The Game Situation

An object-based game analysis framework

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Resumé

Kvantitativ forskning udført i kognitions- og samfundsvidenskabelige studier har endnu ikke lagt sig fast på specifikke metoder til at håndtere computerspil som adfærdsstimuli. Derfor kritiseres studierne ofte for deres interne og økologiske validitet samt for mængden og generaliserbarheden af studiernes resultater. Denne afhandling tager udgangspunkt i det eksplorative spørgsmål 'Hvilken rolle har computerspil i eksperimentel forskning?' og har til formål at belyse eksisterende praksisser i brugen af computerspil i forskning, ræsonnementet bag brugen af dem, samt deres ulemper. Dette eksplorative spørgsmål bruges efterfølgende til at underbygge en række parametre i et rammeværktøj til spilanalyse, særligt i forhold til analysens omfang.

I eksisterende rammeværktøjer er computerspil ofte forstået som en stimulus, som i varierende grad bestemmer spillerens adfærd. Denne måde at forstå spil på er dog udfordret af, at spil udgør en forskelligartet og varieret gruppe. Dette truer dermed også validiteten af de studier, der forstår spil som stimulus. Som en løsning på dette, fortolker det foreliggende rammeværktøj spil som situationer frem for stimulus. Vi taler om stimulus, når vi er interesserede i en specifik genstand i en organismes opmærksomheds- eller reaktionsmønster. En situation er derimod defineret ud fra hvem eller hvad der tager del i situationen, lokationen, samt typen af aktiviteter der udfolder sig. Denne måde at forstå spil på, relaterer sig bedre til den måde spilleren engagerer sig i spillet, og fremstår derfor som en både realistisk og produktiv retning for undersøgelser.

Dette leder til afhandlingens andet overordnede spørgsmål: ’Hvad er en spilsituation?’. Selvom forskningen i psykologiske situationer er omfattende, kan dens viden og begreber ikke direkte overføres til de konstruerede miljøer vi finder i spil. For at forstå hvad en spilsituation er, må forekomsten af 'hvem', 'hvad' og 'hvor' først bestemmes. Med udgangspunkt i økologisk psykologi, og især begrebet tjenligheder (affordances), anser det foreliggende rammeværktøj spilobjekter som byggestenene i en spilsituation. Spilobjekter anses for at være instanser af spillets regler, der leder og modificerer situationsdeltagerens handlekraft, når denne agerer på eller gennem spilobjekterne. Spilobjekter er forbundne med hinanden i kraft af deres komplementære disponibilitet (fx kan en avatar der kan gribe, gribe kasser der tillader det), og danner netværk, der udgør den øjeblikkelige spilsituation. Denne måde at forstå spil på, anser derfor spil-systemet og spilleren som to deltagere i en situation, der er bestemt af den øjeblikkelige konfiguration af opfattelige spilobjekter.

Dette perspektiv på spilmiljøet som et netværk af objekter giver adskillige muligheder for at udforske spillerens engagement i spillet, på både et makro- og et mikroniveau. På makroniveau kan observationer af de mest indflydelsesrige og påvirkede noder for eksempel give information om den måde, hvorpå spilleren kan udøve kontrol, og hvordan spilsystemet udfordrer denne kontrol. En sådan undersøgelse kan også give indsigt i ligheder mellem spil, der tilhører forskellige genrer, og forskelle mellem tilsyneladende ens spil. Dette giver dermed en verificerbar måde at spore forskellige typer af spilengagement, med udgangspunkt i et samlet fælles grundlag – spilobjektet og dets relationer. På et mikroniveau giver rammeværktøjet mulighed for at studere de øjeblikkelige konfigurationer af objekter – de førnævnte spilsituationer. Dette opfylder det krav, som blev beskrevet i indledning, nemlig at der tilbydes en måde at selektere og kontrollere det begrænsede samspil mellem spilleren og spillet under et eksperimentelt studie. Et fokus på øjeblikkelige interaktioner respekterer spils forskelligartethed, og gør det muligt at generalisere på tværs af øjeblikkelige interaktioner, fremfor på tværs af spillene som en helhed.

Selvom rammeværktøjet indeholder spor af karakteristika fra sit oprindelsesdomæne, især i dets fokus på øjeblikkeligt samspil, er det et generativt værktøj, der i kraft af den lille målestok af dets bestanddele – spilobjekterne og deres verificerbarhed – kan fungere som et fælles grundlag for en systematisk analyse af spil.

