Designing mechanics for asymmetric cooperation in hybrid co-located social games

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Other pictures have been taken by me during playtest sessions.
Abstract

This thesis addresses a game design matter with an interaction design perspective, arguing that both are strongly related and can learn from each other. It explores the topic of designing mechanics for asymmetric cooperation in hybrid social co-located games. Co-located social games are games played in a same space. Their main advantages are the direct social interaction between the players, their tangibility and flexibility. Hybrid games merge physical and digital features. The most common one nowadays are augmented board games, enhanced and enriched by digital features. However, generating new mechanics by combining the two materials is an even more promising perspective for hybrid games. Starting by designing mechanics (actions to interact with the game system) instead of building over already existing games could be a relevant process to do so. This paper focuses more particularly on asymmetric cooperation mechanics: when players work together towards the same goal, but with different mechanics (different ability to act or to access to information). Cooperation is more and more popular in the game field and, among with other benefices, asymmetry can strengthen it by making the performances of the players fully complementary. In hybrid games, this kind of mechanics could make people bridge the gap between physical and digital materials through cooperation, by combining actions or sharing information.

Following this theoretical investigation on the matter, this paper presents several experiments of mechanics along with a reflection on the related methods. These experiments are raw cooperation mechanics involving digital aspects thanks to a smartphone, and sparking strong social interactions. Some playtests have been conducted and documented. A discussion is drawn upon them to share the resulting observations on hybrid asymmetric cooperation, and on the process of prototyping game mechanics.

Both theoretical and practical approaches intend to explore the strengths, weaknesses and opportunities of the matter at hand and try to contribute to game design and interaction design by giving a better understanding of designing asymmetric cooperation in hybrid social co-located games.
# TABLE OF CONTENTS

1 • INTRODUCTION .................................................................................................................. 06

2 • RESEARCH FOCUS ............................................................................................................ 07
   2.1 Frame and purpose ........................................................................................................... 07
   2.2 Knowledge contribution .................................................................................................. 08

3 • THEORY, RELATED LITERATURE AND PREVIOUS WORK ............................................ 09
   3.1 Hybrid co-located social games ....................................................................................... 09
      3.1.1 Introduction: games ................................................................................................. 09
      3.1.2 A definition of hybrid co-located social games ......................................................... 10
      3.1.3 The essence of analog co-located social games ....................................................... 11
         Direct social interactions ............................................................................................... 11
         Tangibility ...................................................................................................................... 12
         Flexibility .................................................................................................................... 14
      3.1.4 Digital components in co-located social games ....................................................... 14
         Digital inputs in existing analog games ......................................................................... 14
         Designing hybrid game mechanics .............................................................................. 16
   3.2 Cooperative games ......................................................................................................... 18
      3.2.1 Asymmetric cooperation: an opportunity for hybrid games .................................... 18
      3.2.2 An analyze of existing cooperative hybrid games .................................................. 21

4 • METHODS .......................................................................................................................... 26

5 • EXPLORATORY EXPERIMENTS .................................................................................... 28
   5.1 Design process ............................................................................................................... 28
   5.2 Experiments and results ................................................................................................. 29
      5.2.1 Flappy Bird Coop .................................................................................................... 29
      5.2.2 Swapping .............................................................................................................. 30
      5.2.3 Unblock ............................................................................................................... 32
      5.2.4 Color Cocktail ...................................................................................................... 33
      5.2.5 Missing Something ............................................................................................... 34
      5.2.6 Tell a Line ............................................................................................................. 35
   5.3 Discussion ....................................................................................................................... 36
      5.3.1 Designing for hybrid cooperation: learning from playtests .................................. 36
      5.3.2 Designing mechanics: reflection on the design process ........................................ 40

6 • CONCLUSION ..................................................................................................................... 42

7 • BIBLIOGRAPHY ............................................................................................................... 43
I have never doubted that game design is strongly related to interaction design. They both belong to the design field. They share some design work characteristics evoked by Löwgren (2007): exploring opportunities, considering practical and technical as well as aesthetic, giving a tangible form to ideas... Methods are also similar, such as divergence and convergence, scenarios, prototypes, ideation. And the user experience is fundamental. Playtests are ways to involve the future users into the design process. The difference being that these methods are not employed for the same purpose, since the goal of game designers is to develop games. Also, games are interfaces. Game mechanics are actions to interact with the game system. They are inputs waiting for consequences, for feedbacks, and the game system is their interface. It seems obvious when talking about video games but it is also true when it comes to physical games: “People tend to think of the word interface as applying to computers only, but in the general sense in which we take it—all the ways the game sends and receives information to and from the player—every game has an interface.” (Elias et al., 2012, p.97).

The relation to interaction design is even stronger in cooperative and hybrid games. Interaction design is usually about digital artefacts and emerging technologies. Reflecting on games with digital aspects is a way to explore interfaces, gestures, and shape the digital material. Game design contributes to computing as well as computing contributes to game design. Hybrid games include digital features in an innovative way by merging them with the physical world. And when playing together in this physical world, people are not only interacting with the game but with other people, directly or through the game. Games spark social interaction, and are a media of communication. Co-operation mechanics exploit and stimulate this quality and reveal subtleties of human interactions through games.

This paper intends to address a game design matter, cooperation in hybrid social co-located games, with an interaction designer perspective. More precisely, I explore how we could design relevant mechanics for these games, and how asymmetric cooperation between players can bridge the two sides of the hybridity. To answer my research question, I first define the key concepts, giving a review of existing literature and projects and trying to define the first guidelines to design these specific mechanics, before applying design methods to investigate it further, in practice, and build a concrete knowledge contribution on the matter.
2 • RESEARCH FOCUS

2.1 FRAME AND PURPOSE

Co-located social games, such as tabletop games and party games, are games played for entertainment by people gathering in a same space. They are mainly characterized by face-to-face social interactions, and often use tangible elements (boards, cards, dice…) to structure the game process. However, interactions in the digital era are usually portrayed as long distance communications and disembodied actions. Because of this divergence, bridging physical and video games into hybrid games seems to be a challenge. But because both sides have strong benefits, it is also a promising practice. Already existing projects often tried to upgrade traditional physical games because many aspects can be improved thanks to computing. Digital elements can enhance the game, by assisting players with rules, tracking, calculation and other tasks. It can also enrich it, with audiovisual feedbacks giving more immersion, dynamic boards or a greater pressure thanks to timed events. However, when the digital material is involved some core elements of the original game experience are prone to disappear. And some of these elements are what make traditional games pleasant: the social interactions, the tangibility and the flexibility of the game system. Physical games can be upgraded with digital elements and the other way around, but it should not diminish the game experience by suppressing the assets of the physical game. Moreover, by merging these two aspects, new mechanics can arise.

More than enhancing and enriching existing games by changing their nature, it is possible to create new games based on the hybridity. Therefore, I am exploring the space between physical and digital games, wondering how we could design relevant hybrid games.

I decided to focus on asymmetric cooperative games. Cooperation, beside being a more and more popular trend in games, is a great way to ensure strong social interactions and explore how a digital addition affects communication. Asymmetry is a way to challenge the way cooperative games are often designed today: players with the same tools and mechanics to interact with each other and with the game, even if they have slightly different roles. Also when the players have different abilities or access to different pieces of information, their roles are complementary and cooperation can not be denied. A cooperation between tangible and digital mechanics could be a way to create new gameplays and merge the two modalities. Therefore, my aim is not to only enhance or enrich existing games, but to design new mechanics for cooperation in hybrid games.

How to design mechanics for asymmetric cooperation in hybrid co-located social games?
2.2 KNOWLEDGE CONTRIBUTION

This paper is intended to contribute to both game design and interaction design. Ideally, it could help traditional game designers to benefit from the digital era, and allow video game designers to explore beyond the screen. But it also could reveal opportunities and challenges for interaction designers.

One main purpose is to help game designers to create hybrid co-located games. First, I define some terms such as co-located games and hybrid games that are nowadays valuable notions in game design. Indeed, these notions were not relevant before computerization. Then, referring to literature and already existing designs, I give an interaction designer insight by analyzing the strengths and downsides of hybrid games. This part suggests best practices to design them, considering which aspects should be preserved, exploited, limited. I also focus on asymmetric cooperative games, sharing deeper research on the subject, explaining how it seems to be an interesting field to work with and reflecting on their mechanics. A critic of several games supports my thought. Then, exploratory prototypes of new game mechanics are generated based on this study. These artefacts can be used to discuss asymmetric cooperative hybrid games further and inspire new designs. Knowledge is generated thanks to them in a discussion, focusing on the hybrid cooperation topic and on the general process of designing mechanics. If they are considered relevant, these mechanics could also be added to the toolbox of game designers so they can use them and build gameplays upon them. The experiments are, along with the play sessions reports and the discussions, part of the knowledge contribution.

