground to build upon, and it was expressed that the game felt unique as they had never seen anything similar before. Many were enthusiastic to share their ideas for possible future iterations, and saw a lot of potential in the game idea.

7.4.6.4 Insights Gained from Applying the Framework on a Design Process

Throughout this iteration, we have learned much about how the framework interfaced with the design process. In general, we can note that the Reform Journey proved useful to ensure a well-rounded collaborative idea with Mechanics and Dynamics that supported varied collaboration modes, and helped us ensure that the game affords all three modes by identifying what the idea lacked. On the other hand, the Collaborative Games Properties were not as useful on their own—despite our intimate knowledge of the properties (as their writers), it was not trivial to ideate games solely from them. This supports similar indications from the workshop. However, if the properties are approached with a pre-existing need (such as a lack of support in a collaboration mode, identified with the Reform Journey), the properties could provide a shorthand for identifying general approaches to filling such a need and often inspired our solutions.

Throughout ideation, we could recognise opportunities to introduce new properties—and intuit some of the consequences of implementing them—as the gameplay evolved. We suspect that this comes with an increased fluency in the Collaborative Games Properties, but that they—along with the Reform Journey—provide designers with an awareness of collaborative gameplay details they might otherwise miss. Later playtests also indicated that the intuitions we had were on the right track, although implementation difficulties sometimes lead to deviations from the expected results.

Our *VR:y Hot Potato - Food Delivery* idea put into question whether ***co-location*** is a necessary mean of collaborative games per se, or if ***co-location*** is just one mean of creating environments to facilitate natural ***communication***. We also realised that designing for passing objects between players can be an easy way to afford ***reactive actions***, especially if there is some time limit.

When it comes to digital development, we noticed that we barely made use of the framework at all. The framework is good for analysing a design, identifying a need and providing ideas for how to fill those needs, but it does not provide step-by-step implementation guidance. This makes some sense since games can manifest vastly different contexts, meaning that the same idea can be implemented in completely different ways depending on the context.

However, when we had to revise our project, we found both the Collaborative Games Properties and the Reform Journey useful to presage what consequences these revisions would have on the game. This in turn allowed us to potentially address those consequences by identifying them as needs to find new ideas for.

7.4.7 Alterations to the framework based on Iteration 4

As we were just finalizing the work from the game development phase, we sat down to have a discussion and take a look at our notes of what we had learned from performing a practical session and utilizing the Framework we had been developing. Mostly, we felt that the Framework itself stood pretty stable in its ability to make

understanding games and generating ideas for improvements on implemented features possible. Above all, we never felt confused of what to do when consulting the Framework and its tools. On the other hand, making a game with the framework and upcoming playtests did present some interesting findings that led us to iterate on some parts.

The changes we had found a need for were compiled with the errata from iteration 3, and all of them implemented into the final version of the Reform Journey, presented in the Results of this thesis (Chapter 6), and the Collaborative Games Properties, presented in Appendix C. Below is an outline of the changes made based on this fourth, final, iteration.

7.4.7.1 Reform Journey (Iteration 4)

The playtests revealed a gap in our model that had started to show up a little bit already from the Overcooked analysis in subsection 7.3.2 Game Analysis: OverCooked 2, but became more obvious here. And that is how situational the workload aspect of the Reform Journey is. As was shown in the randomized tracks of the game, what was hard at try 1 for one group would be hard first at try 3 for another group. This led us to emphasize that opportunities for *evaluate* can be postponed somewhat to a soon but later occasion. Once an individual or group has surpassed the *evaluation threshold*, the group may still find itself *evaluating* at a later stage. Thus, it can be said that just surpassing the *evaluation threshold* itself may afford *evaluation*, but there still needs to be room to *evaluate* at some point.

One thing we realised as we were using the framework was the usage of the term *reevaluate* would often become just, *evaluate*. This is mostly an editorial change, but in case the term reevaluation has been use, we mean it is the same as *evaluate* in meaning. Another term that felt slightly confusing was the term 'collective knowledge', which may have indicated that it was a total knowledge that all players shared the same. Our intent was that it would simply be a total accumulation of all knowledge between all members of the group. Thus, we followed suit and renamed it to ***accumulated knowledge***. Lastly, we changed the term "jurisdiction" to "directives" for the sake of sounding slightly less jargon.

7.4.7.2 Collaborative Games Properties (Iteration 4)

Our ideation session with the randomised yellow sheets showed us that it might be possible to use properties for ideation - but it does not necessarily mean that interesting ideas will always be generated. While we were able to come up with plenty of varying ideas, we also had the help that we could mentally browse through all the properties as we had created them. We were thus able to mentally jump between properties when we needed and take help from different but related properties. This might mean that for people who have experience of have used the framework and its properties, it might be possible to use the properties for successful ideation. We believe, however, that it might have been our general background knowledge in the area of games and collaboration that led us to be able to make so many connec-

tions. As was shown in the workshop in iteration 3, this may not be possible for people not accustomed to the framework or with less experience overall in the field of collaboration in games. Still, even for us, we had our moments which we found hard to deal with. For example, we had to revamp our idea with the two properties ***reactive actions*** & ***co-location*** to come up with a satisfying game concept. This shows that even for people accustomed to the framework and the tools, it does not always mean a good hit in idea will be generated each time.

We did notice, however, that properties were of great usage in conjunction with the Reform Journey model upon re-analyzing our game concepts to see where we were lacking. Once a basic game idea was generated, we lined up our ideas and tied them to either, *act*, *involve* or *evaluate* to see if we were lacking something. Upon realizing we were missing some, for instance, *act* - we could take a look into the properties document and find good candidates as solutions. However, this was first possible once a basic idea had been generated. This seems to match our previous findings and thoughts, that the framework works especially well for analyzing and suggesting improvements, but not for generating new things from scratch.

To promote this kind of usage, we wanted to give designers ways to quickly parse our properties document based on tags of I, *involve* and *evaluate* - so that the document can be used when one wants to afford a specific type of collaboration mode. Fittingly, this was one of the issues found in iteration 3 - that the properties document was somewhat hard to browse as it was unstructured. In this iteration, we found an answer to that problem.

Lastly, we decided to omit the property *shared symbols* from the collection and put its content into ***group identity***, as we found the *shared symbols* property rather small and very similar to ***group identity***.

7.4.7.3 Collaboration Definition (Iteration 4)

As part of our project and framework, we aimed to take a stance on what collaboration is and include it in our framework. In the previous iteration, we landed on the definition:

"Collaboration is performing work together for increased performance, adaptability, and/or cohesion."

We still felt quite happy with this definition as it emphasized how collaboration can be seen, and should be seen, from many different angles. Yet, we felt that this definition was not very connected to our concept behind the agenda which we see as strongly related to collaboration. For this reason, we decided to add another definition of collaboration:

"Collaboration is performing work together. An instance of collaboration is formed by an agenda, which is affected by a group's shared references, shared goals, their total accumulated knowledge, and social code."

One of these definitions works better if one has not read our framework. However, the second one more clearly connects to the agenda concept developed throughout our thesis project. For this reason, we decided to keep both of them. Despite being two different definitions, they are similar in that they cover both group and individual related aspects - which we deemed important.

The addition of another definition is not based in any particular data from just this iteration cycle, instead it has matured over time as we have been working with the thesis.

8

Discussion

The discussion is divided in 4 sections, a results section, a process section, an ethics section and future work.

8.1 Results

This thesis has generated a framework consisting of two primary parts for future reference: 1) The Reform Journey model, with its identification of an agenda, scripts, the movement in fit, and the interaction modes; and 2) The accompanying Collaborative Games Properties collection (henceforth: CGP) which gathers a multitude of gameplay elements that have been used or studied in the context of collaborative games. The Reform Journey model and the CGP complement each other; the CGP exemplify how the Reform Journey can be used in practice, and the Reform Journey contextualises each CGP and provides them with a common terminology which aids in interrelating them. Also included in this thesis are two definitions of "collaboration", both related to the framework.

While collaboration has been studied before in games research, we argue that little effort has been made to investigate how we can utilise the significant body of research on collaboration from other research fields, to further insights into collaboration in games. A few investigations in later years, such as those from Azadegan and Harteveld (2014) and Baykal et al. (2020) might indicate a promising change. This thesis has taken that approach one step further by investigating collaboration in games through a Grounded Theory methodology, compiling research on collaboration from game research, CSCL, and CSCW, as well as advice from experienced game designers on the topic.

One could argue that the Reform Journey framework is not necessarily bringing much new knowledge to the table, since the framework is composed from existing information. Indeed, many of the elements in the framework might already come intuitively to an experienced designer, who has learned through experience to spot these effects. What the Reform Journey framework could offer, however, is an explanation of what that intuition stems from. For a newer or intermediate designer, reading it might be a shortcut to gaining that intuition, or at least raise awareness and attention to the details that afford its development.

8.1.1 The Reform Journey Model

One of the biggest contributions this project has generated is the Reform Journey model, which presents a conceptual tool for designers to utilise in designing collaborative games. Our findings from the feedback session (section 7.3.1.3), the game analysis (section 7.3.2 and Appendix B) and our own game design process (section 7.4) all indicate that this model is helpful for diagnosing a current game design, identifying what type of collaborative interactions it invites and potentially where it might need some extra work.

Furthermore, the way the Reform Journey distinguishes between interaction modes and fit provides us with a frame of reference agnostic to the iterations of a game design. The interaction modes turns a designer's focus onto how players interact in order to collaborate with each other, behaviours which can always be categorised into the respective interaction mode regardless of the context that motivated it. Thus, the amount of time players spend *acting*, *involving* and *evaluating* respectively might be a useful measurement for a designer to track and potentially build design goals around. The notion that a collaborative group can extend past a single gaming session introduces a new opportunity for *evaluating*: that between the game sessions, where players can discuss how their playing went and maintain those thoughts into their next session. This is not a new perspective (c.f. Salen and Zimmerman (2004)), but its inclusion was missing in Baykal et al. (2020) which analyses games using the three levels of collaboration of Bardram (1998) (the levels that formed the foundations of the interaction modes in the Reform Journey Framework).

Although the Reform Journey only touches upon the concept of workload at a surface level, we argue that in doing so it equips the designer with useful awareness about how the various elements of their design affords an individual to seek out a certain collaboration mode. It is important to recognise here that workload is heavily contextual—albeit, so is game design—and that our conceptual visualisations are about bringing intuition and awareness to the designer. This awareness can help a designer relate to and empathise with their players, and might aid them in identifying (in broad strokes) what type of load they might want to increase or decrease to afford the sought-after interaction modes.

Another contribution from the Reform Journey model and its accompanying terminology such as agenda, script, and directives, is that it juxtaposes the dynamic relationships between seeing collaboration from an individual perspective or a group perspective. Its distinction between agenda and script clarifies that the gestalt of collaboration is both a product of the group as an entity with shared goals and expectations, and of the autonomous unique individuals that make up the group. To us, viewing collaboration from only one of those perspectives would provide an incomplete image that risks missing the influence of the other.

8.1.2 The Collaborative Games Properties Collection

The properties document developed throughout this thesis project provides designers a quick way to browse and read about various ways collaboration can be affected and afforded. As all properties relate to either the Reform Journey or to each other (or both), they form a network of concepts that build up to a general reference manual, a hand guide — of relevant topics to consider when designing collaborative games.

One issue with the CGP is that it may be hard for new readers to get into the framework since all properties are quite interrelated—not to mention the need to first learn the Reform Journey Model. The orientation table at the top of each Property page is intended as an aid to navigate the collection better, particularly by quickly filtering out properties that do *not* relate to the current needs of the designer. That said, the orientation table is preliminary as it was introduced in the new iteration as a suggested design; as such, they have not been validated through user tests yet.

Although these CGP are introduced based on a synthesis of established research and design experience, the reliability and accuracy of each property in its new form is yet to be validated. It is therefore pertinent to note that the CGP is by no means a complete, comprehensive, or even completed work. Due to their varying coverage in the corpus used, they are on varying levels of elaboration, and resemble a first step towards a more comprehensive framework about collaboration in games. Indeed, several of the identified properties—such as tempo and communication—are large enough to warrant several studies of their own, similar to those made into asymmetry and/or interdependence (c.f. Depping and Mandryk (2017), Harris and Hancock (2019), Harris et al. (2016)). Our properties are intended to be evocative and inspiring; in general, they do not provide implementation solutions but at most some principles from research and experience. Games are too contextual and varied for catch-all solutions, so principles like these are often the closest we get when treating the subject on a level as encompassing as this thesis does.

8.1.2.1 Collaborative Games Properties and Gameplay Design Patterns

The nature of the CGP we developed has some similarity to the Gameplay Design Patterns (GDP patterns) introduced by Björk et al. (2003) in that they are abstracted, reoccurring elements in existing games that have been analysed for how they are used and how they could be used. Like GPD patterns, our CGP work well for analysis of existing designs but their abstracted, interrelated nature means a user likely requires a fair bit of exposure to the collection before becoming somewhat fluent in their use. During our analysis of *Overcooked 2* (section 7.3.2), we also noted that the GPD patterns and CGP interacted well with each other, although there are some overlaps in terminology and/or functionality (such as roles) which complicates the indications. Since the CGP were our primary interest, we went with the CGP formatting and terminology in the case of collisions.