Abstract

Quantitative research conducted in cognitive and social sciences has yet to settle on specific methods of managing the digital game as a behavioral stimulus. Consequently, studies and their results are often confronted by criticism of their internal and ecological validity, and the size and generalizability of the results. The current work starts with the exploratory question ‘What role does the video game have in experimental research studies?’ intending to understand current practices, the reasoning behind their use, and their drawbacks. This exploratory question informs the parameters of this game analysis framework , specifically in terms of scope.

Previously developed frameworks have generally conceptualized the video game as a stimulus, with varying degrees of determination on the player’s behavior. The heterogeneity of games, and their variety, impose a resistance to this conceptualization that results in threats to the validity of the studies. As a response to this, this framework seeks to reframe the video game from a stimulus to a situation. We speak of a stimulus when we are interested in a specific object of the organism’s attention or response pattern. A situation, however, is defined by who the participants are, the location, and the type of activity or activities that are taking place. This reconceptualization appears to relate more closely to the procedure of the player engaging with the game and thus appears as a viable and productive avenue of exploration.

This leads to the second general question of the thesis, ‘What is a game situation?’ While research into psychological situations is broad, knowledge and concepts cannot be transferred wholesale to the constructed environments of games. The instantiation of the ‘who’, ‘what’ and ‘where’ in the case of the game situation must be established, in order to understand what a game situation is. Relying on ecological psychology, and particularly the concept of affordances, the current framework settles on game objects as the building blocks of the situation. Game objects are considered to be instantiations of game rules, transporting and modifying the agency of the situation participants that act on and through them. Game objects are linked by their complementary disponibilities (e.g., an avatar that can grab, can do so with a grabbable box), forming networks that represent the momentary game situation. Thus, this reconceptualization considers the game system and the player as two participants in a situation, determined by the momentary configuration of perceivable game objects.

The perspective of the game environment as an object network allows for multiple avenues of exploration of the player’s engagement with the game, both on a macro and micro level. On the macro level, observations about the most influential and influenced objects, for example, can provide information regarding the manner through which the player may exercise control in the engagement and how the game system challenges that control. Such an examination can also provide insights into similarities between games that belong to different genres, and differences between apparently similar games. In this way, it provides a verifiable means of tracing types of game engagement, starting from a unified common ground – the game object and its relations. On the micro-level, the framework provides a means of examining momentary object configurations - the aforementioned game situations. This answers the requirements presented at the beginning, of providing a means of selecting and controlling the limited engagement between the player and the game during an experimental study. The focus on momentary interactions respects the heterogeneous nature of games and allows equivalences to be made across such momentary interactions and not the games as a whole.

While presenting trace characteristics of the domain of origin, particularly in its focus on momentary engagements, the framework is a generative tool, that by virtue of the small scale of its constituent parts, the game objects, and their verifiability, can act as a common ground for the systemic analysis of games.

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Contents

Chapter 1. Introduction

When I was researching a topic for my MSc thesis, I stumbled upon the work of Mischel and Shoda (1995) and their research into personality changes that occur according to the situation in which the person finds themselves. The idea of mutability and fluctuation of traits as a response to circumstance resonated with me, as a means of understanding the debates surrounding game effects – a means of understanding the behavior of players in the momentary context in which they find themselves without making generalizations to their behavior across games, and across their life contexts. While this was pointing to contextual mutability of personality, it did not offer a directly transferable account of a situation in the context of games. So the question 'what is a situation in a game?' emerged. In the process of writing this dissertation, that question was provided with an answer. But the form it took was not the one I initially envisioned, as it generally happens in research projects.

My initial question regarding what a game situation is changed over the course of the research, principally because it was the wrong question to ask at the time. It was asked to nothing in particular and hung in the air, unsupported. Other questions needed to come before it. Questions like 'when we research game effects, how do we actually use the game?', or 'what does it actually mean that the game is a stimulus?'. Answering these foundational questions allowed the initial one to no longer be unsupported and eventually receive an answer.

The contribution of this dissertation will be explored in a broader and more formal manner in the following section. But the personal motivation, lying at the foundation of this work, is one of curiosity. As will be discussed, the study of games in experimental research in the social sciences is one confronted with many questions. Does playing violent games make children violent? Does playing cognitive training games improve cognitive plasticity? Are the effects of playing games large enough to even be relevant? This is not a work that pretends to provide Answers to all the challenges posed by the study of games, but which primarily wants to ask questions, and in the process, hopefully, uncover a more solid foundation for their analysis.