Besides a contribution to the game design field, some observations could be taken further and some prototypes turned into interfaces outside the ludic area. Computer games often have been feeding the research field with innovations and insights: “Today, computer games have even become an innovating force that causes rapid advancements in other technological areas such as computer graphics or network technologies.” (Magerkurth et al., 2004a, p.1). And hybridity is a trendy topic: the tangible and the digital fields are usually seen as opposite, but combining them is a recurrent ambition of interaction designers. Tangible interfaces, for instance, are made “to bridge the gaps between both cyberspace and the physical environment” (Ishii and Ullmer, 1997, p.1). New opportunities and questionings arise from this challenging approach. Being allowed to use tangible and digital materials opens up the scope of possible interactions. And naturally, prototypes of new mechanics can generate new interfaces and gestures in general. Also, the discussion on the design process can be valuable to reflect on the application of design methods to design mechanics. To design mechanics is to design actions in a ludic context, with games as interfaces: therefore this research also contributes to interaction design.
3.1 HYBRID CO-LOCATED SOCIAL GAMES

3.1.1 Introduction: games

Before giving more specifications about the particular games this paper is focusing on, it is important to define what exactly are games. Many definitions have been written throughout the years. Among the first ones to give their vision, Huizinga (1944) defined a game as an activity outside ordinary life, absorbing, not serious, with no material profit, with boundaries in time and space, and ordered by rules. He also pointed out how games could promote social groupings. Ten years later, Caillois (1961) mainly agreed by saying it was a voluntary, unproductive and uncertain activity governed by rules in a separate time and space, with awareness of the other reality which is not real life. More recently, Salen and Zimmerman (2004) described games as systems with rules engaging players in an artificial conflict towards a quantifiable outcome. Expect for this last characteristic, which I think can be non existent in games about free discovery and creativity, I mostly agree with these definitions. Also, even if people can play games for many different reasons, enjoyment should be evoked as naturally coming in mind when speaking about games. Hunicke et al. (2004) call it “fun” and give it an important position in their MDA framework. This framework is a way to bridge the gap between game designers and players by formalizing the three designing objectives (rules, system, and “fun”) into Mechanics, Dynamics, and Aesthetics. Mechanics are actions and controls, such as betting, jumping, rolling dice etc. The Dynamics are the system features creating the Aesthetics over time. And Aesthetics are the types of “fun”, the reasons why the players are emotionally invested (challenge, enjoyable sensation, self-expression…). In this paper we will talk about mechanics, that I will define more precisely later. And since I am focusing on cooperation, we will mainly encounter the fellowship aesthetic which is enabled when the game is a social framework.

Now that the notion of game is clearer, it is time to introduce the specific kind of games I am focusing on. First, I am explaining what stands for co-located social games. Then, I am introducing the concept of hybrid games, merging physical and digital features. Finally, I analyze how employing both materials into a same game impacts the experience.
3.1.2 A definition of hybrid co-located social games

Gathering to enjoy games in a same space always have been a popular activity. I am using the adjective *co-located* to differentiate them from long distance games, such as online games. It is interesting to point out that *co-located* games were the only existing ones before computing. This adjective makes only sense now that *non co-located* games were made possible thanks to the digital era.

Many different words are used to describe these co-located games, usually mentioning a material criteria. *Indoor games* are defined as games played inside, in a social or family situation. They include *indoor sports*, but also less physical kind of games such as *tabletop games* and *party games*. *Tabletop games* are all the games we can play on a flat table surface, such as *card games*, *dice games* and *board games*. *Party games* are games being played for entertainment during social gathering. They usually are designed to facilitate the interaction between players and can be used as icebreakers during parties. Since they also involve a larger amount of players with different level of skills, they often have simple rules to be easy to learn for new players. *Parlour games* seems to be the ancestors of party games. The word *parlour* was used to refer to the room used for the reception of visitors in a home. These games, like *Charades* featuring players using their bodies to explain words, usually involved logic and playing with words so the players didn’t need any particular equipment.

In my research, I will talk about *tabletop* and *party games*. While being named differently, they could be applied to a same definition. They are both designed to entertain people gathering in a same space. They are co-located and are heavily based on direct social interaction, but do not require an intense athletic activity like sports do. There is no english word attributed to this definition, but a french notion exists: *jeux de société*. It is literally translated by *society games* but its meaning is closer to *social games*. Also, I am not interested in single player games since I focus on social interactions between players. However the notion *social games* is dedicated to online games on social media platforms. Therefore, I am using the notion of *co-located social games* to refer to the kind of games I just defined.

I then focus more particularly on *hybrid* co-located social games. Hybridity is about combining different elements, and in this case different materials: physical and digital materials. Some words I am mentioning in my following explanations (such as *tangible*, *numerical* etc.) have more precise definitions, but I use them as general characteristics to differentiate the sides of the hybridity. Even if I always refer to the same two materials, I sometimes avoid repetition by using them.

We should start with an important distinction between *analog* and *digital*. Computers are electronic devices receiving data (through controllers, sensors...), and performing operations to produce results, feedbacks. The first computers were *analog*, directly
processing continuously varying data (temperature or speed for example). Nowadays, they are mainly digital: processing binary data (on/off electronic signals) converted into codes with numerals, letters, symbols. Personal computers, smartphones, microwaves… are digital computers. But the use of the word analog evolved, especially in the game field. In everyday life, it is sometimes used as a synonym of non-digital, as an opposite of digital, even though it is not its first meaning. When I speak about analog, I am referring to this last use: non-digital. This being said, the hybridity I am focusing on is the combination of analog and digital elements. In one hand, we have the analog world, the physical world, tangible, concrete, perceived through the senses, where people can meet directly and make physical contact. It is sometimes referred as the real world in opposition to the virtual world. On the other hand, this second world is the world of digital computing, of automatization, that could be labeled as intangible, numerical, technological. These are the two sides of hybrid games.

A lot of existing works on co-located hybrid games are board games. They are tabletop games including a marked surface called board. Items are positioned on this board to represent and control the process. They are interesting to study in this research because, besides being very social co-located games, they involve a lot of tangible elements and precise gestures, which is not always the case for other kinds of co-located games. Therefore they reveal the conflict between tangible and digital materials.

3.1.3 The essence of analog co-located social games

Hybrid games can benefit from the advantages of both physical and digital worlds. By combining these media, the gameplay can not only be enhanced but also enriched. Nowadays, computers are very powerful. Video games can be extremely engaging, immersing, complexes, and the only limit is the designer's imagination. Therefore, it can be very tempting to transform a lot of the game elements into digital ones. But co-located physical games are still very popular because of several fundamental characteristics. These characteristics are so important to players that some video games are augmented with analog components in order to reinforce these characteristics. Proof is, the name of the paper written by Magerkurth et al. (2004a): Augmenting the Virtual Domain with Physical and Social. Therefore, these features should be preserved when designing an hybrid game. I am discussing them to highlight their importance, establishing why their preservation should be part of the best practices when designing hybrid game.

Direct social interactions

Tabletop and party games are, traditionally, a collective experience. When playing tabletop games, several players gather around a table to play together. The board and rules facilitate the interaction between them, and the enjoyment is greatly related to face-to-face human interactions. The purpose of party games is even to support this
social synergy. For Magerkurth et al. (2004b), the social aspect is definitely the main specificity of board games:

“The unbroken success of old-fashioned board games clearly relates to the social situation associated with them. Almost all of these games are made for multiplayer use and game sessions are often organized as social events, where friends spend time together in a group cohesive manner. The social situation is very rich, because players sit together around the same table, they look at each other to interpret mimics and gestures which may help them understand the others’ actions, they may laugh together or as well shout at each other, if someone is losing badly.” (p.1)

Its importance can be proved by the number of different kinds of interactions observed by Xu et al. (2011) while studying recorded videos of board game play sessions:

“We present five categories of social interactions based on how each interaction is initiated (...) “Reflection on Gameplay” (reacting to and reflecting on gameplay after a move); “Strategies” (deciding how to play before a move); “Out-of-game” (reacting to and talking about out-of-game subjects); and “Game itself” (commenting on and reacting to the game as an artifact of interest).” (p.1)

Nowadays, most video games are multiplayer but players are usually physically alone in front of their home computer screen when they play. Even if thousands of people are playing at the same time, it is an isolated activity. Indeed, the interactions are more directed toward the game system, and the computer is a media for indirect communication with other people. They can speak to each other, and their characters can interact, but their actions are mediated by keyboards, controllers, joypads, and a rich part of the human interaction is lost.