Unlike GPD patterns, however, the CGP are all tied to the singular core of the Reform Journey, its agenda and its interaction forms. This has the advantage of

lending them a sense of commonality and direction compared to the more generalist GDP patterns, and allows a designer to set some preliminary expectations of the properties they are about to read. But their ties to the Reform Journey also brings a weakness in that the CGP cannot fully stand on its own without the Reform Journey, especially due to the tight integration of the interaction modes *act*, *involve*, and *evaluate*.

The decision to make the CGP standalone, rather than part of the existing GPD patterns collection, was primarily made for two reasons: to define a bounded collection focused around the singular ideal of designing collaborative gameplay experiences, and to allow a designer to utilise its content without needing to master the significantly larger collection of GPD patterns. The tradeoff for so doing is that the CGP cannot readily make use of the vast catalogue of existing knowledge within the GDP patterns collection, and conversely that the relevant GPD patterns are not updated with new collaboration-focused knowledge. A designer or researcher who wishes to undertake such a task might find use of the third column of Table 6.1 (Section 6.2.1), where we suggest GPD patterns that describe similar functionality to that of the respective CGP. That said, several of those GPD patterns were not part of the corpus that created the CGP; as such, the reader should take care to note that this is by no means an exact mapping and that more investigation will be required.

8.1.3 Game Design and Collaboration Design: Third Order Design?

One reflection we would often revisit in this project was the vast amount of possible variables that seemed to be able to influence collaboration in games, and how little *direct* control designers may have over the outcome. Two main areas were factors regarding traditional game design, but also collaboration dynamics. Salen and Zimmerman (2004) concluded that designers can only design the *"rules that give rise to"* the wanted behaviour, that is, a sort of second order design is in place. They meant that game design as an area can only encourage, or afford, certain types of behaviour and experiences - not guarantee it. We mean the same type of challenge exists within collaboration group dynamics in games. Game designers for collaboration can only do so much to encourage collaborative elements between people in various affording ways, but ultimately, the type of carried out behaviour lies on the player's decisions and thoughts. If one player does not want to collaborate even though it would be helpful, he or she will probably not do so. In this regard, one could argue that it is possible to see the specific design for designing collaboration in games a type of second-order design by its own. Indeed, this thesis has only touched the surface upon the area of group dynamics and differences between individuals. For example, our model does not cover personality differences (such as the OCEAN Model (Mumford, 2012)) between players and how that could potentially alter the outcome of collaboration in games. These factors, however while outside a designer's control, do play a role in the ultimate outcome of the eventual collaboration between players.

In this regard, both the direct gameplay can be seen as a second order design as well as the collaboration dynamics between players. Together, the amount of ambiguous factors and uncertainty rises even more because individuals are able to influence the outcome of the collaboration in the group, but the group can also influence the behaviour of the individual. This led us to sometimes regard designing for *collaboration* in *games* possibly being a "third order" design area. Whether or not this labelling makes sense could be an interesting topic to cover in future research, however, we do note that the designer can be seen to have second order control over how players play the game directly, and giving players means to collaborate and communicate. Still, the way individual performances and decisions (via script) can influence the maintenance of the agenda, and how the agenda reforms individual scripts, can be said to be a result of the second order design - resulting in a third layer. The idea of a third order design could prove an interesting concept to study further, as it highlights what role might be played principles from group psychology and other research into collaboration in the otherwise second order design of games in general. As such, it may help identify important concepts to further help in designing multiplayer experiences.

8.2 Validity

While the Reform Journey and the CGP are grounded in empirical research and studies, data and accounts from industry people, and data from our own observation, application and research, one could still ponder about the framework's validity and accuracy. These are valid points. The intention behind making this framework was twofold: to provide designers with a conceptual tool to aid them in creating collaborative gameplay experiences, and to bring together a scattered collection of knowledge into a summarised, digested and unified format. This goal of catering firstly towards designers was a deliberate choice, as specified in described in chapter 2. We welcome any efforts to study our framework further to investigate our generated framework in terms of validity, as we suggest in Section 8.5 Future Work.

One of the main drawbacks of the framework is that it does little to address other relevant topics such as the differences in personality or other aspects. Although we have included sources on collaboration from other fields than game research and game design alone, there are several other fields which have investigated collaboration as a phenomenon—group psychology comes first to mind—but which do not partake in the corpus of this thesis. Investigating whether findings from these fields match or mismatch the Reform Journey Framework would be of significant value as future research.

Furthermore, it is possible to question whether our data set for the GT and the methods for the following selective coding be enough to form a high enough validity. Especially on the side of sources used outside the direct sphere of game design may be argued to be a bit small, consisting of less than 10 sources in total. On one hand, many of those sources were large and incorporated a lot of references to many other relevant articles, on the other hand, the data set could definitely be a lot bigger.

This was a delimitation we had to set for our thesis project in order to be able to finish in time, but one could request a larger sample of information gathering to get an even more all-encompassing view of the area, and probably a result that could be said to have a higher level of validity. Still, we mean that our produced work is not meant to be used as a scientific tool, rather, the idea behind it is to use it as a conceptual design tool in which designers can take the concepts of the framework to design collaborative experiences in games of their own.

8.3 Process/Methodology

This thesis has utilised an iterative process in creating the framework and its components. Overall, it has worked well, especially towards the later stages of the process. However, the first iteration—the Grounded Theory process—took two weeks longer than intended as it required more effort to get through than anticipated. One may use this to conclude that the Grounded Theory method may require a substantial amount of time, so that its generated concepts are allowed to mature. On the other hand, one could argue that the Grounded Theory process itself is iterative—perhaps not in the sense that you iterate directly on the same material (such as one graphical interface), but the Grounded Theory process does imply that the practitioner does repeatedly process his or her material through many different layers of abstraction and clarity. It begins with a coding process and ends with a theorising process, but in-between we have thoroughly gone through our material in the form of conceptualising and categorising. This in itself could be seen as an iterative process, as we continuously revisited the important points until clear points were created.

The use of Grounded Theory has also been one of the more formative methods used for our thesis project. It laid out the starting point and refined much of the early underlying data and concepts which we could use on all later stages and iterations of the Reform Journey Framework. In particular, our experience shows that all steps defined in it are important and valuable. This is especially well manifested as can be seen in section 7.1 Iteration 1, where we concluded that step 3 of Grounded theory, the conceptualisation phase, is indeed important to be able to reach that level of refinement to go to the next phases of categorising and theorising. This is a valuable lesson for future application of the Grounded Theory Method. One could argue that the Grounded Theory method is an iterative process as well in its core, as you are methodologically making sure to touch upon the same type of material through refinements through multiple layers.

One of the biggest challenges with utilising an iterative process for creating a framework was that such a textual product requires a rather high level of detail. Unlike more classical interaction designs such as working with the interactions behind a tangible prototype or a graphical interface, the written content forms the core of the interaction itself. As such, even at “low fidelity” prototypes everything had to be thoroughly processed and put into detailed descriptions—otherwise, their use would be hindered by the user having to interpret the notes rather than utilise them.

8.4 Ethics

One important aspect of designing for collaboration in games is in ethics, as the designer purposely may afford a lower or higher quality of collaboration between group members. This includes the (principle) behind agenda fitness (as introduced in the Reform Journey Framework) between group members, but also other things which have not been addressed in the Reform Journey Framework such as conflict management, personality traits, et cetera. Properties such as ***group vs individual*** and ***betrayal*** may induce some sort of tension that ultimately brings a group together - but it can also result in undesired quarrels between people, and in worst case scenarios, affect relationships negatively. The key of these properties is to have a balance, which may arguably be easier said than done, especially since there are many individual factors between player and player that can alter the results in favour of different directions. Designers can only afford a certain collaborative experience, not guarantee it.

Methodologically, this thesis has had some concerns to meet to ensure that participants and stakeholders take no harm upon investing time and effort into our research. Firstly, we have made sure on multiple occasions on our workshop and playtests that their participation is fully voluntary, and that they could leave at any time would they so will. Additionally, the participants have been kept confidential for readers of the thesis, and a consent form was utilized for participants partaking in the playtests. We believe that these measures have been sufficient in ensuring that our research has been pursued in an ethical manner.

8.5 Future Work

This project has mostly been focusing on extracting a summarizing framework for the purpose of designing collaborative games. In doing this, we have proposed and explored a Framework that can be used to design for collaboration in games. As mentioned in previous sections, we do observe a possible need to further quality-check the model and the properties in a more rigorous manner. Our contribution is only an early proposal of how one could think around elaboration of interactions when designing collaborative experiences. Further refinement possibilities are to be expected, and future efforts to simplify and improve the framework are definitely units of interest.

Furthermore, there is no reason to stop the Collaborative Games Properties collection at 40 properties, as it is highly likely a lot more topics that could be interesting to incorporate. Among other things, we would like to expand on the current collection of properties, and continue refining its content and clarity. We especially see a need to incorporate more traits relating to personality and group psychology as that is undoubtedly important topics when it comes to dealing with groups and group play. Still, all things considered, we believe this is a good starting point for more work to be built upon.

9

Conclusion

The purpose of this thesis was to address the following research question:

> ***Research Question:*** *What considerations should be made when designing multiplayer gameplay that support, encourage or improve collaboration? What properties should these games have to fulfil these purposes?*

This has been done by producing a framework which has been created with the help of an iterative process of data gathering and continuous readjustments. The process resulted in two main items: The Reform Journey model (found in Chapter 6 Results) with its accompanying discussion about agenda, scripts, directives, norms, fit and workload, and the auxiliary Collaborative Games properties collection which is to be used together with the Reform Journey model (Found in Appendix C). Together, these build up to what we call the Reform Journey Framework.

To elaborate, we can break up the research question into its individual parts and show how we have addressed each of them:

> ***Research Question:*** *What considerations should be made when designing multiplayer gameplay that support, encourage or improve collaboration?*

- With **supporting collaboration**, we consider aspects that provide the necessary means for collaboration to exist. The Reform Journey Framework proposes that, for collaboration to exist, a group creates an *agenda* of *directives* and *norms*, informed by their ***accumulated knowledge***, ***shared goals***, ***shared references***, and ***social code***. This agenda influences their pre-existing individual *scripts*, which adjust to consider what they can defer to the group for and what is expected from them by the group.
- With **encouraging collaboration**, we consider aspects that make collaboration more likely to happen by motivating it. The descriptions of how an individual considers their workload provides a model for their motivation to interact with others in various ways. The ways they interact are further discussed by the interaction modes of *acting*, *involving*, and *evaluating*.
- With **improving collaboration**, we consider how players get better at collaborating. To answer this, the Reform Journey Framework discusses the concept

of *fit* and how players can improve it in terms of *performance* and *cohesion*, and with **changing conditions** they might also increase their *adaptability*.

Research Question: *What properties should these games have to fulfil these purposes?*

Our Collaborative Games Properties collection specifically addresses this question by highlighting 40 different properties, all related to the Reform Journey Model, that games can utilise to achieve this design goal.

9.1 The Reform Journey Model

The Reform Journey models offers a tool for designers to refer to as they are designing collaborative games. An important component is that it provides the concept of the Reform Journey, opening up for possibilities to make comparisons of fit between two gameplay versions or situations. Additionally, the concepts building up to the agenda and scripts help distinguishing between the individual and group level aspects of collaboration. The Reform Journey Model gives a structure which the Collaborative Games properties collection can build upon.

9.2 The Collaborative Games Properties Collection

The Collaborative Games properties collection, available in Appendix C, offers the designer a complementary tool for utilising on the Reform Journey model. Each concept is called a property, and is intended to inspire ways in which designers can create affordances for different forms of collaboration in a game. The properties relate to the Reform Journey Model, providing the designer with a way to familiarise oneself with its concepts through application. In particular, they often relate to the interaction modes of *act*, *involve*, and *evaluate*, providing inspiration for how a game design can afford varied interactions in their collaborative gameplay.

A list of all properties created can be found below. They are summarised in Table 6.1 (Section 6.2.1), including suggested gameplay design patterns that might relate to them. Their full descriptions can be found in Appendix C, the Collaborative Games Properties collection.

1. **Accumulated Knowledge**
2. **Additive Efficiency**
3. **Asymmetry**
4. **Betrayal/Traitor**
5. **Challenge**
6. **Changing Conditions**
7. **Co-actions**
8. **Co-location**
9. **Communication**
10. **Community**
11. **Contribution to Group**
12. **Dependence**
13. **Dilemmas**
14. **Distribution of Power**
15. **Emergent Collaborative Behaviour**
16. **Emergent Structures**
17. **Enforced Structure**
18. **Group Identity**
19. **Group Presence**
20. **Group vs Individual**
21. **Helping**
22. **Interdependence**
23. **Mastery**
24. **Mutual Experiences**
25. **Parallel Tasks**
26. **Planning**
27. **Player Capability**
28. **Reactive Actions**
29. **Repeated Play**
30. **Roles**
31. **Shared Goals**
32. **Shared Punishment**
33. **Shared References**
34. **Shared Threats**
35. **Social Code**
36. **Synchronisation**
37. **Team Dynamics**
38. **Tempo**
39. **Urgency**
40. **Vicinity**

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A

Appendix: Consent Forms for Playtesting

This Appendix contains a Swedish and an English version of the informed consent form used. The two are attached in their original PDF form in the following pages.

Informerat samtyckesformulär

Hej!

Du är på väg att delta i ett speltest för en tidig prototyp av ett kollaborativt spel med två spelare. Innan speltestet kan starta är det viktigt att du läser igenom detta papper.