1.1 Motivation

In 2003, the president of the American Psychological Association, David Washburn, ended his presidential address expressing his hope that the introduction of digital games and digital game play into the toolkit of psychologists will spell the beginnings of a new, innovative, and productive research field that will be, above all else, academic (Washburn, 2003). However, the field seems to suffer growing pains as it tries to establish valid and standardized research procedures. As John L. Sherry describes, embarking in a review of the literature published in video game effects research can, at first sight, appear like dealing with a body of work that is ‘large, diffuse and contradictory’ (Sherry, 2006). The practices and methods employed in this domain have received criticism from a breadth of directions, from the small effects sizes reported (Ferguson & Kilburn, 2010; Ferguson, 2007b), to the methods employed for the assessment of effects (Elson & Ferguson, 2014; Ferguson & Rueda, 2009). Assessments, such as the accessibility of aggressive thoughts, have been criticized as conflating cognitive hostility and priming of cognitive associations without a link between cognition, and the intent to cause harm (Elson & Ferguson, 2014). Other measures of effects, such as the Competitive Reaction Time Test, during which participants are asked to administer noise blasts of varying intensities to what they think is another human participant, have been criticized on the grounds of lacking a standardized use, lacking non-aggressive alternative reactions, lacking sanctions as to what would be considered aggressive behavior in the context (as opposed to an ecological context where aggressive behavior is socially and legally sanctioned), and the dissimilarity between the task, and aggressive behavior as commonly understood (Ferguson & Rueda, 2009). Respondents to the criticism, however, cite the replicability of results yielded, however, failing to address the ecological validity concerns raised (Bushman, Rothstein, & Anderson, 2010).

Progress in establishing a domain-specific methodology was also hampered by the field’s entrenchment into moral panics (Bowman, 2015), which, while predictable with the arrival of every piece of new media, technology, or mode of entertainment that enters into public social life, has visible repercussions on research practices as well. In his chapter reviewing the rise, fall, and substrates of moral panics, Bowman notes that the practice of research upon a milieu of established normative beliefs will jump the step of establishing the existence of the effects to a phase of risk mitigation posed by the phantom threat. This attitude of risk mitigation will inadvertently embed assumptions into both the researchers’ stance and their subsequent output, namely, the presumption that the effects are present and dangerous. The assumptions will, in turn, result in the formation of camps that do not have at their foundation the idealistic search for valid, replicable, sound results but personal beliefs. As Elson and Ferguson remark (2014), the formation of camps, with advocates of particularly valenced effects on each side, impacts both the production of relevant, generalizable results and the credibility of the field itself (Ferguson, 2007a).

The existence (Anderson et al., 2010; Scharrer et al., 2018) and non-existence (Johannes et al., 2022; Aarseth et al., 2016) of effects is a debate in constant fluctuation, occurring, as Bowman (2015) notes upon a milieu of normative beliefs. The result yielded is a blackboxing of the object of study and the procedures surrounding it. Thus, the principal focus of this dissertation is not whether or not games produce measurable behavioral effects. Instead, the starting question posed is how is the game utilized, and its influence operationally defined in studies concerning their effects? I considered this to be the foundational aspect that needed to be established prior to examining the validity of measurements and the size of their effects. After all, if playing a video game does not mean the same thing, and the engagement with the game as a method of variable manipulation is not thoroughly unblackboxed and understood, then the examination of effects can only yield the question 'effects of what?'. The answer to that question is both varied and singular. Games are utilized in studies where the behavior (e.g., Hasan et al., 2013) or attitudes of participants are targeted (e.g., Yang et al., 2014) or environments in which new skills are taught (e.g., Bediou et al., 2018). Aside from the diversity of research interests they enable, games have also been attributed to varied roles in the research designs. Ivory (2013) distinguishes four general categories attributed to the game within social science research: the video game as a stimulus, the video game as an avocation, the video game as a skill, and the video game as a social environment. Likewise, Washburn (2003) notes four roles occupied by video games in experimental designs. Like Ivory, he identifies the role of the game as a stimulus, a means of manipulating the independent variables, alongside their roles as an educational resource and an assessment tool. Thus, the role of the game can be summarized as falling into one of three categories: a behavioral determinant (stimulus), an environment, and an assessment tool. The first category of a behavioral determinant is generally the role within which the game is noted to pose challenges to the experimental design.

One of the challenges that emerge is that of variable control. Controlling for third variables, a concept that will be further unpacked in Chapter 2, has been previously noted as a validity threat brought forth by the systemic complexity of games (Adachi & Willoughby, 2011a; Adachi & Willoughby, 2011b; Gundry & Deterding, 2019). Targeting a specific variable for manipulation during the experimental intervention is made exponentially more difficult by the interconnected systems that function in a digital game. Thus, ensuring that only the variable that is targeted for variation, such as the level of violence present in the game, does not guarantee equivalence among the other existent variables. Competitiveness, difficulty, pace of action, agency, and interactivity have been noted by scholars as necessary variables to control and maintain in a state of equivalence when researching video game induced violence between games that present and those that do not present violent content (Adachi & Willoughby, 2011b; Breuer et al., 2017: Engelhardt et al., 2015; Ferguson et al., 2008).