Co-located video games are different because they bring people together around a common screen. Like other video games, they are designed for players not to interact directly but through the digital system. Players are sitting side by side and towards the screen, so direct elements of communication such as hand gestures, mimics and eye contacts are not supposed to be part of the game experience. Speaking is permitted, but is usually not part of the gameplay. However, the proximity allows more interactions. Players can communicate directly in-between game sessions, and they can add social interactions while playing by nudging other people or stealing their controller. This proximity allows unexpected interactions, and it seems to be part of the success of such games.

**Tangibility**

Analog social games are not unique only because of the interaction between players,
but also because of the interaction between the players and the game. This specificity less applies to party games, which are focused on human interactions, but some of them do involve props, tangible items. This aspect is precious to players for several reasons. Specific gestures, routines, sensory aspects are part of the game experience.

Players are more engaged because of the physical contact: “The weight of chess pieces, the feel of shuffling and dealing cards, the tactile qualities of poker chips—noncomputer games have always had a good deal of pleasure and satisfaction coming from the physical feel of their components.” (Elías et al., 2012, p.99). The authors even point out that rolling dice is so enjoyable some games are just an excuse to do so. Computer games usually did not have tactile feedbacks, but some of them begin to explore the matter, such as the remote of the Wii console by Nintendo, a remote that players have to move around, shake, turn, and that sometimes sends a vibration in return. Also, using analog items allows players to control them freely. Players can use strategies when organizing cards, or display their skills when shuffling them. Magerkurth et al. (2004b) said that “For most players the physical act of rolling dice is a highly social activity involving skillful rolling techniques which are permanently supervised by the other players to prevent cheating.” (p.4). Players are also engaged when displaying, touching, owning, collecting or even personalizing these items. This emotional aspect is observed by Magerkurth et al. (2004b): “Additionally, many tabletop games feature beautiful and sometimes custom-painted playing pieces that feel good to touch, to collect, and to place on the game board” (p.1). Finally, physical objects can help immersion: looking through documents do not have the same engaging appeal if they are digitized pictures or real pile of papers on a desk.

It is also interesting to see the strong connection between the social and tangible characteristics. Players can touch objects, but also bodies because direct social interactions allow physical contact. Many co-located social games use this feature. One of the most current contact is when players have to snap their hands on top of each other to decide who is first. This action is not only about being fast, it also implies making contact, bumping into each other, sometimes slapping painfully. And strongly social out-of-game contacts possible in co-located settings, such as nudging or high-fiving, can build the fellowship aesthetic.

Finally, in my point of view tangibility does not only mean involving graspable items. It suggests further than that. It also means belonging to the physical world, and depending on it: being embedded. If common video games are separated to the physical world, hybrid games are in it, and are part of Embodied Interaction as defined by Dourish (2004): “Embodied Interaction is interaction with computer systems that occupy our world, a world of physical and social reality, and that exploit this fact in how they interact with us.” (p.3).
Flexibility

Flexibility is a fundamental component of games. Playing with the rules is a main characteristic of play: “In so many different ways, breaking the rules seems to be part of playing games.” (Salen and Zimmerman, 2004, p.268). Sicart (2014) also points out that “A key ingredient of playing is thinking, manipulating, changing, and adapting rules.”. It also allows easy cheating and free personalization, two strongly engaging features. Analog games are flexible because they are not automatic and their material is accessible, transparent, easily modifiable. They allow modifications and home rules to re-evaluate the balance, adapt the game to a precise situation (absent player, playing with children...), avoid repetition etc. It is also part of a more global experience: sharing alternatives with other players, by annotating the rulebook for example. But digital features in games can limit this flexibility. The system can become more pre-programmed and determined, because of an immutable software for example. The code used for automation can be modified but, unlike an analog element, it is not easily accessible or understood by everyone. Some people are skilled enough to hijack the rules of videogames, but it seems to be a too complex task to achieve during a social gathering. Digital features in games can lead to a rigid and diminished experience. To design more flexible hybrid games, we could use the digital input in other ways than automating the rules and tasks. For example, the digital feature could be transparent and pliable, like an open media of communication, instead of a closed regulation system. At least, having some tangible elements in hybrid games allows to preserve a part of the flexibility and minimize the frustration of an obscure system.

3.1.4 Digital components in co-located social games

Digitalization have a lot of potential for co-located social games. The possibilities for hybrid games are endless. Each existing device, sensor, kind of feedback... can give multiple game ideas. Therefore, I am starting by analyzing the more common hybrid games to reflect on the relevance of their hybridity. I am not discussing every downsides of digital features (Eg. malfunctioning electronics, rise of prices etc.), but focus on the design choices that could reveal the limitations of hybridity for the gameplay. Then I suggest a method to design new hybrid mechanics.

Digital inputs in existing analog games

A good way to observe the advantages of digital components is to discuss how they can upgrade analog games. Indeed, the most common hybrid games are existing board games being enhanced and enriched with computerized elements. The traditional gameplay remains the same, but automations are added. Boer and Lamers (2004), in a paper on electronic augmentation of traditional board games, listed the potential benefits of board game digitization. The following list gives the most common uses of digital
features in automated board games. It is based on their work, with the addition of other features in italic that I observed during my researches and a slightly different organization.

Enhancing the game by assisting its process:
• Rules integrated digitally
  (Eg. teach the rules through animated game examples, detect the errors)
• Artificial intelligence
  (Eg. autonomous game pieces, simulation of extra players, suggestions for game moves, manage balance and difficulty according to the situation)
• Automated administrative tasks (also allows to save and restore game situations)
  (Eg. registration of time, scores, game movements, and player statistics)
• Automated physical tasks
  (Eg. setup, dealing cards, actualizing moves)

Enriching the gameplay and immersion:
• Dynamic board
  (Eg. randomly changing composition, hidden unexplored areas)
• Audiovisual feedbacks
  (Eg. audio effects, music, visual animations, narration)
• Time countdown
  (Eg. timed events)
• Private/public information
  (Eg. a public screen and private screens, secret actions)

The authors’ conclusion, based on a survey, is that the most desired features are random changes of the board, simulation of additional players and integrated rules with error detection. This is quite interesting, since reading the rulebook is a very notable obstacle in board games. But they also agree on the fact that pre-programmed games can be a problem, and that they should be transparent. According to these observations, I suggest that the more favorable digital inputs are the ones that can not be done with analog material: the ones that add something physically inaccessible, instead of replacing an existing feature. Indeed, the main risks for hybrid board games is to remove too many valuable parts of the original game, even if they do not seem appealing at first sight.

“We note that “chores” in board games (e.g. waiting for a turn, rule learning and enforcement, maneuvering physical objects), which at first appear to be merely functional, are critical for supporting players’ engagement with each other. Although most of these chores can be automated using technology, we argue that this is often not the best choice when designing social interactions with digital media.” (Xu et al., 2011, p.1)

The next step is to see how, technically, digital features have been added to augmented
games. Some augmented board games are using specific digital devices, tailor-made artefacts such as the banking unit of *Monopoly Electronic Banking Edition*. But nowadays there are two main approaches to augment board games: turning the board into a digital tabletop, or adding a companion mobile application, an app, on a smartphone or tablet. Concerning digital tabletops, several researches have been done to find the right balance between tangible and digital elements. Usually, a traditional game is then prototyped in a version involving a digital board and tangible elements, and another version which is almost only digital. Ip et al. (2011) did so with the board game *Settlers of Catan* and Pape (2012) with *Pandemic* to analyze the impact of a digital inputs on the game experience. Also, *STARS* is a digital tabletop presented by Magerkurth et al. (2004). It includes a board, a common screen on a wall and private screens on handheld devices. It is also not limited to one game: it is a technical system in which different games can be implemented. To conclude, digital tabletops are not widely commercialized projects yet, but various researches have been done. However, they could become more and more accessible thanks to tactile tablets. Indeed several projects use the detection of tangible elements positioned on a tablet to create new game experiences. The prototype *Dungeon Light* by Volumique is a good example: the screen is used as a dynamic, changing surface according to the positions of physical pawns.