Testet kommer användas som underlag till en masteruppsats om kollaborativa spel. Dina uppgifter kommer hanteras konfidentiellt och du har själv rätt att bestämma din medverkan i speltestet, och kan därför när som helst avstå utan att behöva uppge orsak. Du kan även, efter utförandet men innan 22 Maj 2020 kontakta någon av testledarna för att dra tillbaks din data.

Proceduren kommer gå till att ni kommer få instruktioner på hur spelet fungerar och speltestets upplägg, därefter börjar speltestet som kommer att spelas in med videokamera. Testledarna kommer att finnas till för observation och för att svara på frågor.

Jag ger härmed mitt samtycke för deltagande i speltestet,

Datum: _____

Signatur: _____

Förtydligande: _____

Informed Consent

Hi!

You're about to participate in a play test for an early prototype of a collaborative game with two players. Before the test can begin, it is important that you read through this paper.

The test will be used as material for a master's thesis about collaborative games. Your information will be handled confidentially, not be shared with third part, and you have the right to decide on your participation of the test at any time – and can therefore abstain participation with no need to explain why. It is also possible to, after the procedure but no later than May 22nd, 2020, contact one of the test leaders to withdraw your data from the data set.

The procedure will begin with you receiving instructions of how the game works and the setup for the play test. After that, the play test which will be recorded by a camera will begin. The test leaders will be present for observation and for answering questions.

Proceduren kommer gå till att ni kommer få instruktioner på hur spelet fungerar och speltestets

I hereby give my consent to participate in the play test,

Date: _____

Signature: _____

Name: _____

B

Appendix: Game Analysis of Overcooked 2

B.1 Introduction

This is an analysis of the game *Overcooked 2* using the Reform Journey Framework to describe how collaboration works in the game. *Overcooked 2* is a co-operative cooking game for 1-4 players developed by *Ghost Town Games* in collaboration with *Team17* and released in 2018 (Ghost Town Games, 2018). The players are chefs in a kitchen, cooking and delivering various recipes on order. This analysis was made playing four people (in local multiplayer) on the version released for the Nintendo Switch console (Nintendo, 2017).

A note: This analysis was performed during Iteration 3 and therefore follows the terminology from that iteration—like how the Collaborative Game Properties were still called Tools and the interaction mode *evaluate* was still called *reevaluate*.

B.2 The Primitives of Overcooked 2

To avoid ballooning into describing every minutiae of the game, this section references gameplay design patterns (in SMALL CAPS) from GDP3 (n.d.) as shorthand for many functionalities of the primitives in the game. Terms in bold are our Collaborative Game Properties (still called Tools during this iteration), described in Appendix C, while those in *italic* refers to the interaction modes of the Reform Journey framework (see section 6.1.5).

B.2.1 Components

- Chefs, the Avatars for each player.
- Multiple Levels, each one open for Unlocking by finishing the previous Level and collecting a high enough overall score on their shared Score Tracks.
- Plates, upon which the players place food and then leave at the counter area to fulfil orders. An example of Limited Resources, the plates then come

back dirty and need to be washed in the sink before they can be used for new orders.

- Several Controllers such as chopping boards, stoves, blenders, and the sink, which all offer different Location-Fixed Abilities to their players. Some of them, like stoves and blenders, act as Switches, while the others are Installations for Extended Actions.
- Pots/pans, Game Items and Limited Resources that are needed to cook ingredients on stoves.
- Fire, which if it breaks out creates Inaccessible Areas and quickly spreads unless extinguished.
- Fire extinguisher, a single Game Item per Level offering a player who carries it the Privileged Ability of extinguishing fires.
- World map with Minigame of driving between any of the unlocked Levels
- Resource Sources for retrieving ingredients or dirty plates
- Countertops, providing places for plates and pots/pans but also used to block movement, creating Choke Points or potentially separating players into areas with **asymmetry of access**.

B.2.2 Actions

- Walking
- Sprinting
- Retrieving ingredients or dirty plates from Resource Sources
- Throwing ingredients in a straight line, either to another chef, straight into a Controller from a distance, or onto the floor at a distance.
- Chopping food (Location-Fixed Ability, Extended Action)
- Washing dishes (Location-Fixed Ability, Extended Action)
- Cooking food (After they're done a Time Limit to remove the food from the surface or it may start a fire which then spreads)
- Extinguishing fire, a Privileged Ability only available to a player holding the fire extinguisher Game Item
- Plating food, either by carrying the pots/pans to the plate or the plate to the pots/pans. Plating is an Irreversible Event – if the players combine the wrong foods, they have to throw it in the bin and start over cooking everything anew. As such, mistakes in plating serves as a **shared punishment**.
- Delivering food by carrying a finished plate to the serving area

B.2.3 Goals

Every goal is a food order, which involves cooking ingredients according to memorized recipes (a set of sub-goals), plating the food and then delivering them. All

orders are **shared goals** and multiple orders are active simultaneously, creating **parallel tasks**, each with a TIME LIMIT within which they should be completed. Since there are always multiple, time-sensitive goals to achieve at any given moment, the **tempo** is continuously high until the LEVEL ends and you return to the world map.

B.3 How Overcooked 2 Affords Acting

Only one person can work at each of the INSTALLATIONS at any given time, creating **parallel tasks** where other players are left to perform other actions or use other CONTROLLERS. There are more INSTALLATIONS and **parallel tasks** than there are players, meaning that every player needs to juggle multiple tasks as well. These INSTALLATIONS are EXTENDED ACTIONS, which also open for **reactive actions** as a player who had been assigned the **role** of performing one task going might be stuck in another EXTENDED ACTION. There is no **asymmetry** between players (other than a potential **asymmetry of access** to a location), meaning that any player with access to the location can dynamically take over the performing of a task – in other words, all **roles** are **emergent roles** determined by how the group plays rather than the game itself.

Other CONTROLLERS are SWITCHES, meaning that the player is free to continue with other actions while the process is ongoing. Consequentially, these players do not get the brief pause of performing the action to reorient themselves, a pause they could have used to *involve* others or investigate if there was something to *reevaluate*. Instead, they are afforded to continue *acting* by performing another action while waiting for the food to finish. The tendency to move on to new actions also means that the cooking action can be started by one player and finished by another, opening for **reactive actions**.

Each individual task (or sub-goal) in a recipe can be done independent of the others up until plating, further affording **parallel tasks**, and each task has a low *task load*. Therefore, if you have a set **role** and can work it smoothly you rarely need to *involve* or *reevaluate*. Since there are always new orders coming in, the **tempo** remains high throughout the LEVEL, pressuring players to keep performing the tasks.

B.4 How Overcooked 2 Affords Involving

Since each **shared goal** requires the completion of several independent sub-goals within a set time limit, it is beneficial for players to turn achieving these sub-goals into **parallel tasks** which enables them to quicker complete them **shared goal**. To complete an order, then, players need to continuously *involve* each other in what tasks remain on each goal, **synchronising** who does what and when a dish is ready for delivery. Since there are multiple orders active at any given time, it is often quicker to perform the same task several times in quick succession, creating a form of **roles** where players take responsibility over specific tasks. Additionally,

several of the preparations for different recipes use the same Controllers for different ingredients, which means their use needs to be **synchronised**.

The levels are often designed so that the ingredients are across the Level from their respective Controller, meaning that a player either have to run and get ingredients one by one—or they can *involve* other players who already are on that part of the Level, **communicating** to them to throw over some of the needed ingredients. This is an example of where the task of **communicating**, grabbing and throwing several ingredients in quick succession to then resume *acting* has a much lower *task load* than the task of running over and carrying them over one by one. The difference in load is so significant that, even with the added *communication load*, the *team workload* is usually lower than the *individual workload* – hence the players *involve* each other in retrieving ingredients instead of going about it alone through *acting*.

To further afford *involving*, walking across the level to grab items usually makes a player walk where they risk blocking off the other chefs in the process—which is a negative **contribution to group** and can spur other **synchronisation** difficulties. Similarly, some locations have steep ledges without railings where players might fall off if they collide, **punishing** players if they don't *involve* each other before moving across.

As players are often separated into different areas, the **asymmetry of access** can bring **interdependence** as some tasks can only be performed by players that have access to them. This works as an **enforced structure**, necessitating the players to *involve* each other in finishing plates, and often Game Items like plates or ingredients need to be brought from one side over to the other for each side to complete their tasks.

While each task on its own is moderately low in load, the multitude of tasks for each player to juggle and the strong affordance to continue *acting* makes it difficult for each player to keep track of what type of orders are currently active and urgent. This creates an opportunity for an **emergent role** where one player with slightly lower task load in the moment keeps tabs on the upcoming orders and calls them out to the rest of the group; an example of emergent **team dynamics** which can bring a sense of positive **contribution to group**.

B.5 How Overcooked 2 Affords Reevaluating

The game is played in multiple Levels, each one a new kitchen with a new layout of where the and a new combination of recipes (some potentially brand new). Consequentially, the layout needs to be relearned and pre-existing habits like **emergent roles** or what tasks are important requires reexamining by moving to *reevaluate* again.

As with Reconfigurable Game Worlds, some of the Levels dynamically change their layout throughout whilst playing it, which makes it a challenge to cre-

ate a reliable fit. By changing the circumstances (**changing conditions**) around where the players are playing, the game introduces discrepancies in the accumulated knowledge and incites *reevaluating* to adjust to the new circumstances. While adapting to these changes could technically be done through only **synchronising** (i.e. *involving*), these changes are typically cyclical and repeated in nature, meaning that players can learn the cycle and *reevaluate* to form a more instance-independent plan over how they should alter their play to accommodate the changes.

It is possible to plate the wrong thing on a plate, which if it happens is an Irreversible Action requiring the group to thrash the food and start over on the order (or let it fail). This **shared punishment** further increases the need for players to *involve* each other. Another shared punishment that opens for *reevaluating* is falling down a ledge, where the group will have to make do with one fewer member for a while as the player is given a respawn timer until which they cannot perform any action. However, this respawn can also be an **enforced structure** during which a player can get an overview of the current game state, opening for **reactive actions** and allowing them to observe what others do and potentially notice agenda norms that need *reevaluating*.

The choice of which Level (of those unlocked) to play is performed on a world map. By turning the Level selection process into an open world map to be driven around rather than a menu, the designers create a lull in the gameplay without having it come to a full stop. These moments are characterized by how they 'extract' the players from the core gameplay, giving them space to *reevaluate* as they reminisce about the latest Level, explain what their individual tactics were, and discuss how to work in similar situations next time. To accommodate analysis and description of similar effects in games, we introduce a new property to the collection called **repeated play**:

> **Repeated play** allows a team to come back to a play session for more than one try. It allows players to explore alternatives in the action space within a similar context, creating **accumulated knowledge** and supporting the development of **mastery**.

Steering the car to the next Level is almost a **co-action with unified input**, except that it doesn't require multiple players to steer it. This **co-action** does not distinguish between character inputs, which contradicts our advice to indicate the autonomy of each agent participating in driving. However, since the location of this **co-action** is a Minigame of selecting the new map, the lack of indication is less crucial than if driving had been a core game mechanic. In this case, this might be a beneficial design choice since it means the onus of driving to the next level is not put on a single player, equalising the **distribution of power** and simultaneously allowing all players equal opportunity to focus on *reevaluating* rather than driving. In this configuration, the player who feels the least need to *reevaluate* can contribute by driving whilst the others can focus on the discussion. If driving had always been assigned to player 1, this player would always have more elements to distract them from *reevaluating* than the others, limiting their **contribution to group** – and

other under-stimulated players might get frustrated if player 1 stopped to discuss while they want to get to the next LEVEL while the discussion is ongoing.

In general, we noticed that the LEVELS are paced at an intense **tempo**, never relenting or slowing down but instead always adding more **shared goals** and **parallel tasks** to keep the pressure high. This made *reevaluating* hard during the playthrough of a LEVEL, since there was always something that needed to be done through *acting* or *involving*. We noticed several situations where it would have been beneficial to *reevaluate*, and where the players noticed it during their play, but where they refrained from doing so since the urgency of TIME LIMITS and fire hazards took prevalence. Instead, players played through the LEVEL and then started *reevaluating* between levels. To accommodate analysis and description of similar effects in other games, we introduce a new property to the collection called **urgency**:

> **Urgency** is created by introducing a need to perform a task or fulfil a condition within a limited room for action. This limited room for action can be implemented in many ways, such as specifying limited real-life time, as with high **tempo**, or by the task requiring the use of a significant amount of the actions remaining before its completion. If the task is not performed within its limitations, it will fail.

C

Appendix: Collaborative Games Properties

This appendix contains the full property collection of 40 Collaborative Games Properties developed in this thesis project.

The properties come in alphabetical order, and references to other existing properties in the collection are written in ***bold italic***. The properties collection document begins with a refresher of key terms.

COLLABORATIVE GAMES PROPERTIES

KEY TERMS

Agenda & Script

Agenda — An agreement between players on what is to be done, and how the group works towards it. Informed by ***accumulated knowledge***, ***shared goals***, ***shared references***, and ***social code***.

Script — The way one individual responds in each context. Set by experiences and modified by the agenda.

Fit — How well the agenda and scripts work towards fulfilling their intents. Improving fit means working towards *cohesion* (how well the scripts of the group align) and/or *performance* (how well they execute a task), and on an implicit level *adaptability* (how quickly the group performs well under new circumstances).

Accumulated Knowledge — The total assembled (relevant) knowledge within the group. Sets the boundaries of what a group collectively may know—more knowledge leads to higher possibilities of forming better fit agendas.