In their review of validity threats to data gathered using video games, Gundry and Deterding (2019) note that the systemic complexity of games creates problems regarding the isolation of the constituent parts relevant to the targeted variable, thus creating the risk of introducing confounds or third variables in the research design. They break down the systemic complexity into three characteristics. The first one concerns the complexity of the game stimuli, which they note, can involve built-in confounds due to high arousal and cognitive load. The second characteristic is the potential for a branching experiential variance, variable changes that are performed on the lowest systemic level affecting the 'gestalt' of the game experience. Thus, for example, a change in granting rewards following violent acts will not only affect the reward system but all the systems linked to it. A final validity threat they note is that games are learned experiences; discovery and novelty are the desired experiences. This has the potential of impairing the equivalence between participants or between groups, as well as the effect of the repetition of events within the same experimental group. Likewise, Järvelä et al. (2015) note that the complexity of the game adds to the complexity of the experimental designs and that great attention to detail is required when anticipating potential confounding factors, interpreting the results, and communicating them. In their remarkably reflective review of using *Mario Kart Wii* (Nintendo EAD, 2008) in a study examining the relationship between natural control and player performance, McMahan et al. (2011) note several advantages and disadvantages of using commercial games in experimental studies. Among the advantages, they note the ecological validity provided by the fact that commercial games have a preexisting population of players; the reduced time necessary for implementation, as opposed to bespoke games; the reduced possibility of researcher bias that could be introduced in the process of developing a bespoke game; and finally, the increased possibility of study reproducibility due to the availability of the game. However, they also go on to note the disadvantages and challenges. Some of the challenges are related to the possibilities of game selection, noting that researchers may not be able to find a video game that is representative of their research interest. Other challenges concern the possibility of controlling confounds that may emerge both from the video game selected and the experience that participants have with playing games.

However challenging, multiple frameworks theorizing the effects of games have emerged, placing the game in various degrees of determination of the player's behavior, perceptions, attitudes, and motivations (e.g., Feguson et al., 2008; Buckley & Anderson, 2006; Ryan et al., 2006; Van Mierlo, J. & Van den Bulck, J, 2004; Ortiz de Gortari, A. B. 2015).

Attributing this role to the game invariably places it within the processes concerning the stimulus, that is, selecting the stimulus to be used and exposing the participants to it. In the case of video games, the two practices clash. While games are selected according to static characteristics such as their genre (Lucas & Sherry, 2004) or the appearance of the relevant independent variables (e.g., Krcmar et al., 2014), the player's exposure to them consists of active playthroughs. This clash between procedures can be considered to be at the root of the challenges presented above. Experience variability, inequivalence of playthroughs, and branching, undesirable changes become visible during the active engagement with the game. These challenges can be overlooked in cases where the game is considered a monolithic experience, embedding the stimulus in its structure.

From the initial question of 'how is the game used in effects studies?', a new, more specific question emerges. How can the procedures in which the game takes on a central role be brought into agreement? Previously developed game analysis frameworks (e.g., Elverdam & Aarseth, 2007; Debus, 2019; Järvinen, 2008) generally identify game elements that can be discreetly analyzed and compared between games. These can include imperative goals, the verbs that the game puts at the player's disposal in the form of mechanics, or the rules that constrain their actions. The application of these frameworks in the context of experimental research on games, while valuable, does not answer the requirements of accounting for systemic interdependencies and the heterogeneity of the played game. For instance, the imperative goal of *Super Mario Bros.* (Nintendo, 1985) is that Mario reaches the castle and, from a narrative standpoint, saves Princess Peach. However, to do that, Mario must survive the many enemies appearing in his path by avoiding or eliminating them. Calling *Super Mario Bros.* a survival game would not be wholly descriptive of the game artifact, but it is descriptive of the momentary process of engagement. In this sense, then, it would be more suitable for characterizing the brief engagement between the player and the game during the course of an experiment. Likewise, using an equivalence in imperative goals would not be suitable for the selection of equivalent games. In the game *The Missing: JJ Macfield and the Island of Memories* (White Owls Inc, 2018), for example, while the imperative goal, reach a designated end-point, is the same as that in *Super Mario Bros*, the harmful objects of the game are not to be avoided, as in the previous example, but to be used in solving the puzzles. The equivalence between the two games, although existent in terms of the imperative goals, cannot be found in the momentary engagement, where the procedures of experimental research designs need it.