Board games with companion apps are more current and, unlike hybrid tabletops, more frequently commercialized. Some apps are used for enhancement, like scanning items cards to manage a personal inventory. Others enrich the physical game, such as in *Xcom: enemy unknown*. It uses an app to keep the high complexity and the original sense of panic (limited time) and chaos (unexpected events) of the video game it is based on. Another recurrent use of apps is to replace the human game master (a player telling the story and managing the events). It is the case in the hybrid board game *Mansion of Madness Second Edition* that I describe in more details later in this paper. However a human game master is unique. Being a game master is a dramatic performance (gestures, intonation, use of the environment…) and there is a playful dynamic between the players and the game master (suspense, cheering, jokes…). An app cannot fully replace a game master, but it has other advantages (calculate the right balance in a complex gameplay, impartiality…).

**Designing hybrid game mechanics**

We now see that both physical and digital aspects have many interesting features for hybrid games. But, in my opinion, hybrid games can do more than merging already existing features. They can generate new mechanics. I do not say that these mechanics could not exist with only physical elements. Indeed, we can sometimes find physical alternatives to digital qualities, such as creating randomness with dice or animating paper with pop-ups and kinetic tricks. But what is valuable is how unexpected ideas of interactions are generated because tangible and digital capacities are brought together.
What exactly are mechanics? We already briefly defined this notion thanks to the MDA framework of Hunicke et al. (2004). Sicart (2008), after analyzing previous definitions of mechanics, comes up with the following definition: mechanics are “methods invoked by agents for interacting with the game world.”. Better described as verbs, mechanics are actions used by players to interact with the game system. They are the interactions possible for the players, related to specific input device triggers. The author also differentiates different kinds of mechanics. Primary mechanics, or core mechanics, are the ones repeatedly used by players to achieve the game: “core mechanics that can be directly applied to solving challenges that lead to the desired end state. Primary mechanics are readily available, explained in the early stages of the game, and consistent throughout the game experience.”. Secondary mechanics are more occasional. He also use the notion of compound mechanics to merge “a set of related game mechanics that function together within one delimited agent interaction mode”, such as driving for turning the wheel and accelerating. However it is good to notice that game mechanics do not totally determine how players will play the game because they may be appropriated in unexpected ways.

Augmenting existing games is not meant to generate new mechanics. But by starting the game design process by designing prototypes of hybrid mechanics, designers could find ways to use the digital input as a relevant and innovative part of the game. Some design research studios specialized in interfaces related to entertainment are working this way, such as Disney Research and the studio Volumique. Their method is to develop a prototype of innovative interface before trying to use it as part of a gameplay. In a sense, it is close to the MDA framework since they start with an action, then build up a gameplay afterwards. Their goal is to explore emerging technologies and apply them to the entertainment industry. For example, they both worked on the idea of digital devices used not only as screens but also as physical objects full of sensors. This conception of appropriation of smartphones initiated alternative controllers and new interfaces. Acoustruments by Disney Research lab are experiments of added plastic elements around smartphones that the users can press, touch, grab... and the noises created are directed to audio sensors, giving the information to the phones. For instance, a phone has been turned into a car toy, and the device knows its speed and direction thanks to tangible wheels. Many games can be build upon this prototype involving a simple but promising technical idea. Volumique started with a prototype of smartphone capable of displaying another dimension of a paper board when it is placed on it, and finally developed World of Yo-ho, a now commercialized hybrid board game. Starting with one same concept, appropriation of the smartphone as a physical object, both studios generated promising mechanics.
Figure 1. Smartphones used as mobile items able to reveal a virtual layer of the board in *World of Yo-ho*. Figure 2 & 3. *Acoustruments* turns smartphones into sensitive tangible interfaces.

I could give many examples of various hybrid mechanics based on other concepts (use the environment, appropriate everyday life objects...) but my point is already made: starting with one single concept or technical idea can engender a multitude of mechanics. Hybrid mechanics can lead to many new gameplays, and opportunities are endless. Therefore I decided to focus on one kind of games: cooperative games.

### 3.2 COOPERATIVE GAMES

#### 3.2.1 Asymmetric cooperation: an opportunity for hybrid games

Collaboration is the action of people working together, helping each other. Cooperation is, more precisely, people working together towards the same end.

There is a difference between a game defined as cooperative, designed to make people work with each other, and actual cooperation during a game. Sometimes, players can refuse to cooperate in a cooperative game. Or they can decide to help each other in a competitive game. According to Elias *et al.* (2012), who wrote about some characteristics of cooperative games, “Such is the difference between cooperation as a design mechanic and cooperation as a social system.” (p.52). In this paper, I am talking about cooperation as a design mechanic, hoping to engender social cooperation. The authors defined cooperative games as when “all the players are on the same team and succeed or fail together.” (p.62), and as an equivalent to “single-sided games with more than one player on that single side.” (p.67). This definition gives a vision of “pure”, total cooperation: joint goal without competition between the players. It should be differentiated from games in which cooperation is not “pure”, or including elements of opposition. Some games have a traitor mechanic, a player secretly working against the team. Others include personal achievement, even if it is of the best interest of the players’ to...
work together. The later situation is closer to collaboration. Also, cooperation can exist among teams playing against each other, but these competitive games are not “pure” cooperation games.

There are many reasons why focusing on cooperation is significant. The obvious first reason is that it is an engaging, entertaining activity. Even if it depends on different personalities, Elias et al. (2012) explain that “In and of itself, cooperative interactivity is a good thing, in the sense that interacting with teammates is something many people enjoy—humans are social animals.” (p.65)

Cooperation is also a more and more popular mechanic in games. All papers on cooperative games evoked in this research agree on this. It is the case for both computer games and analog games. For the last ones, it especially increased since the release of the modern cooperative board games Lord of the Rings and Pandemic. In both, players have to combine their different roles to succeed their mission. An online article by Leacock (2016), the game designer of Pandemic, even revealed the increasing percentage of games suiting the key word “co-operative play” featured on the most famous specialized website (BoardGameGeek.com).

However, authors give very various reasons for this phenomenon. According to Elias et al. (2012), it happened thanks to computers, because they can be a non-human opponent and easily allow people to gather in teams to cooperate against them. Rocha et al. (2008) estimate that it is because they reached for a new kind of gamers: “studies on the demographics of players suggest that there is a whole group of potential players that currently do not play because games are not made for them. This group favors cooperative experiences and play experiences shared with others in the same physi-
cal space.” (p.73). Booth (2015), suggests that it reflects the cultural economy: early humans and small tribal societies, solidarity societies, are related to cooperative forms of play, while a neoliberal context valuing the individual induce games focusing on achievement. According to this vision, players enjoy cooperation in today contemporary culture to feel part of the collective social dreams. In any case, cooperation is a trending topic generating new games.

Also, in our specific context of hybrid games, cooperation is a great way to preserve the social aspect of co-located social games. Discussions and negotiations are important in these kind of games, and it could strengthen the social aspect of a game using digital elements.

But cooperation can be vulnerable. First, it can be frustrating. As explained by Elias et al. (2012), if the level of cooperative interaction is high, if it is not just about adding scores but influencing the mutual performance, the performance of a player cannot be measured individually: it depends on others. Some players can get frustrated if their teammates do not perform well enough. These games can be unpleasant for beginners because of the social pressure. Also, experts can be tempted to give so much advices to the beginners that they end up playing for them. In two-sided team games, other players would bring it up as cheating, but the beginner is vulnerable in cooperative games. The authors also point out that cooperating players still have the same goals as in every game, such as winning and improving, but they also want to contribute. And this could disappear if someone takes the lead. Truth is, we never know for sure if the players will be cooperating, if cooperative game mechanics will lead to social cooperation. Booth (2015) include this concern in his definition of cooperation:

“A style of game play wherein each player works with the others but the play does not guarantee a balanced outcome; according to Jonas Linderoth there are two types of cooperation—”pure cooperation” wherein everyone works together equally and the “tragedy of the commons” style of cooperation, where the system falls apart if players are too individualistic.” (p.190)

Elias et al. (2012) give diverse solutions to prevent these issues. If the game require personal mental or physical skills, one can’t play for the other. And time pressure and complexity, giving too much to do at the same time, do not let space for players to achieve something else than their own tasks. Also, communication between teammates can be limited in the rules (in some card games, teammates cannot share their hand). Finally, in role play, a character can refuse to listen to an advice because of his characters’ personality.

I suggest another solution to enhance cooperation and avoid this problems: asymmetry. Asymmetry and cooperation work together perfectly because asymmetry means not only coordination but also full complementarity. Therefore, one can not ignore teamwork.
Asymmetrical cooperative games are based on an inequality between the players that they combine and overcome by working with each other. The inequality can be about a difference of capabilities (of communication, action...), knowledge (different accesses to information), or tools (different controllers...) between the players, leading to an asymmetry of mechanics. It is for example a feature of the recent console Wii U by Nintendo, in which players can use a classic controller or a touchscreen one called GamePad. Therefore, players can be on the same game while playing in different ways.