Shared Goals — The overlap between the goals of individual group members. Gives the agenda a target to achieve and directs the group to work in a more unified direction towards its resolution.

Shared References — The perceived shared understanding and presumptions between group members; what they know—or assume—is known by all participants. Give team members a sense of mutual reference values for more efficient interaction and develops expectations of how the group works towards their goal.

Social Code — How players can behave while remaining aligned with the agenda. Formed by culture, game rules, and the game state, and forms a standard of how players should treat each other.

Interaction Modes

Act — The group members are in an active, performance-focused, solitary mode. Informed by the current script, created explicitly or implicitly, they focus on enacting their individual contributions to the overall solution. Note that this mentality has no inherent relation with spatiality—two players can act right next to each other if they are working on different tasks or sub-tasks.

Involve — The group members reach out to each other to communicate or cooperate on a task together. The motivation for this can be to update other players on how one's own work is going (and vice versa), to synchronise actions so that they are performed in a particular order or within a specific time frame, or because a task requires more than one person to solve and thus inherently involves two people throughout its performing.

Evaluate — The group members have identified a discrepancy—a misfit—in their script and that they must reconsider their approach. Thus, they divert their focus to discussing the problem, questioning their agenda and script to see if the agenda can or must be remade to enable a better fit and thus a more efficient solution.

PROPERTIES SORTED BY CONCEPT

Affording Interaction Modes

Act	Additive Efficiency, Asymmetry, Emergent Structure, Enforced Structure, Mastery, Parallel Tasks, Player Capability, Reactive Actions, Roles, Shared Goals, Tempo, Urgency
Involve	Additive Efficiency, Asymmetry, Challenge, Co-Actions, Co-Location, Communication, Contribution to Group, Dependence, Dilemmas, Distribution of Power, Emergent Collaborative Behaviour, Emergent Structure, Group Presence, Helping, Interdependence, Mutual Experiences, Player Capability, Shared Goals, Shared Punishment, Shared Threats, Social Code, Synchronisation, Team Dynamics, Tempo, Urgency, Vicinity
Evaluate	Accumulated Knowledge, Betrayal/Traitor, Challenge, Changing Conditions, Communication, Distribution of Power, Group vs Individual, Planning, Player Capability, Shared Goals, Shared Punishment, Shared Punishment, Shared Threats, Tempo, Urgency

Affording Different Qualities in Collaboration

Performance	Accumulated Knowledge, Additive Efficiency, Asymmetry, Challenge, Contribution to Group, Dilemmas, Emergent Collaborative Behaviour, Helping, Interdependence, Mastery, Parallel Tasks, Planning, Player Capability, Repeated Play, Roles, Shared Punishment, Tempo, Urgency, Vicinity
Cohesion	Asymmetry, Betrayal/Traitor, Co-Actions, Co-Location, Communication, Community, Dependence, Distribution of Power, Emergent Collaborative Behaviour, Emergent Structure, Group Identity, Group Presence, Group vs Individual, Helping, Interdependence, Mutual Experiences, Planning, Reactive Actions, Roles, Shared Goals, Shared Punishment, Shared References, Shared Threats, Social Code, Synchronisation, Team Dynamics, Vicinity
Adaptability	Betrayal/Traitor, Changing Conditions, Distribution of Power, Emergent Collaborative Behaviour, Enforced Structure, Repeated Play, Shared Goals, Synchronisation, Urgency

Affording Aspects Informing the Agenda

Accumulated Knowledge	Accumulated Knowledge, Additive Efficiency, Asymmetry, Challenge, Changing Conditions, Mastery, Parallel Tasks, Planning, Player Capability, Repeated Play, Roles, Shared Punishment, Synchronisation
Shared Goals	Betrayal/Traitor, Challenge, Co-actions, Contribution to Group, Dilemmas, Interdependence, Parallel tasks, Planning, Shared Goals, Shared Threats
Shared References	Additive Efficiency, Asymmetry, Challenge, Changing conditions, Co-location, Communication, Community, Dependence, Emergent Collaborative Behaviour, Emergent Structure, Group Identity, Group Presence, Group vs Individual, Interdependence, Mastery, Mutual Experiences, Planning, Player Capability, Reactive Actions, Roles, Shared Goals, Shared Punishment, Shared References, Shared Threats, Synchronisation, Team Dynamics
Social Code	Betrayal/Traitor, Challenge, Communication, Community, Contribution to Group, Dependence, Dilemmas, Distribution of Power, Emergent Collaborative Behaviour, Emergent Structure, Enforced Structure, Group Identity, Group vs Individual, Helping, Interdependence, Parallel Tasks, Planning, Player Capability, Shared Punishment, Shared Threats, Social Code, Synchronisation, Team Dynamics, Urgency, Vicinity

ACCUMULATED KNOWLEDGE

Accumulated knowledge is the total amount of disposable knowledge between members of a team. The more accumulated knowledge a team has, the more possible aspects and solutions can they find around game concepts and ***shared goals***. In a way, it is a sort of conceptual action space, but with knowledge.

- The overlap of accumulated knowledge between team members creates a basis for ***shared references***. If the team members know at least some things the same, it is possible to use thing knowledge to infer what each of the does – and conveying this with the means of actions and doings rather than words.

- A way to expand the width of the collective accumulated knowledge of a team is to utilise ***roles*** and ***asymmetry*** *of information* which gives players (unique) insights that they can share with their team if deemed necessary. This assumes that the roles and information given to the players provides them with new knowledge for the team as a whole.

- A large collective accumulated knowledge allows the team to afford a width of considerations regarding understanding game states and goal setting. In other words, it somewhat increases the total competence pool for the team as a whole. However, a too discrepant individual knowledge base may create misfits of scripts and interpretations of agendas as their individual understanding could re-guide individuals' take on the agenda. Individuals may need to **EVALUATE** with each other to have enough ***shared references*** so that they can stay on the same page.

ADDITIVE EFFICIENCY

When a group works well together, their joint effort can outperform the sum of their individual contributions. Such is the case of well ***synchronised*** INVOLVING and divide-and-conquer style ACTING like ***parallel tasks*** or *specialised* ***roles***, where collaboration leads to an increased, or additive efficiency, compared to what they could do on their own.

- Difficult tasks and ***challenge*** motivate collaborating to achieve additive efficiency. Additive efficiency comes at a cost/investment which might hide its benefits from developing players until they have reached some ***mastery***. Look into ways to nudge/reveal its benefits in advance.
- With ***asymmetry of action spaces***, collaborating provides additive efficiency in itself.
- ***Accumulated knowledge*** and ***shared references*** can result in an additive efficiency. This is called the Collective Working Memory Effect and describes how group members, despite not knowing everything by themselves, can create a collective knowledgebase by borrowing information from a group member's long-term memory.
- ***Interdependence*** creates additive efficiency: players specialise to create a strength while depending on others to cover weaknesses. It also strengthens Collective Working Memory.
- It seems that players prioritise additive efficiency over their own autonomy. Therefore, creating strong affordances for additive efficiency might be a way to afford that players engage in group-centred choices when it comes to ***group vs individual***.
- Let additive efficiency be a reward rather than a difficult base requirement. If you balance the game expecting players to have additive efficiency, the game might feel too punishing for players whose script and agenda are not fit enough. By letting additive efficiency be an expression of power over the system, collaborative behavior becomes its own reward. If collaboration is optional, the game should typically not be balanced expecting additive efficiency.

ASYMMETRY

Asymmetry is when the gameplay behaves differently for different players on a Mechanics level. They can have different game mechanics, possess different information on the game state, different access to resources, differing goals or differing challenges to face.

The prime use of these asymmetries is to design the **ACTING** of each player to be distinct and unique, but many games that implement asymmetry puts a larger focus on what happens when these differing players **INVOLVE** each other by utilising asymmetry to create *complementarities* and/or various forms of ***dependence***.

- If there are differences in gameplay between players but everyone can still achieve their respective goals, asymmetry is implemented without requiring any form of ***dependence***.
- If asymmetry is implemented and everyone can achieve their respective goals but collaborating with a player of different asymmetric properties would provide benefits or new options, asymmetry leads to *complementarity*.
- Implementing asymmetry can easily be made to lead to ***dependence*** by having a player's goals require asymmetric features that only other players have access to. This leads to either *unidirectional dependence*, where only one party depends on the other, or **interdependence**, where both parties depend on each other for different features and reasons.

By extension, the forms of **INVOLVING** and dependencies that asymmetry creates often give strong affordance for **EVALUATING**, since the group needs to involve the respective asymmetric parties in the discussion and planning.

Implementing Asymmetry

Asymmetry is about providing different Mechanics to different players - a tool that designers have next to full control over. Theoretically, this means that designers can make most anything they offer to players asymmetric simply by providing different subsets of the complete feature set to each player. Common game elements to implement asymmetry in includes *access*, *action space*, *information*, *resources*, ***goals***, and *interface*. It might also be useful to frame *progression* and ***player capabilities*** as asymmetries over which the designer has less direct control.

Asymmetry of Access

Limiting access to areas to only allow some players can open up for ***contribution to group*** and ***distribution of power***. Typically, such access is spatial, but it might also be tied to other variables like time, such as only letting guards be there at night. Although usually combined with *asymmetry of action space*, asymmetric access can create ***dependencies*** between players with otherwise identical action space.

Asymmetry of Action Space

Create asymmetries in the action space by varying the available game mechanics between players. Limits in action space can be tied to the player characters, or to specific equipment which allow players to redistribute the asymmetries amongst themselves. Compromising between the two are "skill trees" where players choose which subset of game mechanics their character have available to them, allowing for *specialisation* (see **roles**) through character development—a form of ***emergent structure***.

Asymmetry of Information

Push players to **INVOLVE** by giving each player complementary subsets of the overall information on the game state. This builds a strong foundation for creating ***dependence*** between players, since understanding the situation they're facing creates a need for **INVOLVING** and **EVALUATING** to create a higher fit of ***shared references***. If their ability to communicate information is restricted, this need generates ***reactive actions***.

Asymmetry of Resources

Providing different players access to different resources pushes them to **INVOLVE** each other to acquire resources for themselves. This can be a foundation for overlapping or complementary goals, affording the creation of ***shared goals***, as it encourages players to pay attention to each other and potentially offer ***help***. Trading is an example of how players with complementary goals **INVOLVE** in a brief collaboration to provide each other with the resources they prefer over those they currently possess.

Asymmetric Goals

Providing players with different goals can open for ***emergent collaborative behaviour*** in two ways: either by lacking reasons to conflict with each other compared to the benefits of collaborating, or by identifying overlaps in the goals which can provide the ***shared goal*** basis for an agenda. While overlapping asymmetric goals might prove to have insufficient shared features for long-term collaboration, they form an excellent growing ground for temporary alliances.

Another way to make asymmetric goals is to have conflicting goals within the party, which enables advanced dynamics like ***group vs individual***, ***dilemmas*** and ***betrayal/traitor***.

Asymmetry of Interface

Creating asymmetries in interface can offer more ways for players to engage with a game. These can differ in both output, such as how information is presented to the players, and input, such as which controllers a player uses. Although asymmetry of interface might arguably be easier to create in digital games, it can also be used to create co-actions or interdependencies in teambuilding games. Asymmetry of interface often inherently includes some *asymmetry of action space* or *asymmetry of information*.

Warning: Asymmetry of Player Capabilities and Progression

The inherent ***player capabilities*** might create a form of asymmetry unintended by the designer. Although not deliberately designed, it can be useful to consider these as asymmetries since they create similar affordances. As such, we speculate that design choices which restrict asymmetry might be utilised to restrict the effects of ***player capabilities***. A similar discussion can be had on ***progression***, ***mastery*** and any resulting power gap. Consider which ways you might encourage these players to still involve each other, such as ***vicinity*** or ***co-actions***, and how your ***distribution of power*** is built.

BETRAYAL/ TRAITOR

Betrayal is the deviation from the shared agenda to benefit oneself at the expense of the group at large. It can occur as a result of conflicting goals or drives. Traitor is similar, but a traitor has his or her own agenda from the start and works towards sabotaging the other's agenda or work while staying hidden. The inclusion of known possibilities for betrayal/traitors induces uncertainty in a group, which forces both individuals and the whole group to repeatedly **EVALUATE** the situation both for themselves and the group.

- The inclusion of betrayal/traitor patterns may not work well for all circumstances. The possibilities of tension and mistrust makes for possibilities of social ***dilemmas.*** This may be problematic to include in casual gameplay. It may also be too demanding to implement in highly challenging environments, as these tend to be **ACT** focused, making it hard to consider elements needed for **EVALUATING**.
- The apparent possibility of traitors changes the way social interactions and ***communication*** occur. The exchange of ideas may slow down and inherent mistrusts may make people apply more working **ON-YOUR-OWN** as they consider the risks of getting betrayed an additional teamwork load.
- Betrayal can occur simply due to a conflict in goals or the prioritisation of them.
- It still appears that competitive games and games involving betrayal/traitor elements can still be used to form togetherness. A game session may result in a good story and ***mutual experiences*** which may help forming a feeling of togetherness.

CHALLENGE

Challenge directly increases task load and possibly also communication load as things become harder. For this reason, increased challenge often results in more **INVOLVE** and **EVALUATING**.