Cooperation is not the only advantage of asymmetry. Many cooperative automated games are replacing a game master by an app, therefore removing a kind of asymmetry. Challenging this practice can be very generative for new, different designs. Also, different mechanics can suit different players with their own preferences, personalities, and still bring them together. It could also address an inequality of capacities. For example, parents could cooperate with their children and both could enjoy the game by dealing with difficulties of their own level. Younger siblings could participate to their older's computer games without frustrating them by struggling with the complexity. Sometimes, even light contribution could satisfy one player, just enjoying being able to participate. And replayability is enhanced. If one game propose many different mechanics, players could experience many ways of playing it and avoid repetition. Moreover complementarity of mechanics encourage players to discuss strategies to fit them together, therefore to appropriate the game their own way.

Finally, as an interactive designer, I think that asymmetry can generate interesting perspectives. Dealing with asymmetry means not only thinking about how a mechanic or an interface works on its own, but how they can be brought together. Especially in a hybrid system. One interesting prospect is that cooperation between players using digital features and players using analog ones could bridge the gap in-between, through their actions or communication.

3.2.2 An analyze of existing cooperative hybrid games

Rocha (2008) examined the cooperative mechanics of video games and described two main kinds of designs to make players cooperate. The Challenge Archetypes involves different abilities among the players (that are fully complementary or intertwined), goals (fully shared or intertwined), and special effect of an action if it is specifically applied to a team member. Design Patterns refer to pure challenges (physical, coordination, memory, knowledge etc. challenge) and applied challenge (the time pressure, exploration of areas, conflict between two team, or working together to manage economic issues).

Cooperative games can indeed have many different mechanics, but I organize them in a different way. In one hand, a difference of capabilities between the players results in a cooperation through combined actions. In the other hand, a difference of access to
knowledge results in a cooperation through communication. Both can be present in a
same game, but one usually is prominent. And, as discussed before, cooperation can
be more or less symmetrical, ranging from extreme symmetry (like working together on
a puzzle) to extreme asymmetry (dealing with completely different mechanics or con-
trollers), with all the nuances in-between (like players having the same mechanics but
slightly varying abilities, or same mechanics and different information). To get a bet-
ter understanding of these distinctions, I analyzed hybrid cooperative games showing
different kinds of cooperation and different levels of asymmetry. Even if cooperative
games and hybrid games are becoming more frequent, the combination of the two is
still difficult to find. These games are still very rare and unique.

Cooperation through actions happens when players do not have the same capabilities
but have to work together, usually on a same interface (board, screen…). They need to
find the right strategy to achieve an objective. Very often, they have different characters
with different abilities, but the core mechanics, tools, controllers etc. are the same for
everyone. It is the case in Mansion of Madness Second Edition. This hybrid coopera-
tive board game is an evolution of the first analog edition. Players are investigators and
have slightly different abilities according to their characters, but have the same me-
chanics (move their token, open doors, collect items…). Following a story, they explore
a haunted mansion while checking items, information, confronting intruders. This man-
sion is represented on the physical board, and also on a companion app which is guid-
ing the story. The app is a valuable addition to the game. It is replacing a game master
by telling the story, imposing events and incarnating non-player characters (change po-
sition, dialogue, conflict). Several scenarios are available via the app which is then able
to create new paths and adapt to the game state. The immersion is strengthened by
music and sound effects, a very advantageous addition for a horror theme. Also, some
limited time events and unexpected choices increase tension. Players interact both
with tangible props (cards, tokens…) and the app to validate choices and sometimes
resolve digital puzzles to access items. The app only shows the common information.
Physical cards and physical clue tokens (like jokers) make players able build their per-
sonal inventory in front of them, keep an eye on it, discuss repartition with others etc.
The board and character tokens being replicated on the screen, they could be seen as
useless, but their physicality allows a best quality of cooperation and social interactions
by allowing simultaneous actions and discussions supported by a shared general vision
of the game state. Of course, the values of tangible features evoked earlier are present:
the emotional pleasure of dealing with the aesthetic of cards and pawns, the sensory
dimension, the freedom of organizing the different objects… Finally, cooperation has
many forms in this game: exploration of different areas, gathering strengths to defeat an
enemy, heal each other, and even take turns to resolve puzzles. Even if the main char-
acteristic is to combine similar actions, discussing the right choices to make is also an
essential dynamic. Combined actions are supported by communication.
Cooperation through actions can also be more asymmetrical. As mentioned earlier, some *Wii U* games are based on extreme asymmetry since players can have different tools (a controller or a controller with a private screen) and still cooperate on the common screen. In the *New Super Mario Bros. U*, the player with the GamePad can interact with items by tapping the screen to help the other player. The mechanics and abilities are totally asymmetric and complementary. It is impossible to succeed without teamwork and combining actions, therefore cooperation is extremely strengthened.

Figure 8. In the *New Super Mario Bros. U* cooperation feature, each player has a very different mechanic.
Then, cooperation through communication is strong when some players have the information and the others do not. *Space Team* is a mobile game for which several players sit together and use their phones. They are ship commanders, and have different kinds of buttons on their screens. They can accomplish different commands thanks to the buttons (such as “decrypt transmission”). When the timer starts, different written commands appear on their screens. But the players can usually not accomplish the command they get, because they don’t have the right button on their own screen. So they have to tell the information to the others. Also, some unexpected events sometimes occur, commanding them to shake or turn their phone upside down. This use of smartphone sensors brings some physicality to the game. There is pressure because they must act quickly and at the same time, also because of sound effects and the visual deterioration of the buttons when they make a mistake, making the interface more difficult to use. This results in a chaotic experience, with people frantically shouting at each other, panicking, laughing and trying to find better strategies between two sessions. It is a highly social game, defined as a party game. There is asymmetry in the abilities and access to information, however the mechanics are symmetric.

![Image](https://via.placeholder.com/150)

**Figure 9.** Players gathered to play *Space Team* in the video trailer of the game.

**Figure 10 and 11.** Two different screens for different players. One is deteriorated because of mistakes.

In opposition, but still focusing on cooperation via communication of information, is the asymmetric game *Keep Talking and Nobody Explodes*. A player is dealing with a digital bomb (on a computer screen or in a VR mask) and asks information to a player going through a paper document giving instructions on how to defuse the bomb. To succeed, they have to go through several puzzles placed on the bomb. The one with the ability to act on the bomb has to ask what he is supposed to do, and answer to the other asking what he is seeing to know which are the corresponding instruction. The information go back and forth. Social interaction is galvanized, however eye contact is less present
since they must be very efficient in their tasks, can not see the other’s document, and sometimes a VR mask is even included. However, cooperation is still extremely strong: they have to listen to each other, answer efficiently. And here again, the time pressure and immersion into a narrative bring enjoyment. The immersion is also enhanced by the fact that the instructions are in a real paper document and the player leafs through it. In this unique game setting, communication bridges the gap between the physical and digital materials, settling its hybridity. It is the best example of the kind of mechanics I am aiming to explore.

Figure 12. Players trying *Keep Talking and Nobody Explodes* and dealing with asymmetric mechanics.
Figure 13 & 14. The instruction on paper documents and the digital bomb with its puzzles and timer.

Combining actions and communicating information are the two main ways to cooperate in hybrid cooperative games. An asymmetry between analog and digital mechanics makes it even more interesting, since cooperation is then the way to merge these two worlds and make the hybridity of the game valuable and relevant.
My design-based research is supported by different methods. I am introducing them in this section, explaining why they are relevant in my context. I reflect upon them a second time in the discussion of my experiments to describe how they fitted in my practice.

According to Zimmerman et al. (2007), Design Research in the design research area implies producing and contributing knowledge instead of only supporting the finalization of a commercial product. It is the opposite of Design Research in the HCI field: the upfront research to ground, inform and inspire the development of products for consumption. This method enables a certain freedom of exploration, since there is no perfect solution required and no commercial demand. It allows designers to explore an area full of possibilities by generating experiments. I am then close to the Design Research method, but focusing on exploration. I use the word “exploration” to explain the fact that I am investigating an area which has not been explored in depth yet, and I am trying to establish main observations through diverse experiments. I am not trying to finalize a perfect game, but exploring a precise matter: mechanics of hybrid cooperative co-located games.

As mentioned earlier in this paper, mechanics are actions used by the players to interact with the game system. They can be described by verbs (jump, roll the dice, draw…) and are more or less crucial in the game. Since they are actions, they can be used by people with no need for added ornaments or aesthetics, nor a complete game system. And putting them into practice, even if they are “naked”, seems necessary to really explore my matter, since I focus on cooperation and social interaction. Designing for Homo Explorens perspective of Hobye (2014) inspires my practice. Indeed, it is based on several experiments to evaluate how small differences change the experience of the users, while focusing on “social exploratory interaction between participants mediated through designed artifacts.” (p.10). I also design some experiments, and they are meant to mediate and explore interaction between players since social interaction is a key element of co-located cooperation. But to make it happen, playtests are necessary.

The playtests can ground my discussion, and be part of the knowledge contribution as artefacts. Since these artefacts are central to my knowledge contribution, I also consider the method of Research Through Design as defined originally by Frayling (1993): “research where the end product is an artefact – where the thinking is, so to speak, embodied in the artefact, where the goal is not primarily communicable knowledge in the sense of verbal communication, but in the sense of visual or iconic or imagistic communication.” (p.69). Therefore they should be well documented, with visuals, descrip-
tions and playtests reports along with the discussion. It also seems profitable to create an annotated portfolio. This method is a mean to visually highlight the resemblances that exist in a collection of artefacts. Bowers (2012) points out three of its advantages that greatly relate to my goal. First, a collection of designs establish an area in a design space. Then, portfolios inspire novel work by mapping dimensions of this design space. Finally, they “bring together individual artefacts as a systematic body of work” (p.46). Unlike a written contribution, a portfolio allows to connect experiments all together by producing a common picture and highlighting the emerging pattern, creating obvious connections between them, and merging them as one solid contribution.
5 • EXPLORATORY EXPERIMENTS

5.1 DESIGN PROCESS

I explored cooperative mechanics in hybrid co-located games with several experiments. While thinking about mechanics, I kept in mind two main concerns. First, the balance between the analog and digital inputs is important. Both should be relevant, and bring something unique to the game. Then, the interaction and cooperation between the players should be the core elements of the mechanics. Using the advantages of both hybridity and cooperation should enhance enjoyable interaction between users. Keeping these aspects in mind, I decided to create experiments with a same starting point to be able to compare them efficiently in the end. The first recurrent element is the fact that there are two players. Usually, one player is on the analog side and the other on the digital side of the game, to create the asymmetry. The experiments are also based on a same digital device, a smartphone. Indeed this single device contains various inputs and feedback features such as sensors, cameras, a screen etc. It can be used in a lot of different ways, engendering various ideas for hybrid mechanics. It is a very powerful and generative object. Besides, it is today a common device, well known and owned by most people. It is one of the more direct and efficient ways for game designers to involve digital elements into co-located games. This starting point helped me to generate ideas.

The ideas of the different mechanics emerged almost at the same time. At first, it was too tempting to remove the digital features to increase the chance of a fruitful social engagement. I then decided to start by turning single player digital mobile games into hybrid and cooperative games. The first three experiments are the result of this effort and were made almost simultaneously with the intention of exploring different areas: cooperation via communication (Flappy Bird Coop), via parallel actions (Swapping) or via actions in a same space (Unblock). While designing these three ideas, I tried to think of balanced mechanics not using existing apps. My first idea, Color Cocktail, is inspired by the game Space Team I mentioned earlier. Then, Missing Something is inspired by the fact that Unblock puts the tangible layer and the digital layer on top on each other. Finally, Tell a Line is an evolution of Color Cocktail but is meant to be more original, using other tools and gestures.

Since I designed these mechanics more or less at a same moment, it allowed me to gather them in common playtest sessions. I conducted five sessions involving two players sitting in front of each other and trying the different experiments. They took turn, trying both sides of the asymmetric cooperations. The sessions ended with discussions and open questions to compare the different experiments. In-between playtests, iterations were made on the experiments and the way the sessions were managed.
5.2 EXPERIMENTS AND RESULTS

5.2.1 Flappy Bird Coop

Figure 15. A cooperative version of Flappy Bird: one can see the screen, the other can touch it.

Description
Flappy Bird is a mobile game: the player has to tap the screen in varying rhythms to make a bird character avoiding elements on its way while it is floating to the right. I turned this game into a multiplayer game using communication cooperation. Player A can tap on the screen but cannot see the screen. Player B can see the screen, but cannot touch it, and has to tell the other player when to tap the screen.

Results
This mechanic generated strong interactions between the players, especially in-between the games when players were actively discussing the better way to communicate. Different strategies were created, such as saying “hop” each time the player should tap the screen, telling when to start and stop tapping, or telling if the speed of the rhythm should be slow, medium or fast. As a player said, “It is challenging because you have to make up your own language.”. Anticipating the obstacles in front of the bird was also important, because the communication aspect made the process decision/action slower. They also gave each other advices when exchanging roles. Another set-
ting was experimented: the smartphone was held on the nose of the player tapping the screen. It was an inconvenient position, but also very amusing for the players because they could look each other in the eyes and share their emotions.

Some players not seeing the screen were sometimes frustrated, but the feedback sounds of the game and the tension in the face of the teammate helped to keep them involved. These two elements, sounds and emotions, were amusing to the players.

5.2.2 Swapping

Figure 16. The two different activities of Swapping: playing Flappy Bird and rolling dice.

Description
Two players do different actions. Player A plays to a digital game involving precision and timing, Flappy Bird. Player B is throwing dice. When a die shows the number six, the two players swap their activity: Player B plays at Flappy Bird and Player A rolls dice. The goal is to swap as many times as possible before the bird of Flappy Bird crashes.

The cooperation is an alternation between asymmetrical mechanics. Besides swapping between analog and digital interfaces, players also swap between an activity involving skills and an activity involving luck. However, throwing dice is also a bit about skills: grabbing the cubes, throwing quickly in a certain area, and collecting them again as quick as possible. The main collaboration moment is when the players have to swap, and a player has to jump into the fast paced mobile game.
Results
The first playtest involved a different digital game. However, it was a slow paced and satisfying game. Players needed less cooperation and actually felt frustrated when they had to give the game to the other player. They even confronted each other, shouting “No it’s my turn!” or “Haha, you lost!”. I therefore choose to use Flappy Bird since it is a difficult, fast paced game which gave the swapping mechanic more importance. Being a difficult game, players were less inclined to keep it for themselves, and more ready to play as a team against the game system. Also, frustration built up along with the strong desire of doing better and better. The confusion of the first trials was slowly replaced by more method. Players believed that they could get better at this game with practice: “If you practice a lot, if you play with the same person, then you can get really good because you know exactly when to switch and how this person does it.”.

Players had different opinions on this mechanic. Some, who were swapping easily, felt like it was not as cooperative as other experiments since they were alone doing the activity. However, a majority struggled and was very enthusiastic, feeling that the swapping moment was pure cooperation. This moment provoked tension and excitement. During downtime, they discussed the word to shout when it was time to swap, strategies to pass around the smartphone, the orientation of the screen, and even the right moment to pass the game to make easy the moment to jump into the game before the bird crash down. “You have to figure out how you do the swap, and prepare the swap: get the bird up here so she doesn’t have to do anything, so she has a time… You prepare when to do the shift so you don’t give it away in the middle of something.” a player explained. Other strategies emerged, such as keeping an eye on the screen to know the progression while throwing dice. A majority of players were excited about the game, and were even more engaged when the current record of number of swaps was told.

During the discussion, other ideas were generated. The use of dice was discussed. Some players appreciated the feeling of rolling dice, and the switch from a tactile screen to tangible objects. Others suggested a tangible activity involving skills, such as stacking cubes, which would change the dynamic between a highly stressful game and the more relaxing action of throwing dice. Another idea generated was to involve more players with very different activities, by adding a puzzle to complete in order to win for example. Also, I found the fact that players were preparing the position of the bird before switching interesting. Developing this mechanic further could lead to an app designed to give maximum tension and cooperation during the swapping, giving importance to where the player leaves the game when giving it to the other player.
5.2.3 *Unblock*

![Image of the setup of Unblock, with tangible shapes blocking the screen but moved around by a player.](image)

**Description**

Player A plays a game app involving a fast pace and the need to tap different spots everywhere on the screen. For the playtest, I used the app *Fruit Ninja*: the player has to tap the screen to slice the fruits coming into sight, and avoid to tap on bombs. Several «blocks», little cardboard shapes, are on the screen blocking the view. Player A is not allowed to touch the blocks, but Player B can. He has to move them around to make space for Player A to touch the screen. A cardboard frame around the screen prevent the shapes from leaving the screen. There is a cooperation of different capabilities on a same screen.