- Make failure a strong possibility: People play games together because they want to play together, that is, they want to solve problems together. For this reason, do not be afraid to make the game hard. Making games hard will increase the will to **INVOLVE** and **EVALUATE** the situation together and parts of the puzzle is to be able to co-solve it as a group activity. Research indicates that people do not mind failing as a group too much, as long as they can keep trying (accommodating ***repeated play***).

- A way to challenge players is to restrict their access or means for ***communication*** in certain situations. This will make the need for a fit script higher, requiring players to **EVALUATE** and **INVOLVE** thoroughly – especially in challenging games.

- A way to afford increased challenges is to reward advances in ***synchronisation, planning*** and ***reactive actions***. Making these more efficient increases the team's ***mastery*** as well as their total agenda fit. Thus, to make teams be able to meet increased challenges, rewarding the above stated qualities can work as a stepping-stone to a more advanced script.

- Another way to afford increased challenges is to reward ***interdependence***. Again, ***interdependence*** has been found to be basis for collaboration in games—and rewarding it could make possibilities to present the group to more challenging gameplay.

- Another way to create challenge in a team is to create tension between ***individual vs group***. This increases the burden on the players as they need to consider short and long-term effects of their own winning versus group. The tension may provoke more **INVOLVING** and **EVALUATING** as it creates a sort of ***dilemma*** between the players. See also ***betrayal/traitor.***

- Let ***additive efficiency*** be a ***reward*** rather than a difficult base requirement. If you balance the game expecting players to have ***additive efficiency***, the game might feel too punishing for players whose script and agenda are not fit enough. By letting ***additive efficiency*** be an expression of power over the system, collaborative behavior becomes its own ***reward.*** If collaboration is optional, the game should typically not be balanced expecting ***additive efficiency***.

CHANGING CONDITIONS

Changing conditions is a property that necessitates an overhaul of the situational script and agenda as the previous conditions may no longer apply. The designer can use this property to deliberately break the fit of a group's agenda or script, which, depending on the scale of the changing conditions, affords the team to either **EVALUATE**, or **INVOLVE**. As the members cannot utilise their previous strategy, they may need to come up with something that answers to the new conditions. The affordance is more likely to succeed if the changing conditions applies for all or more than one team player.

- Changing conditions relates to ***shared references*** as teams with a strong repertoire of shared references may be more likely to quickly understand each other. Depending on their ***social code*** and their total ***accumulated knowledge***, the less effort has to be spent on elaborating thoughts – which may require the group to only **INVOLVE**. Typically, however, a team exceeds the evaluation threshold which affords them all the way up to **EVALUATE**, either directly as the changing conditions appear, or at a later stage due to ***urgency***.

- **Mastery** may be a factor that also reduces the need from **EVALUATE** to **INVOLVE**. Even if the situation is new for the individual player(s), if they have a high mastery, they may be able to deal with the opposition alone without thoroughly discussing and **EVALUATING** the situation or agenda.

- Even for situations familiar for the players beforehand, a sudden changing condition may still wreak havoc of a team's agenda and scripts' fit, especially if they may are currently **ACTING** on ***parallel tasks***. However, the more ***shared references*** and ***mastery*** players have, the more likely they are to quickly reach a new fit in an agenda through **EVALUATING**.

CO-ACTIONS

Co-actions are game mechanics that require synchronised action from multiple players, either simultaneously or, less typically, in quick succession. Classical examples are two players carrying an object too heavy for a single character, pressing two buttons on opposite walls, or combining two actions for a third, new, action or effect. Co-actions are inherently about **INVOLVING**, since they do not allow for **ACTING** alone but always require at minimum ***reactive actions*** where both acknowledge each other. The player-to-player interaction and resulting ***mutual experiences*** that co-actions bring can give strong enough response to be used as the core game mechanic, defining the gameplay.

- A co-action can be considered a ***dependency*** on a task level rather than on a gameplay level, since a player cannot fulfil the co-action without the help of another player. As such, a designer can utilise the multiple insights about ***dependence*** and ***interdependence*** to create interesting co-actions outside of the typical examples.

- Continuing with the ***dependence*** similarities, co-actions can exist on a coupling spectrum like those of ***interdependence***
  - At the looser end of coupling are *combined* co-actions such as team combos or holding down buttons to open a door for another player to move through.
  - At the tighter end of coupling are classic forms of co-actions where both players interact simultaneously and often continuously for a combined effect, such as moving heavy boulders together.
  - In between the two there are *co-actions with unified input*, where a game object has properties defined by the net input of both players. If both players are limited to moving within the space shown by a shared camera angle, moving the camera so that the group could move further in some direction is such a co-action.

- ***Roles*** may be a foundation for the use of co-actions and who should partake. The utilisation of ***roles*** can be formed to have a privileged access or be a necessity for certain co-actions.

- If co-actions are not necessary for reaching the end state in your game, they open for ***emergent collaborative behaviour*** and can reward such by expanding the action space of a player with access to features or areas unavailable in independent play.

- When designing co-actions, remember that the players performing it are autonomous agents that **INVOLVE**. If your co-action gives no indication of each autonomy at work on it, your players will have a very limited ability to read how the co-action is affected by the inputs—their own and others. While an argument could be made that doing so creates a need for players to ***communicate*** and ***synchronise*** their efforts, it also shuts down the player's abilities to read ***contribution to group***, take ***reactive actions***, and indicate intent by any other means than non-diegetic ***communication*** through some ***communication*** *channel*.
    - This is particularly important in co-actions with unified input, since the input of both (all) players have immediate consequences for the co-action. We suggest therefore that there should be some "give" in these co-actions so that players can identify changes in the behaviours of others and infer intent from those changes.

CO-LOCATION

Being co-located allows for natural ***communication***, which lowers the overall communication load compared from being dislocated. This, in turn, makes it easier to both **INVOLVE** and **EVALUATE** compared to when playing separated from each other. ***Communication*** may be performed with voice only, but the co-location of interlocutors will help convey more things easily as body language helps a lot in conveying information. Even video conferencing will not be enough as you cannot change the angles. In the end, co-location helps build a natural spatial setup that affords natural ***communication***.

In other words, developing ***communication*** *channels* for dislocated setups that feel natural and co-located could result in some really good ***communication*** – but it is also one of the biggest challenges.

- Technology today is generally bad at mimicking co-location when being separated. There have been some advances in the virtual reality industry but communicating online is still not on par with physical co-location. If high-end ***communication*** is very important for a game experience, consider making the experience physically co-located, or creating ***communication*** *channels* as close as possible to those of co-located play.
- Being co-located makes it easier to ***synchronise*** with each other. In the end, this may also make ***planning*** easier.
- Co-location gives the opportunity for mutual oversight. The effect of a shared screen, for instance, is that team members may see exactly what the other team members are seeing, as well as their posture. This can make inferencing and answering to each other quicker and seamless. Due to this, a co-located setup may make ***limiting communication*** somewhat harder.

COMMUNICATION

Communication is one of the most essential aspects of collaboration. Without communication, it is hard to exchange ideas, so it is hard to form an agenda or script without it. This makes an interesting opportunity: for by controlling communication, you do, to a large extent also control the collaboration space.

It can be argued that communication, and verbal communication in particular, manifest which state a group is collaborating in. One may note that for our three states **ACT**, **INVOLVE**, and **EVALUATE**, it may be hard to find signs of **INVOLVE** and **EVALUATE** without considering communication elements.

- High communication and ***interdependence*** have been found to positively predict player experience, and reduced frustration.
- ***Interdependence*** has been found to produce more elaborate types of communication.
- *Communication channels* are the foundation of how team members can collaborate in games. If there is only a text chat available, that will affect the flow of ideas and concepts. For elaborate communication, efficient *communication channels* allowing richness of information need to exist. An easy and natural variant of this is *voice chats*, though there are several other alternative ways to convey ideas.
  - Remember that, in the modern day, players can often add communication channels that were not intended by a designer such as a third-party voice chat.
- Limiting communication is an efficient way to force the collaboration levels down from **EVALUATE** to **ACT** or at least **INVOLVE**. Since limiting communication makes it harder for people to exchange ideas, individuals will need to rely more on themselves and their abilities. The less communication, the more **ON-YOUR-OWN** the players are likely to be.
- The need for communication can be increased using ***asymmetries*** like ***asymmetry*** *of information*. As players see things from different angles or from different information ground, a need to convey these points increase.

- Communication takes effort and has a cost on mental processes. If it does not seem to be worth the effort, players may not communicate with each other.
- Communication allows teams to distribute workload among team members. This gives individual team members the opportunity for *specialisation* (see ***roles***), as players can focus on different things.
- Communication allows for ***synchronising,*** *strategising, and* ***planning.*** This is because without communication, it is hard to exchange intentions and ideas, needed for these three doings.

POTENTIAL COMMUNICATION CHANNELS, A SELECTION

Diegetic voice	-	In-game voice behaving as though coming from the characters themselves.
Squad radio	-	In-game voice channel between a limited amount of the available players, usually a subgroup within a larger team.
Captain's radio	-	In-game voice channel between one player from each subgroup within a larger team, enabling ***synchronisation*** between subgroups.
Natural (co-located) communication	-	Players using their own voice and body language within a co-located space, inside or outside the game itself.
Extra-game voice/video chat	-	Voice or video channel used from outside the game itself, meaning the game itself has no influence over how the communication behaves.
Text chat	-	Availability of in-game chat functionality to send messages to each other.
Symbols	-	Limited in-game chat functionality, using only abstract symbols which players need to interpret. Opens for interesting interactions but fraught with potential for mismatches.
Gestures	-	Visual communication through body-language or animations. Examples span from \wave emotes in *World of Warcraft* to games of charades.
Actions	-	How a player acts and don't act can hold implied information in itself for attentive co-players. For example, see ***reactive actions***.
Environmental communication	-	Creating in-game artefacts representing what one wishes to express, e.g. placing block to shape words, drawing in snow, or written diegetic signs.

COMMMUNITY

Communities allows individuals to relate to a culture and a group. Some games are instanced to a pre-defined set of members who play together, but some games such as MMORPGs have a more fluid discrepancy of this circle. Being a participant in a game or identifying with a game may form a community on its own merits. The term is therefore a bit ambiguous, as it can consist of a larger or smaller sample. For simplicity, we see communities as the common culture formed by many individuals. Determining what number is "large enough" is left to the designer.

Communities give a shortcut to certain shared symbols and understanding, which over time forms ***shared references*** between individuals which in turn helps both individuals and groups base a shared agenda. The agenda naturally becomes more fit as members of the community become more and more alike each other. The similarities between members of a community can ease the formation of relationships between people who have never met like an extended form of togetherness.

- Communities are at least partially dependent on ***social code.*** The social code between individual forms the basis of how to communicate and interact with each other.

- Ideas and concepts can cascade between groupings within a community: this means that in order to induce a thought process or idea into a community, one may only need to contact key hubs of groupings in the community, and it will naturally spread to others. However, this also means that some things will seemingly never leave a community. A healthy community has to be cultivated and will not change overnight.

CONTRIBUTION TO GROUP

Players engage more in group efforts when they feel that what they are doing brings meaningful benefits to the group. Similarly, how other players engage with a player is affected by their apparent contribution to the group. Consequentially, everyone has a vested interest a clear interface between player, action, and results and how these benefit the group

- Make players feel they contribute to the agenda. Ensure that they can tell what actions they take, what immediate results these bring, and how they forward the group's ***shared goals***.
- Make the collaborative elements of these actions visible to the rest of the group as well. A partner's action is better received when that partner overcomes their own challenges in order to make a meaningful contribution to the team.
- Use caution, however: players will rather stay passive than make a bad contribution to the group. If a player worries their actions might hit the group with ***shared punishments***, this might mean they consider it a ***dilemma*** and might get stuck with analysis paralysis. Additionally, players get less committed to the team if they see partners not doing their best—or worse, hinder it.

DEPENDENCE

Dependence is gameplay which requires one player to rely on another player in order to fulfil their goals and reach an end state. Typically, dependence utilises ***asymmetry*** and creates instances where the player needs the asymmetric properties of another player to advance. Dependence increases the need to **INVOLVE** group members as the individual players cannot cope with their challenges or tasks alone and must relate to each other.

- Make dependence interactive: see, for example, ***helping***.
- *Unidirectional dependence* means that one player relies on another player, but not the other way around. It often takes temporary forms, such as *helplessness*, where a player is rendered unable to **ACT** until another player aids them. Many trust exercises also centre around one individual surrendering to a unidirectional dependence towards another player.
- *Co-dependence* means that both (all) players depend on each other to provide an effect, but the effect provided is identical. If all player can heal others but not themselves, healing is a game mechanic that brings co-dependence. Co-dependence shows that one can make players dependent on each other without ***asymmetry*** and the additional work asymmetry requires. (See also: ***vicinity***)
- ***Interdependence*** means that both (all) players depend on each other to provide an effect, and that the provided effect differs between players. This dependency has been used and researched significantly, warranting discussion on its own—see ***interdependence***.
- Dependence fosters the need for ***communication*** as one agent or one type of agent sits on the capability to deal with the problem while the other one sits on the problem.

DILEMMAS

Dilemmas, or social dilemmas, can give rise to tension between individuals and group members. It gives players an urgent topic to either individually or group-wise **INVOLVE** or **EVALUATE** around. The tension makes it rather demanding but overcoming it may result in a stronger fit in the agenda.