**Results**

The brief was short but important, since the players had to understand that the one moving the blocks was not only there to be in the way, but to truly help the other player with the issue. The word “helping” is essential when explaining this mechanic. The cooperation is strong because the player moving the tangible blocks is directly helping the other one on a same screen. Players are really close, and working on the same task. They interacted a lot during playtests, giving each other directions, asking to move of the way, saying “thank you”. An interesting observation was the way blocks were used to hide the bombs, avoiding a mistake from the player trying to touch the screen.

Some iteration have already been made, such as finding the right shapes for the blocks and adding a frame around the screen, but other upgrades can happen. Using a bigger screen could help the players to feel less frustrated. They could have more freedom in their movements, and work better together. Moreover, the mechanic of hiding and blocking certain game elements with the tangible blocks could be interesting to work further. The blocks could be not only elements blocking the way, but also an advantage against traps or enemies.
5.2.4 Color Cocktail

![Image of Color Cocktail](image)

Figure 19. The two sides of Color Cocktail: a smartphone being shaken and the meaning of the different colors.

**Description**
Player A holds a smartphone displaying random colors, and has to do certain actions with the smartphone (shaking it, turning it upside down, shouting in the microphone). Player B holds a paper telling him which color corresponds to which action. Some colors can be combined, resulting in a complex action. For example, if red is “shaking” and blue is “upside down”, purple means “shaking upside down”.

The cooperation involves communication. One player must translate the colors into instructions, the other perform the actions. This experiment is the only prototype not working for real. The random colors are a pre-made video and nothing sense or indicate that the players failed or not.

**Results**
In the first setting, the player holding the phone could not see the screen, and the other just had to tell him what to do according to the colors. The mechanic worked, but was not engaging enough, especially for the player doing the actions. To give him more tasks, I asked him to be the one able to see the screen and to tell the other the colors displayed. But the game seemed to be too easy, therefore not really enjoyable.

To take this mechanic further, many elements should be upgraded. First, replayability should be enhanced. Learning the color instruction should be difficult thanks to more different actions and visual patterns, along with a randomization of the relation between the two. Then, more feedbacks should be given to increase the tension, such as sounds becoming louder each time they fail an action so the communication becomes more
difficult. Finally, the skills of the player holding the phone should be more involved. The moves could be more difficult, or he could be getting hidden information himself. For example, the phone vibration during certain colors could indicate to do the opposite of what he is told by the other player.

The interesting element of this prototype is mostly the way the smartphone is used as a tangible controller thanks to its sensors, as inspired by *Space Team*.

### 5.2.5 Missing Something

![Figure 20](image1.jpg) **Figure 20.** First step: a player hinting, with her body pose, a missing ice cream while her teammate is taking a picture.

![Figure 21](image2.jpg) **Figure 21.** Second step: a player doodling what she thinks is missing from the picture (in that case it is a horse).

**Description**

Player A draws a paper where the name of an object is written, then takes a pose hinting the use of this object. Player B takes a picture of the pose, tries to guess the missing object, and doodle it on the picture. Since Facebook messenger was used for this experiment, the final picture can be easily shared between them.

**Results**

Players appreciated the creativity involved in this mechanic. But the waiting time when a player was drawing was too long. I believe this mechanic could be more entertaining when more than two players are involved, so the drawing time could also be a social time for the other players. The interesting part of this experiment is the superposition of the two layers, combining a body and a digital drawing, and the way the final product is a cooperative picture.
5.2.6 Tell a Line

Description
Two players sit in front of each other. Player A holds a smartphone and watches a video of a black dot moving, tracing the shape of an object without leaving a trace. Player B has a paper and a pencil, ready to draw. Player A has to communicate to Player B the movement of the dot so Player B can draw it on the paper. Together, they try to get the right shape and guess what it is supposed to be.

Results
This experiment was the most appreciated by the players, and its mechanic seemed very enjoyed. Because of the difficulty of the challenge, making them panic while explaining the video or fail at drawing, they had many moments of laughter. The moment of revelation of the answer was also a strongly amusing time.

They felt like it was a very cooperative mechanic, because they were working together on the same task and communication was essential. One had the information, and the other the capability to represent this information. They felt like they were “failing together or succeeding together”, especially because the game was difficult since the movements were fast. It was understandable and acceptable if mistakes were made. Moreover, the downtime between two drawings was dedicated to excited discussions. They told each other their difficulties and established strategies, deciding on the right way to communicate efficiently the movement of the dot. The freedom of creating strategies was appreciated, and players were very creative. They explained the movement by using their hands, or their voice, or both. They tried to show the movements with a finger,
describe the movement, or explain the movement and shape of the line while giving the direction right/left by tapping the good hand on the table. They also advised each other or explained what helped them to understand the movement, like giving the context of the current line for example (Eg. telling that the line goes “inside the precedent circle” instead of “to the right”).

It is also interesting to point out that the players themselves came up with their own constraints, even if there were no many rules during the first sessions. They choose to not make it too easy. Indeed, they decided that explaining the movements of the dot by showing it with the finger was too easy, and not as entertaining since they were not talking anymore. Since they were not competing against other teams, they favored the enjoyable interactions over efficiency. Failing was not an issue, even if succeeding brought a lot of enthusiasm. Knowing this, and the fact that discussing the way they should communicate was a main moment of the game, we could imagine bringing this mechanic further. We could challenge the players by giving them a different constraint of communication each turn, inducing them to reconsider their strategy regularly. It would also improve replayability.

A way to engage the players was also to create drawings with different difficulty levels. Even when struggling with the easy levels, players were eager to try a complex drawing and, ultimately, fail with amusement. Provoking enjoyable social interactions was the main success of this experiment.

5.3 DISCUSSION

Designing for hybrid cooperation: learning from playtests

It has been valuable to experience the difficulties and opportunities of designing hybrid games. Keeping the balance between the digital and tangible features is essential. If one aspect is too weak, not interesting enough, the mechanic does not seem right. But doing so is surprisingly difficult. Many early ideas of mechanics I had were deficient, because they would be working better by removing a side of the hybridity. It was always tempting to gather everything in one world. Especially because many game features, such as time countdown, randomness or sound, can be created with both analog and digital material. Also, keeping the face to face social interactions was another precious goal when designing these experiments. And it can be threatened when using digital features, especially smartphones which are designed for long distance communication. The appropriation video calls into mechanics seemed promising, but was not relevant enough for a co-located setting. My main concerns when thinking of mechanics were then: is the use of digital and co-located features valuable? Does the cooperation rely
on social interactions? Is there a right balance between the players roles?

Different kinds of hybrid cooperation are explored through these experiments. Communication to share information is used in Flappy Bird Coop, Color Cocktail and Tell a Line. The discussions between the players bridges the gap between analog and digital worlds. In Unblock and Missing Something, these two layers are merged, but each player manage one layer. Finally, Swapping is all about shifting from an tangible activity to a digital one. We could say that cooperation took three different shapes between the analog and digital aspects and the two players: communicate, combine, alternate.

Social interactions were intense during the playtests. Players talked a lot both during and in-between games. Cooperation was revealed in several ways. Players were saying “we”, “help me”, “thank you”. They also felt like winning and failing together, showing their enthusiasm for teamwork with “high fives”. They said not feeling burdened by the performance of the other, especially since the games were difficult: they were united against the tricky game system, and understood if mistakes were made. They gave each other advice, talked about strategies, shared their difficulties. This mutual aid was important since the players would switch roles regularly. Teamwork also reached its peak if a current record on the game was announced, even if the other team was not present nor named: “We will do better for sure!”. But this brought competition into the picture. Some precise goals should be settled, with different levels of difficulty, instead.

Some features were recurrent during the discussions, showing their high value for the players. First, the flexibility of the mechanics and “space to appropriate the rules” were appreciated. The rules were not extremely detailed, but players quickly came up with rules and strategies while playing. They negotiated what should be allowed to do or not, and they didn’t choose the most easy ways to communicate: they preferred the solutions implying a lot of social interactions but more challenge. Indeed, succeeding perfectly did not seem to be their ultimate goal. When failing, they usually laughed a lot instead of being disappointed. Debating strategies was also a key element of cooperation. Players discussed a lot in-between rounds about how to communicate or help each other. Then, time pressure (with short videos in Tell a Line or an end game limit in Swapping for example) was a good way to make the players involved, excited, and have them help each other. Indeed, the level of complexity increased with the time pressure, and overcoming the challenge required cooperation. This difficulty was beneficial for cooperation: one cannot dictate orders to his teammate in this situation, and players are more prone to help each other. Also, difficulty prevents boredom and judgement over the player making a mistake. Flappy Bird is known to be an absurdly difficult game, and it helped to maintain an exhilarating and light mood when used in experiments. And when players could choose between facility and challenge, they choose the later to experience more “fun”. Finally, players liked the fact that they could get better at certain mechanics with practice, experience, and by getting to know how their teammate plays.
Ultimately, the popular mechanics were the one involving these elements of flexibility and complexity boosting interactions of cooperation: *Flappy Bird Coop, Swapping* and *Tell a line*.