- ***Betrayal*** is a form of social dilemma, as its potential existence
- Presenting dilemmas can work as a breeding ground to reach out: Giving players the opportunity to for instance ***betray*** but where it results in no ***betrayal*** may result in transforming tension to more *trust*, consequently increasing the cohesiveness of the team and by extension the ***shared references***.
- Antagonistic social dilemma is a high-risk high-reward tool: Putting players against each other can result in some very interesting ***mutual experiences*** but it also requires more effort which can be affected by a large number of things. Antagonistic social dilemmas changes the tone of the game which may not fit casual gameplay.
- The use of conflicting goals may give rise to social dilemmas in groups, where for example a distribution of resources or tasks may result in a dilemma for group members to prioritise one or the other.

DISTRIBUTION OF POWER

Team dynamics are affected by the distribution of power or agency within the group, that is, the ability to fulfil their goals and enact their intent upon the game. With higher power, be it from in-game agency, ***player capabilities***, ***mastery*** or status in out-of-game relationships**,** often follows an expectation of authority, where they get and/or expect more say over the decision making than their less powerful peers. This phenomenon, sometimes referred to as *alpha players* or *the quarterback problem*, can be an issue to collaboration as it limits the ***contribution to group*** of other players and hence lower their commitment to and investment in the group. This section outlines a few potential ways to redistribute power between the players.

- ***Asymmetry*** and ***interdependence*** can limit the control a single player has over the game state, opening for other players to have their exclusive areas of ***contribution to group*** and ***mastery.*** Similar effects can emerge in gameplay from **roles,** once players start specialising in relation to each other.

- Allowing a player to make decisions which affect the entire group, or which mandate the outcome of another player's actions, could highlight problems with competitiveness by amplifying the effects of egoistic behaviour all the while offering more players options to override or punish too independent **ACTING**. Their existence, and the worry of someone using them, might prompt powerful players to **INVOLVE** and **EVALUATE** with group members.

- The way players relate to each other in the game, through ***social code*** and ***team dynamics***, strongly influences on play experience. Naturally, these are also affected by pre-existing relationships. Consider what you can do to play with pre-established expectations, such as a reverse in the responsibilities of each player.

- Sharing resources within the group can lessen the risk to explore and learn how the game works or trying out options less safe than otherwise. At the same time, excess spending of shared resources might lead to players blaming each other for a lacking ***contribution to group*** and complicate ***group vs individual.***

- Distributing ***parallel tasks*** means surrendering power to another player. To create affordances for this, you could provide a need for ***parallel tasks***, such as having multiple simultaneous threats of similar ***urgency***.

- Since ***co-actions*** are highly ***dependent*** and essentially require players to be **INVOLVING** or **EVALUATING**, they can provide affordances for players to ***communicate***, **EVALUATE** and ***planning***.

- Another option is to go the opposite way my minimising the ***communication*** allowed, limiting how far a powerful player can instruct and control their partners.

EMERGENT COLLABORATIVE BEHAVIOUR

Emergent collaborative behaviour discusses all forms of unexpected or at least unrequired collaboration—that is, whenever the game itself has not set explicit requirements of collaboration, but collaboration still happens. Distinguishing it on its own is useful first and foremost to gain an overview over what affords spontaneous collaborative behaviour. Emergent collaborative behaviour typically initiates when **INVOLVING** with other players, although ***reactive actions*** can also provide it to a lesser extent, perhaps even unknown to the players involved.

- Emergent collaborative behaviour can appear in any multiplayer game where two or more players can interact—either in-game or through 'meta-game'—and reap benefits of such behaviour. An example of meta-game collaboration can for example be sharing tips and tricks through the available ***communication*** *channels*: they create ***shared references*** of the game, with the ***shared goal*** of increasing the ***mastery*** of both or either party, with a ***social code*** that permits for guidance rather than expecting every player to learn on their own.

- Letting players discover mutual benefits of collaborative behaviour, rather than enforcing it, bundles ***contribution to group*** and ***mastery*** and can allow the two to fuel each other. These mutual benefits could sometimes be enough to motivate collaborative behaviour in itself; in terms of an agenda, it could be considered a ***shared goal*** of providing each other the mutual benefits, strongly tying the ***shared goal*** to a ***social code*** rather than a specific outcome. Give players the tools needed for mutual support and they will find reasons to do so through emergent collaborative behaviour.

- As players gain ***mastery*** over the game, there will inevitably be a learning curve also to collaborative behaviour. When setting up the ***challenge*** of a game, consider that players will vary in their affinity for collaboration with increasing ***mastery***. If collaborative behaviour is not enforced by the game but provides additional benefits and advantages, this variability is heightened further since the benefits might not be discovered until much later.

- You can create affordances for collaborative behaviour in games by including instances where ***co-actions*** or ***synchronisation*** requires two or more players to **INVOLVE** each other. If these elements are not required for completing the game, the collaboration is emergent.

- Players who choose themselves to collaborate could experience a stronger sense of togetherness with their partners than that of enforced collaboration—but this must be balanced towards the lesser likelihood of collaboration happening at all. (See also ***enforced structures***.)

- Using emergent collaborative behaviour, we can see the Reform Journey model being used to describe instances of spontaneous collaboration. To begin with, there is little behavioural difference between **ACTING** and playing without a group—except for the existence of a ***shared goal*** with some other player. If two lone players have any point of mutual gain, they might start to play and react to each other, adjusting their script by what the other person does in a way very similar to ***reactive actions***. The players then start creating norms about how to treat each other, which might escalate into **INVOLVING** each other. If they then **EVALUATE** their norms together to create a ***social code***, they have created an agenda and are now in full-blown collaboration.

EMERGENT STRUCTURES

Emergent structures concern how a group, through repeated collaboration, might consolidate specific ways of behaving—thus creating a structure or pipeline for how things are to be done. The way something is used emerges from the situation and repeated use. As such, realise that reform through any means (**EVALUATING**, ***synchronisation*** or ***reactive actions***) might mean a crystallisation of norms that were not expected by the design. After a while, this also creates a form of ***shared references*** if it is crystallised in a similar way between multiple individuals.

- If group members devote themselves to a ***role*** to the degree that they *specialise*, sacrificing one aspect of gameplay to double down on another, they create an emergent structure where they assume ***dependency*** or ***interdependency*** towards other group members to cover up their weak points.

- Depending on the context of the game and its players, command structures might emerge. The structure of these can reflect the game-based social statuses, which can be manipulated by giving additional power or importance to certain ***roles*** or via ***asymmetry***. Consider, for example, what you might do to nurture emergent structures that might differ from how the players normally treat each other outside the game.

- Another emergent structure can occur when players, through **EVALUATING**, opt to reconstruct gameplay through house rules or changing their function. The more control a player has over the gameplay, the more likely these forms of structures are to emerge. In tabletop roleplaying games, players direct much of the gameplay and can therefore create emergent structures easily. In board games, the onus of enacting system behaviour and game state changes often lies on the players, which ultimately means that they can override the system behaviour and reconstruct gameplay in a way that suits them more. In digital games, the system is typically more independent and self-sustaining, leaving less ability for players to reformulate it. However, they can always affect the gameplay experience through revising elements they are in control over, such as changing the ***social code*** of what actions they allow players to take or how to relate to one another.

ENFORCED STRUCTURE

Enforced structures are boundaries or constraints which forces players to behave in a desired way. This can be a quick way to get players to a desired minimum level of interaction; however, the collaboration risks growing less genuine and motivating for the group members.

- Don't overly force cooperation, motivate it: There are many tools presented in this collection that could afford and spur collaborative behavior. In some circumstances, a bit of coercion may be needed to get people onto the right direction, but the effort put into collaborating is usually stronger if players take active part in creating the agenda.
- Enforced structures can be useful in some respects, such as ensuring that no player is left behind by requiring the group to gather at designated spaces (e.g. a checkpoint) before anyone can proceed.
- Enforced structures might also provide an icebreaker or scapegoat for the players, where they can blame the structure for their failure rather than each other. This could help their *cohesion* and togetherness—but beware: this happens at the expense of creating dislike around a part of your game. This has some similarities with a ***shared threat***.
- Players don't need to be "tugged around" as much in collaborative play; they have each other. Trust that they will be able to solve problems and explain things to one another.

GROUP IDENTITY

Group identity is an expression for the distinguishing character or essence of the group. In addition, it also relates to a player identifying with the group. Rather than relating to a Reform Journey interaction mode, group identity relates more to the ***social code*** within the agenda. As an Aesthetic element to the game, however, it can affect the motivations behind participating in the Reform Journey and how players work through it; there are indications that as identification with a group increases, so does trust**,** ***contribution to group***, and group efficiency (*performance*).

- The sense of group membership form easily if there is some way to distinguish between the those within the group and those outside it. A clearly distinguished foe, such as a ***shared threat***, can provide a shorthand for identifying with others in the same situation and affording the creation of groups—as can adding similarities like team colours or diegetic relationships to players between which you want to promote group identity.

- It seems stronger group identity might relate to treating a success more as a group success than an individual success, strengthening shared commitment and togetherness**.** This does not mean that they don't acknowledge ***contribution to group***, but that they are prone to consider everything as ***shared rewards.***

- Shared Symbols and emblems may help a group both express and form ***shared references***. Giving players symbols that is exclusive to them creates a stronger "we"-sense, a group identity. Having more things in common increases group belonging and helps the group relate more to each other, consequently leading group members to **INVOLVE** each other more. Thus, shared symbols facilitate the transition from **ACT** to **INVOLVE**. Also, knowing that another player mirrors oneself, showing that they are on the same page, helps the utilisation of a more fit **INVOLVE** and **ACT**. Shared symbols could therefore, in the long term, somewhat increase the fit of a team's agenda.

GROUP PRESENCE

Group Presence is the experience of being present with others and being together. Feeling presence of others can itself be a motivator for social interaction and may also be a basis for togetherness. In the long run, group presence helps develop a feeling of belonging, resulting in a more cohesive unit.

- Group presence can be formed from a 'joint attention' towards the same object. It is tied to ***shared references*** as it helps inferencing when individuals know their co-subjects are focusing on the same thing(s) and see the same things are they are.
- Group presence and ***group identity*** has been found increase effort towards working in a group. It makes players more involved with each other and more involved in each other's success.
- Group presence can be afforded by inducing a clear in-vs-out identity, so-called *In-group vs Out group*. A ***shared threat*** can fill such a function.
- In order to base ***group presence*** with others, it is important that they are able to track each other and stay aware of each other. Players need means for this, either via the graphical interface or diegetic components inside the game.
- Being ***dependent*** or ***interdependent*** on each other has been found to induce higher feelings of group presence.

GROUP VS INDIVIDUAL

Group vs Individual is the dynamic ***dilemma*** created by conflicting goals. It creates a tension between individual gains and group gains, where the individual gain is often more apparent and immediate, but the group gain usually positively affects others on the group level. For collaborative games, the goal is to make players prioritise making a ***contribution to group*** rather than to oneself, while still giving the opportunity—and possibly the temptation—to prioritise oneself.

- A way to counteract too much individualistic play is to make the game or task too big to deal by oneself. Simply speaking, if it becomes too much of a ***challenge*** to deal with alone, players will try to turn to the group instead.
- The more tempting it is to choose the individual option, the more significant the act of choosing the group option will appear.
- Be careful with using guilting to promote group in favour for the individual gains. It could be used to form ***mutual experiences*** but guilting can make players feel like they are losing agency for the sake of the group.
- Another way to reduce individualistic play is to make players *specialised* (see ***roles***) and ***dependent*** on each other, as it over time develops a group thinking and ***group identity***.

HELPING

Helping is a type of scenario where one agent requires help from another agent. Helping can create a form of situational interactive ***dependency***. The ability to help team members gives some interesting opportunities/conclusions:

- Helping allows for greater risk-taking. This makes it possible to divide **ACTING** between members to **INVOLVE** each other in case of emergency or need. In the long run, increased risk-taking could lead to a faster exploration of the action space, granting more ***mastery.***
- Severely punishing effects encourages helping. If the game punishes the player for mistakes, or is very hard to deal with, helping each other may become a necessity. Punishing effects together with helping give material for problem solving and discussion (**EVALUATING**), but also room to come back in case things don't go the full way. (See also: ***shared punishments***.)
- Helping is a way to make ***dependence*** interactive.

INTERDEPENDENCE

Interdependence is a form of ***dependence*** where, in order to fulfil a goal and/or reach the end state, both (all) players depend on each other to provide an effect, and where the provided effect differs between players. Interdependence requires some form of ***asymmetry***, whether pre-designed or player-created through ***emergent structures***. Like other forms of ***dependence***, interdependence increases the need to **INVOLVE** since they rely on the properties or actions of each other.

Interdependence has been shown to increase enjoyment and interest as well as lessen frustration, and if players have a ***shared goal***, interdependence reduces the tension perceived in the game. Furthermore, it has been showed that interdependence increases relatedness and interpersonal trust whether playing collaboratively or competitively, indicating that it increases togetherness. This might be because it increases the amount of **INVOLVING** done during the game, which is vital for ***mutual experiences***.

- Since no player can do everything, interdependence is a democratising force that distributes power between players. Similarly, utilising interdependence highlights an individual player's ***contribution to group*** which fosters engagement and ***communication***.

- In interdependent settings, it has been found that *conversational turns*, the number of times conversational partners switch between speaking and listening, fully mediates interpersonal trust. This provides us with a handy playtesting metric for trust formation in games.