Some mechanics could be taken further, but this research could also be improved. Indeed, I worked to strengthen the social interactions and flexibility but my use of the tangible advantages was too restricted. For example, sensory feedbacks could be more involved in the mechanic, like in the suggested evolution of *Color Cocktail* using vibration. Indeed, a tangible sensation can be impossible to guess just by watching, therefore it could be a private information that a player has to feel and share. It could also improve eye contact, since the information is not visually displayed like in my experiments. And, even if the digital matter can produce several sensory feedbacks (like vibration), physical objects can bring a great diversity of textures.

Finally, the annotated portfolio on the following page gathers the experiments together as a common work, in a design space shaped by several concepts that could inspire other designs. To make this portfolio, I tried to figure out the main interesting outcomes of the different mechanics. The annotations are placed so we can see which experiments are concerned by a same pattern. First, I noted the fact that some mechanics have been created by turning a single player game into a cooperative one. Then, we can observe three categories of relationship between the digital and analog features: bridging analog and digital matters by communicating information, combining layers of the two matters, and alternating between the two matters. Every mechanic fits in a category. Then, I highlighted some interesting dynamics between the two players: the fact that one player often gives instructions while the other is acting, and a sometimes necessary physical proximity (that can be enhanced by the act of sharing a same screen instead of having two players doing spatially separated tasks). Finally, I observed that two mechanics used creativity as a way to give more freedom, flexibility to the players. These annotations are destined to spark ideas, to help designing new mechanics based on them. Indeed, working from a key word or key feature is very generative when brainstorming ideas. This portfolio could also help doing the same exercise with existing mechanics: categorizing them by pointing out what they have in common, and highlighting interesting features that makes them unique.
ASYMMETRIC HYBRID COOPERATION
ANNOTATED PORTFOLIO OF PROTOTYPED MECHANICS

CREATIVITY FOR FLEXIBILITY

TELL A LINE
MISSING SOMETHING

INFO BRIDGE ANALOG/DIGITAL

COLOR COCKTAIL
FLAPPY BIRD COOP
UNBLOCK

INSTRUCTING/ACTING
FROM SINGLE GAME TO COOP
PROXIMITY & SHARED SCREEN

SWAPPING

ALTERNATE ANALOG/DIGITAL
Designing mechanics: reflection on the design process

By experimenting a precise area through Design Research, I was able to build knowledge such as defining some of the strengths and weaknesses of the mechanics. The prototypes of individual mechanics, without a complete game system or added aesthetics, were efficient. Even a not fully functional prototype could be used, but the presence of someone leading the experiment was essential to manage the flaws. My role was not only to explain and observe, but also to support players if a flaw appeared.

The prototypes could be engaging enough for the players to enjoy the game. However, some raw mechanics were less engaging than others. It is always possible to give a brief narrative introduction if the players need more motivation, to help them step into the “magic circle”, in the time and space dedicated to the game. In that case, the mechanic has to make sense in the game world. But the social interactions along with the cooperation were usually sufficient to involve the players. As cooperation was a key concept of these experiments, the mechanics mediated interesting interactions between the participants. Each small modification, even in the way I announced the rules, created different dynamics. As I iterated, I realized that giving less precise instructions, on the way to communicate for example, gave the players more flexibility in their exploration of the mechanics. Therefore they generated more surprising strategies. The Designing for Homo Explorens perspective seemed to be a relevant one to explore social game mechanics.

The low-fi aspects of these prototypes had some advantages. Players easily and quickly understood them. They also felt free to modify and criticize them. Thanks to the sobriety of the experiments, players were not afraid to express their honest thoughts. They clearly pointed out what could be frustrating, or leading to competition instead of cooperation. I could then iterate on some elements through the different playtests. They also came up with ideas of rules by themselves, and further enhancements of the mechanics have been discussed. Changes were made in the existing mechanics, but new ideas for further explorations also came up. And this seems related to the fact that the prototypes look like they are easy to modify. Too finalized or complex prototypes could have prevented players to dare giving negative reviews and ask for adjustments. Also, the less

The playtests are also generating ideas for more complete games. Indeed, some unexpected discoveries could be pushed further. It is a main outcome of my process: each subtle cooperation method observed could be maximized to become a core mechanic. For example, Unblock could lead to a game with blocks not only blocking the screen but also allowing to block enemies. And the physicality of the blocks could be explored further. The following idea is inspired by Unblock and the shadow effect of Dungeon Light by Volumique: a light token could be added, and the blocks could project digital shadows on the board. Moving blocks and tokens could be the way of revealing or
hiding certain area of the board, to collect items or block traps. Blocks could also be staked on top of other blocks to create bigger shadows or different shapes. This way, the tangible matter and the hybridity would have even more value. Then, Swapping showed how deciding on the right timing to exchange roles could be used as a mechanic, along with playing with the rotation of the screen. Tell a Line could benefit from randomized constraints to exploit the cooperative aspect of discussing strategies. New gameplays could be build upon little but surprising observations.

These mechanics could also be integrated to games. Indeed, we saw that companion apps for hybrid board games are sometimes used during a precise stage of the game, at the end of a round for example. We can imagine collecting blocks during a round of board game and finalizing with a timed hybrid cooperation like Unblock. Then, gamification is the application of game elements in non-game contexts. The mechanics could applied to other contexts. For example, the tangible manipulation of Unblock, Swapping or Tell a Line could contribute to health rehabilitation.

All these possible applications show how prototypes of mechanics as experiments, artefacts, can be valuable knowledge contributions and inspire new designs. Therefore, Research Through Design, doing to understand, seems to be a solid way to reflect on a specific kind of mechanics. However, applied by a game designer, these methods would more likely have the purpose to create a finalized game instead of exploring a design space. Finally, if we look at the current discussion, Research Through Design is also a way to reflect on the process of designing mechanics itself.

The annotated portfolio is an efficient way to conclude the exploration. The interesting features are pointed out, and categories to structure the experiments are also suggested. This portfolio was designed while writing the last theoretical part of this thesis, and helped me to differentiate mechanics of cooperation through actions (different capabilities) and through communication (different access to information). That way, reflecting on the experiments by finding common patterns fed my theoretical reflection. But the main goal of this portfolio is to link the experiments to gather them in a same body of work and visually represent the design space in which I experimented, while hinting ways of working in this space via the annotations. It gathers and displays my designs, which could inspire other ideas of experiments. Therefore, this tool seems interesting to conclude a practice while encouraging a further exploration at the same time.
To conclude this paper I briefly review my process while discussing its academic value, resorting on Löwgren (2007) criterias for the construction of scientific knowledge: it must be new, relevant, grounded and criticizable.

Few examples of symmetric cooperation in hybrid social co-located games exist. Hybridity in games is growing and their is a recent increase of the cooperation mechanic. But merging them and focusing on asymmetry create an unexplored, new design space. The definitions of the main concepts were established thanks to literature and reflections on asymmetric cooperation have been made. The first suggested guidelines are related to the importance of preserving certain features in hybrid games, such as direct social interactions, tangibility and flexibility. Then, I suggested a mechanic-first approach of designing games to come up with relevant uses of both analog and digital aspects. Through all this theoretical research, I tried to highlight the value, the relevancy, of the different concepts I am gathering together: why they are interesting to consider in game design (externally relevant), but also for interaction designers (internally relevant). Analyzing existing games, I came up with two main kinds of cooperation: by combining actions, and through communication, combining information. All these theoretical and analytical groundings are then supported by an empirical grounding thanks to tested experiments of mechanics. The playtests are documented and result in a discussion on best practices to design hybrid cooperation but also on applying design methods to design mechanics, all in an attempt to answer my research question. I see this practical exploration as an annotated repertoire to inspire further designs. Hopefully, the way every step is detailed helps this knowledge construction to be criticizable.

How to design mechanics for asymmetric cooperation in hybrid co-located social games? There is no short, finalized answer to this question but I attempted to find opportunities, limitations and guidelines through all my research. The experiments could hint a way of designing mechanics: though exploratory low-fi playtests, allowing players to bring their own vision. More iterations and experiments should be made, not only with smartphones but opening to the diversity of existing technologies. This way, the discussion on this topic could keep going and extend, question or solidify my own contribution.


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