- We can consider interdependence to exist on a spectrum, called *coupling*, of how much players need to **INVOLVE**.
  - At the far end of loosely coupled interdependence, the players can **ACT** independently throughout almost all gameplay, but their outcome might be defined by what others do. This opens for ***parallel tasks*** and is typically the outcome of ***roles*** specialisation.
  - Meanwhile, in tightly coupled interdependence individual actions require the participation of both (all) players within a short timeframe, like ***co-actions***. This coupling sets a stronger need for ***synchronisation*** and significantly reinforces the group to **INVOLVE**. Although appreciated by players seeking a more advanced ***challenge***, it can prove frustrating and/or tedious for others.

- Consider what possible ways you can vary up the interdependence over time. This can provide a useful way to alter the fit of the individual scripts within the group, improving their adaptability by providing them with new but familiar ***challenges***.
  - You can alter who has a ***dependency*** on whom for a feature or action,
  - You can have multitudes of various interdependencies, each of which only become relevant at interspersed occasions,
  - You can alter the interdependence coupling to increase or decrease the group's ability to transition between ACT and INVOLVE, and/or to increase or decrease the ***challenge***.

MASTERY

Mastery is an increased level of skill (and knowledge) that is generated over time through learning. Becoming adept or masterful in an area can help reducing task load tied to the area, which can help individuals and teams cope with different levels of problems. Since the overall task-load is reduced, the need for ***communication*** and EVALUATING may be reduced as well. On the other hand, masterful players have more available mental workload available to them, should they desire to communicate. Furthermore, the risk of ending up in a state of ON-YOUR-OWN is also reduced and the game would need substantially more ***challenge*** for it to occur.

- Mastery makes players feel more capable and in control, this can help players open up to other players.
- Acquiring mastery requires effort. Players will not become good at something unless they try, so inducing mastery is for designer partly about inducing motivation and effort. If players want to become good at something, either because of a storyline or gameplay mechanics, they will naturally also become better at the game.
- However, just playing a game will make players gradually become better over time, either through prolonged exposure or through ***repeated play***. If one want ***challenge*** to be a part of the game, this needs to be in consideration. Later levels should be objectively harder than early levels to compensate for mastery.
- Mastery can form ***asymmetries*** between team members. If certain members master things differently or become masters in different areas, it creates a natural asymmetry of knowledge and skill. To some extent, this is good as it creates emergent ***roles*** as well as opening up for ***interdependency***. However, players need to have enough ***shared references*** to keep relating to each other. If a trajectory for a team proceeds to increase the asymmetry of knowledge and skill, something needs to be done to tie the players together.
- The acquisition of mastery can be made easier with guidance: if it is important gameplay-wise that players increase in mastery, provide means just in time for them to learn and study their gameplay.

MUTUAL EXPERIENCES

Mutual experiences is the recognition of experiencing something together as a group, becoming a common "story" between them which can itself work to form togetherness between group members. Sharing a story with someone can make the individuals relate to each other more, as they over time develop ***shared references***. Just having mutual experiences can therefore slowly develop the fit of a group as they have things in common, viewing more things the same.

- Mutual experiences require awareness and presence of others: One important aspect of mutual experiences is that it can be important to let other team members know what the others are doing. If they cannot keep track of each other, it is hard to **INVOLVE** each other.

- Mutual experiences can sometimes be the whole reason for people to play together – to experience something together. One should therefore consider toning back the ***challenge*** of gameplay or certain gameplay sections where the most important aspect is to promote a certain Aesthetic or experience. That said, all experiences are not collaboration.

PARALLEL TASKS

Parallel tasks are essentially distributed, coordinated tasks divided mostly by one **ACT** per individual in a team. It is about performing tasks separately without regards to the others in the team for that specific task; about being able to function in isolation for that specific **ACT**. People work, so to say, in parallel. Parallelization of tasks require individuals to only **ACT** and not **INVOLVE** and **EVALUATE**, as they need only to consider their own tasks. In fact, enforcing **INVOLVE** in parallel tasks may instead evoke frustration.

- To create parallel tasks, present players with multiple simultaneous ***challenges***, threats or opponents which are too many to handle within the action space of a single player. This will require different players to focus on different immediate threats, affording **ACTING** rather than **INVOLVING** or **EVALUATING**. It may also be possible to simply distribute tasks spatially so that it is impossible to perform them as a unit, creating ***enforced structures*** requiring parallelization.

- Parallelization creates functional ***roles***, which can make some things harder to perform for some players than others. This can be useful to counteract power gaps from other sources, such as ***player capabilities***.

- Parallel tasks or actions may be performed on an individual or split group basis but may still affect the outcome for the whole group. This creates a form of ***dependence*** or ***interdependence*** between players.

- Efficient parallelization of tasks requires elaborate discussions. While performing parallel actions is mainly an **ACT**-focused endeavor, efficient and good parallelization makes for a better end result. As the idea behind working in parallel is still to work towards a common good, players need to make sure that they are all on the same page. This connects to the formation of shared agenda and a fit script. For this reason, it may be needed to **EVALUATE** the situation before undertaking one's **ACT** responsibilities, or at least to **INVOLVE** the others so that they know what one is doing.

- While performing parallel tasks, it may grow harder to socialise with others as there is less reason to do so. Giving players the ability to join in on the parallel activity of another may help bridge the gap between two players.

PLANNING

Planning allows teams to structure their work together. The higher the ***tempo*** of a game is, the more important it is for team members to have planned beforehand. Naturally, planning gives players a more fit script as they discuss and get a shared understanding of what needs to be done.

Planning can be divided into three levels: *High-level planning*, *Mid-level planning* and *low-level planning*.

- *High-level planning* is mostly focused on developing strategies and defining goals. While in high-level planning, the problem-solving process is integrated in the whole workflow and players can freely move between concepts and ideas. This free space allows the individuals to more thoroughly debate and negotiate their standpoints. This affords the team the possibility for **EVALUATING**.
- *Mid-level planning* is mostly about distributing tasks within a set strategy. Individuals are mostly concerned on meeting the perceived goal and makes shorter utterances towards actions that can lead to the goal or distributing who does what.
  - Mid-level planning and above often require some sort of pause from more hectic play to allow transaction of ideas and more thorough ***communication***. Attempting to do mid-level (or high-level) planning may become very burdensome on the communication load unless there is some efficient codes or training involved. A clear and shared agenda or ***shared references*** may help alleviate some of the burden.
- *Low-level planning* (***synchronisation***) is mostly about answering to micro-actions or imperatives. In a given moment, it is concerned with very short utterances usually requiring a somewhat quick reaction. Performing ***reactive actions*** or ***co-actions*** could be said to include some degree of low-level planning.
  - Internalisation allows for low-level planning: Internalisation and crystallisation helps break down the burden as internalised knowledge and experience require less mental workload to handle.

- A multitude of options increases planning needs. As multiple options exist, the action space expands—leading to more possible outcomes and more reasons to plan ahead.

PLAYER CAPABILITY

Player capability can loosely be explained to be the player's total ability and knowledge acquisition. Similar to ***mastery***, the capabilities of a player may decrease the task load compared to what another player would experience. Hence, to encourage **INVOLVING** or **EVALUATING** might require a harder task for these players. On the other hand, if the task is static a highly skilled player need to invest less mental workload on it, leaving them with more mental availability for ***communication*** with others.

Designing with skill in mind is therefore an important factor if one wants to design for certain types of collaboration, as some things that might be easy for one player can be ***challenging*** for another. This will influence whether team members are willing to invest in **INVOLVING** or not.

- ***Asymmetry*** can sidestep different player capabilities: If a group consist of players with different capabilities, one can design their respective asymmetric elements so that it fits their skill levels.
- Skilled players enjoy harder ***challenges***. One way to increase challenge is to utilise highly coupled ***interdependence*** or ***co-actions***. This will increase the need for efficient and tight ***synchronisation*** which will promote the members to **INVOLVE** and **EVALUATE** with each other.
- A difference in skill may leave players behind: it is important to consider that in mechanically ***challenging*** games. This may result in an emergent power gap—which, if unaddressed, may breed frustration.
- A group of capable individuals forms capable groups: if all members of a group are highly capable, but have not necessarily worked much together, their knowledge and skill will still reduce task load and consequently reduce the need for **INVOLVING**. A way to increase the ***challenge*** for these players is to introduce ***changing conditions*** to the nature of the task. This essentially forces team members to **EVALUATE** their positions.

REACTIVE ACTIONS

Reactive actions occur when a player makes personal adjustments to their own **ACT** to better fit with how others **ACT**. This moves the players toward a more fit solution without the group **EVALUATING** or even **INVOLVING**. While reactive actions offer a very flexible and quick way to improve fit, they usually do so in small increments compared to **EVALUATING** and run the risk of creating deep-rooted misalignments between the individual scripts towards the agenda that might be hard to resolve.

Reactive actions can be considered a Reform Journey on an individual level. A single player can **ACT** alone within the boundaries of the script, then **INVOLVE** in what others do by observing the behaviour of the other. This observation might lead to small adjustments in the player's own actions or it might prompt them to consciously **EVALUATE** the way they treat the agenda or interpret the script. The adjusted script is then used for future **ACTING** or **INVOLVING**; thus, the reform journey is complete. If the journey occurs without the player informing the other(s), these changes become adjustments in the (personal) script—which nonetheless moves the group as a whole towards a better fit.

- Reactive actions are triggered by disruption, where a player notices a change in how others **ACT** or a difference between how they themselves **ACT** compared to others.

- One way to implement reactive actions is to design ***parallel tasks*** so that more than one player or ***role*** have agency over the same variable. For example, if one player drives a tank and another handles the turret, both players influence where the turret is currently aiming - one by turning the turret itself, another by turning the tank upon which the turret is mounted. The shared influence over the variable creates a form of player-driven ***changing conditions***.
  - In these cases, the players are incentivised to continually readjust to each other in order to effectively perform their tasks, leading them to perform reactive actions. Should the necessary adjustments grow too erratic, they will begin ***synchronising*** with each other instead.

- When **EVALUATING** or ***planning***, a group can deliberately devise a *script* which supports reactive actions. By strengthening ***shared references***, a player can prepare solutions that are more suitable for the (upcoming) situation, enabling them to potentially utilise reactive actions to **ACT** in response to a situation that they otherwise would have needed to **INVOLVE** the other player(s) in.

- Reactive actions seek to improve situational fit without **INVOLVING** since that could distract other players from important tasks. Thus, reactive actions can replace ***communication***—but more interestingly, limited ***communication*** can breed more reactive actions as players try to align what they and others do in a shared direction. By extension, reactive actions from limited communication seems to be able to form a type of collaboration with an agenda and script built entirely from ***shared references*** and individual norms. Nevertheless, reactive actions require some oversight between players so that they can see what other players are doing and adjust their approach.

- ***Co-actions*** by their nature require players to **INVOLVE**, however much of the continuous interaction between players will be highly like reactive actions as players adapt to the behaviour of each other without necessarily ***synchronising*** their actions.

REPEATED PLAY

Repeated play allows a team to come back to a game level or game state for more than one try. It allows players to explore alternatives in the action space within a similar context, creating ***accumulated knowledge*** and supporting the development of ***mastery***. Games that are designed for repeated play are usually somewhat shorter, and their variety comes from the Dynamics of how they are played or random events rather than the Mechanic properties within the system. It creates an opportunity for some flexibility and adaptability for the team, rather than merely chasing performance alone.

- Repeated play is a way to let **EVALUATING** occur even in high ***tempo*** games, as it gives a natural pause where team members can afford to be elaborate in their ***communication***.

- Arguably, repeated play can be claimed to exist in every game that is played more than once as long as the group's existence isn't tied solely to the game session itself. After the players stop playing a game, they might discuss their ***mutual experience*** playing (assuming they still have some means of ***communication*** after the session ends), where they reminisce about situations that occurred or explain their thoughts behind something they did. In essence, this discussion is a form of **EVALUATING**, as they build upon their ***shared references*** and create new norms for a potential future agenda should they be playing (and collaborating) again. They might also discuss what they would do differently the next time.

- Repeated play allows ***challenge*** to be a more significant part of the game, as players can return to the same gameplay again and again to explore different ways of utilising the game mechanics and creating ***accumulated knowledge***. This allows for a continuous journey of reforms to increase fit over time. As players play repeatedly, they may perceive a clear improvement of fit, both in terms of agenda and script—their playing is affording them to develop ***mastery***. ***Challenge*** makes this journey appear more distinctively.

ROLES

Roles are a partitioning of responsibilities, which make their distribution clear for group members. This makes collaboration easier as especially ***communication load*** will be somewhat facilitated. By default, clearly defined roles help defining who should be responsible for what, which promotes **ACTING** and lessens the need for **INVOLVE** and **EVALUATE** in situations with a defined agenda.

- ***Dependency*** can be seen as an ***enforced structure*** of roles, since it partitions gameplay into responsibilities that some players must take on for the group to succeed.
- Conversely, utilising roles might create ***dependencies*** between individuals. If group members devote themselves to a role to the degree that they *specialise*, sacrificing one aspect of gameplay to double down on another, they create an ***emergent structure*** where they create ***dependence*** or ***interdependence*** towards other group members to cover up their weak points.
- Roles and responsibilities do not need to be equivalent to ***asymmetry***—they may be fluid and change over time. For example, a role can be tied to an item rather than a character, in which case whoever holds the item has the role.
- Roles often have unique abilities or information. As such, ***asymmetry*** may lead to the formation of roles motivated by how the differences in player properties can make one player perform better at a task—or be the only one capable of performing it at all.
- If the roles are designed rather than emergent, there's always the risk that one role will be considered the 'best' or 'favourite' role. Make sure that all role-takers feel their roles have some ***contribution to group***.
- Some roles can give mandate over the outcome of another player's actions, or even the whole. Such roles of ***distributed power*** make for interesting ***team dynamics*** as it pushes players to **INVOLVE** with others.

SHARED GOALS

Shared goals is the use of either player-defined or game-defined objectives that a team observes and mutually works towards. It creates a natural focus point for the group members, leading in an apparent direction for the whole team. A clear shared goal can help a group of players aim for the same thing, resulting in a more cohesive and fit agenda for working together. The agenda prioritises a subset of the shared goals which the group should attempt, and unlike the set of shared goals, also focuses on how they are achieved.

- A discrepancy in the interpretation of the shared goal may put the team in the state of **EVALUATING** as they have to discuss the apparent problems and what needs to be solved. Even if the agenda is not reformed, the team may **INVOLVE** each other to discuss how to overcome certain obstacles or reach their specific targets.
- Shared goals and ***interdependence*** are two distinct ways to afford collaborative behaviour that has been extensively tied to collaborative games. One may argue that these are two essential ingredients for collaborative games, as they give teams an object to base their agenda on as well as a discussion *(***INVOLVE/EVALUATE***)* of how to utilise each other to the best.
- Shared goals have been found to increase feelings of relatedness to co-players. Perhaps, then, shared goals could form a basis for friendships and relationships with other players.
- If individuals observe team members work hard for the shared goal, it may produce more effort and engagement for the individual.
- It is possible that a shared goal rather is a temporary overlapping goal between players, creating ground for alliances or pacts. These can be especially prevalent in games with competitive elements.
- Non-global goals (goals apparent for only one or parts of the individuals in a team) may induce a reduction of the fit of a team's agenda—especially in competitive elements. As such, ***shared references*** have some influence over shared goals since there needs to be some identification of the fact that the goals are actually overlapping/shared to begin with.

SHARED PUNISHMENT

Punishment is a way to give players and individuals apparent consequences for misplays and missteps that increase the stakes of the game. Shared punishments help a group form a shared and fit agenda. Since the actions of both oneself and others may affect everybody in the group, **INVOLVING** and **EVALUATING** becomes important to make sure everybody is on the same page. The more severe the punishment, the stronger it affords **EVALUATING**.

- Let players fail: A collaborative game can be full of ***challenge.*** Failing is not necessarily a bad thing and may even work in favour for fostering togetherness. Punishing elements can therefore be a form of ***challenge*** to overcome.
- Let individual penalties/punishments cascade to the group. This makes every team member's decision a matter for the whole team, with the potential to create tension between ***group vs individual***. This motivates players to keep **INVOLVING**, to at least make sure that they themselves stay safe too.
- Too much ***independence*** can be punished with forced ***dependence,*** such as *helplessness.*
- Consider not punishing ***co-actions*** too much since they encourage ***synchronisation*** and ***reactive actions***.

SHARED REFERENCES

Shared references are the apparent shared understanding and presumptions between group members that helps inferencing of concepts between individuals as they communicate. It is based on the apparent shared knowledge, beliefs and suppositions between individuals partaking in the same activity. Shared references are important as it gives team members a sense of mutual reference values which can be used for more efficient collaboration. Shared references naturally improve the likelihood of a well fit agenda, and by extension well fit scripts. It may be less important to **INVOLVE** others if you can infer what they are doing, but it may also help **INVOLVING** at the right time as you can infer when it is the right time to do so.

- The more shared references between individuals, the less effort has to be made to ***communicate***.
- The use of products crystallises over time, creating sorts of standards that results in higher levels of shared references.
- Shared symbols and similar tokens of ***group identity*** may be expressions of shared references.
- Shared references can help groups determine the next steps needed for certain tasks or activities, which helps them develop a fit for both situational and more long-term scripts—however members of a team would often need to keep in touch with each other to make sure they stay on the same page. If it is clear that players have different ideas, and there is room for discussion, **EVALUATING** is afforded.

SHARED THREATS

Shared threats is an efficient method to form clear in- and out-groups, forming a sort of ***group presence*** through an "us versus them" mentality. Shared threats can emphasise or form new ***shared goals*** as it gives teams something to avoid. Shared threats and ***challenge*** may inspire willingness to collaborate with others. In many ways, shared threats is similar to ***shared goals*** as it guides team members to focus on the same thing(s), the difference lays in the often more **punishing** elements of shared threats, which can increase the stakes and tension of gameplay while goals may not. Depending on the severity of the threats, teams may have to **INVOLVE** or **EVALUATE** their ideas of how to approach them.

SOCIAL CODE

Social codes are based on etiquette and rules of how to conduct interaction and communication with each other. It guides and directs the way we speak and interact with and to each other, to ensure that things can go on well and in harmony. It is a necessity for continuing to further grow relationships and ***shared references*** among other things.

Social codes may emerge within the group or stem from cultures and ***communities***. It informs people the acceptable way to perform interaction rituals. The way these codes are made may vary depending on social and external factors, and who are in the social context – however having a somewhat unified social codex helps bringing a shared understanding, ***shared references,*** and ultimately more cohesive scripts and agenda.

- A discrepancy in social code necessitates reflection on how the group members treat and relate to each other. For example, this might result in the sacrifice of one individual for the group to succeed—or the ***betrayal*** of the group for the benefit of a single individual.

SYNCHRONISATION

When players synchronise, they **INVOLVE** to make an adjustment to their individual script and let other players know about their new trajectory. Synchronisation is about ***communication*** of the here and now, to let others adjust how they apply the agenda to the situation in a less elaborate way than **EVALUATING**. It may clarify how well previous ***planning*** is holding up to practice or coordinate the **ACTING** of group members. Synchronisation can also somewhat take the role of **EVALUATING**, though its lower level of elaboration may pose a risk for misunderstandings and lower levels of cohesion fitness in the agenda norms.

Synchronisation often includes making small (temporary) adjustments to the script based on the current game state. Over time, however, the behaviour may crystallise to future similar contexts. Some of the adjustments will remain a part of the individual script, however some of them will have to potential to become norms (or even directives) which eventually affects the agenda.

- By its nature, **co-actions** bring synchronisation since they require simultaneous and conjoined **ACTING** by multiple players who must coordinate their efforts together. So long as they are simultaneous, these ***co-actions*** can be either discrete and immediate or continuous and long form.

- On the other hand, a continuous state of ***parallel tasks*** put a need for at least some intermittent synchronisation to keep track of for instance individual's ***contribution to group***. This is an example of how synchronisation can be used to maintain and add to the ***shared references*** between players, especially prevalent in games with **asymmetry** of information or interface.

- Synchronisation also involves sequential timings, such as one player setting up a situation that is immediately beneficial for another player if they follow up on it, or one player preparing an action for when another player is ready for its effects. The need for such synchronisation increases with tightly coupled ***interdependence***.

- Synchronisation between other group members may also be the growing ground for ***reactive actions*** for those observing it but not partaking in the synchronising.

- As ***mastery*** and ***shared references*** increases, synchronisation may increasingly take the role of **EVALUATE** for reforming agendas and scripts. This may or may not be a preferred effect. Still, the risk of unfitness increases if the players perceive themselves to have higher levels of ***mastery*** and ***shared references*** than they may actually have. On the other hand, increased efficiency of synchronisation also means that teams can take on increasingly harder ***challenges***, which can feel very rewarding to overcome.

TEAM DYNAMICS

Team dynamics concern the relationships between group members i.e. how group members perceive and relate to each other, within the confines of the *magic circle* of the game. In a sense, team dynamics is to the ***social code*** what the agenda is to the script—while the ***social code*** is more centred around how group members **ACT** and behave towards each other, it is motivated and informed by the team dynamics.

- Team dynamics are affected by the ***distribution of power*** or agency within the group, that is, the ability to fulfil their goals and enact their intent upon the game. With higher power, be it from in-game agency, ***player capabilities***, ***mastery*** or status in out-of-game relationships**,** often follows an expectation of authority, where they get and/or expect more say over the decision making than their less powerful peers. Consider what means you have available to redistribute power between players, such as ***interdependence***, ***asymmetry*** of information. For more, see ***distribution of power***.

- Heterogenous competences, such as those from loosely-coupled ***interdependence*** or ***roles***, enable players to **ACT** in a more fit way as they clarify who is best suited for a task. Through learning or ***mastery***, these competences might solidify while fit increases, which might in turn make the team dynamics grow static. While this can be good for collaborative performance and a sense of ***contribution to group***, in longer games it risks growing stale. Changing up the problem so that the competences are no longer fit can be an effective, if disruptive, way to reinvigorate the group by trading collaborative performance for collaborative adaptability.

- ***Mastery***—previous experience with the game—will make for significantly different starting team dynamics in the game. Groups members with previous experience will enter the game with pre-built assumptions on the ***shared references***, whereas new players will be exploring the rules of the gameplay. If these rules do not predetermine collaboration (opting instead for ***emergent collaborative behaviour***) or allows for a lot of ***parallel tasks***, it may take a while—even entire game sessions—before new players start **INVOLVING** with each other.

- Adding some competition within groups—like scoring players individually—can be a motivator for players to pursue a greater ***contribution to group***. Measuring contribution to group in a fair way however might prove a challenge and attempting to do so might shift the balance when it comes to considering ***group vs individual,*** bringing tension into the group.

TEMPO

Tempo is about the utilisation of real-life time in the game. Low and high ***tempo*** determines the amount of actions you can take in a given amount of time, so the tempo of a game largely determine how it is played. High tempo may create a sense of ***urgency***, placing constraints on what a team can do at a given time, making it difficult to reach higher levels of elaboration during these moments. With increasing tempo comes increasing load for both task and ***communication***, the magnitude of each depending on their setup. Consequently, a high tempo may force a team down to a state of **ACT** or at least **INVOLVE**. At the other end, low tempo allows the team to **EVALUATE**.

- Fast pace limits ***communication***: If things happen very fast in a game, it is hard to both keep track of everything, but also to convey important information in that time span. The higher pace, the more **ACT**.
- The tempo of a game affects how ***communication channels*** are used.
- High pace and Interdependence may breed frustration: High pace and ***interdependence*** would require team members to have efficient ***synchronisation***. If the team are not ***synchronising***, frustrations may emerge.
- Low ***tempo*** periods allow for ***planning*** ahead for high ***tempo***. A way to deal with the constraints of high tempo is to allow for periods with low ***tempo***, allowing for ***planning***. This gives a team the opportunity to reach both **INVOLVE** and **EVALUATE**.

URGENCY

Urgency is created by introducing a need to perform a task or fulfil a condition within a limited room for action. This limited room for action can be implemented in many ways, such as specifying limited real-life time, as with high ***tempo***, or by the task requiring the use of a significant amount of the actions remaining before its completion. Another option could be using multiple threats, creating ***parallel tasks*** that risk overwhelming the players into **ON-YOUR-OWN**, or a low health bar. If the task is not performed within its limitations, it will fail.

Usually, urgency demands attention from the players, inciting them to **ACT** soon to complete it. If urgency was implemented through other means than time limits, the group might be strongly afforded to **EVALUATE** their situation, ***planning*** how the urgent task affects their agenda.

- Urgency is not necessarily the same as importance. If the task that risks failing does little for the furthering of the group's agenda, there is little need to perform it. That said, urgency often implies a sense of importance, true or not, by inciting fear of missing out. Identifying what urgent stimuli to respond to can be an expression of ***mastery***.
- Urgency can create ***changing conditions*** if it breaks from what was expected while ***planning***. As such, it can increase a group's adaptability to unexpected situations and boost their predisposal for ***synchronising*** or ***reactive actions***.
- Urgency need not mean unexpected. High ***tempo***, gameplay that continues to behave similarly during ***repeated play***, or looming threats slowly reaching their climax can all be urgent but predictable.
- Real-time urgent, important tasks can adjust the *evaluation threshold* by making players temporarily accept load levels beyond the usual rather than **EVALUATING** which takes time not currently available. Players rationalise that it's better to do something unfit rather than stopping and losing precious time to potentially create a more fit agenda. After the urgency has passed, the group can **EVALUATE** what went well and what didn't, sacrificing the details of remembering for the instantaneousness of execution.

VICINITY

Vicinity is a spatial example of ***additive efficiency***, where agents that keep a diegetic proximity to each other are rewarded with additional features. For example, staying together could grant extra experience points or reduce damage taken. All vicinity features are *co-dependent* (see ***dependence***), since both players need each other to uphold the proximity. Thus, their existence affords and rewards **INVOLVING** between players.

- The proximity between players can increase opportunities for ***reactive actions*** as it simplifies oversight. Similarly, the opportunities for ***parallel tasks*** might lessen due to the need for proximity.
- Vicinity can ease the sense of one player outpacing the others by encouraging them to continue **INVOLVING** with the others rather than work independently. In a sense, it is the reverse approach to the *unidirectional* ***dependence*** of *helplessness* but for the same result: vicinity encourages players to **INVOLVE** through the carrot of rewards, while helplessness pushes players to **INVOLVE** through the stick of punishing independence.
- Vicinity might work best as an encouragement rather than a requirement, since its use limits the availability of ***parallel tasks*** and thus obscures an individual's ***contribution to group***. Implementing ***asymmetry*** and ***interdependence***, however, would sidestep the issue.
- Consider if you want vicinity to always be present; juxtaposing with brief instances of separation might create a useful contrast to highlight its features.