An underlining question persists over the ones explored above: 'what is the utility of such a framework?'. The criticism brought to game effects studies is, as was seen, diverse. This is not a negative factor but a positive sign of the desire for high-quality research. The current work does not seek to address the different difficulties of the field or even a particular criticism. Instead, being informed by the practices of experimental research and the challenges video games bring to the method, the framework wishes to provide a common, unifying ground for the start of the conversation while leaving the end, and the individual interests of the researchers who may utilize it, open-ended. As will be discussed in the following chapters, the framework presents a method of analyzing games where the common, unifying characteristic is the influence that the player and the game system exert upon each other. This provides a common ground for establishing the equivalence between game segments used in the experimental intervention, upon which the independent variable of interest may be manipulated. Adopting a perspective that considers brief segments of the game instead of the game as a whole and a focus on the experience that the game engagement may enable addresses the necessities of the experimental intervention, bringing the two discordant procedures of selection and intervention into accord. In short, while the framework does not seek to answer the criticism leveled at game effects research, it seeks to provide a method-appropriate platform through which the answers may be sought.

1.2 Approach

To address the questions above and provide a game analysis framework that reconciles the experimental procedures that the game is a part of, the principal unifying perspective that was adopted was that engagement with the game provides a heterogeneous experience. To this end, a unit of analysis that corresponded to smaller parts of the game and considered the game as played was sought. This was approached as a move away from the conceptualization of the role of the game as a stimulus to that of a situation. The two conceptualizations are not, and should not, be considered mutually exclusive. Differentiating between the situation and the stimulus is primarily a matter of hierarchy (Pervin, 1978). The stimulus, the behavioral determinant, is embedded into a variety of situational structures, which can be spatial, environmental, temporal, social, or otherwise (Baumeister & Tice, 1985). The current work wants to focus on the supporting, and possibly confounding structures surrounding the stimulus of interest. However, it is worth keeping in mind that the two concepts are not mutually exclusive. Nevertheless, the change in perspective allows a recontextualization of the role of the game, which includes the process of play. Describing the differences between a stimulus and a situation, Pervin states:

> ‘Distinctions among the concepts of stimulus, situation, and environment would appear to relate to the kinds of variables and relationships among variables which one considers to be critical to understanding the phenomenon of interest. Thus, we speak of the stimulus when we are interested in a specific object of the organism’s attention or response pattern. (...) In any particular situation we are interested in the organism’s engagement with an array of objects and actions which cover a time span. A situation is defined by who is involved, including the possibility that the individual is alone, where the action is taking place, and the nature of the action or activities occurring. The situation is defined by the organization of these various components so that it takes on a gestalt quality, and if one of the components changes we consider the situation to have changed.’ (Pervin, 1978, pp. 79-80)

This perspective change brought with it new challenges. While Pervin understands the situation as a gestalt of participants, actions, and location, this cannot be wholly transferred to the domain of video games research without adaptation. It is, of course, possible to state that the location of *The Elder Scrolls V: Skyrim* (Bethesda Game Studios, 2011) is Skyrim, that the participants are the player character and the friendly and dangerous non-playable characters, and that the activity is a lot of back and forth shouting, but that provides only a descriptive account of the instance and not a standardized understanding of the situation. To this end, we need a method of identifying a standardized, abstracted formulation of a situation. Following a review of analytic frameworks concerning psychological situations, which will be expanded upon in Chapter 4, the most productive approach emerged from the field of ecological psychology. As the advice regarding the selection of the stimulus is that it should be possible to select it independent of the participants’ appraisal (Pervin, 1978, Rauthman et al., 2015a), the most productive approach was considered to be that of ecological psychology. Alongside the requirements of analytic independence from the player’s appraisal, another reason for the choice was the concept of affordances. While a contested concept, affordances are a productive term that allows the examination of the ways the player is enabled to act within the game environment. Affordances thus provide the means of building an analytical framework centered around the experiential possibilities, and their object dependence enables a movement towards a more granular perspective of the experience, one more appropriate for the practices of experimental research. Thus, affordances are taken on as one of the core concepts of this framework and one of the primary means of understanding the game situation.

The approach to affordances adopted in the context of this framework corresponds to Turvey’s conceptualization (1992). As such, affordances are seen as disponibilities of objects that exist in relationships of complementarity, and their juxtaposition results in effectivities or manifest properties. That is to say that an object with the affordance of being grabbable and an avatar's affordance of grabbing may connect and result in the object being grabbed. Following a discussion on the translation of the concepts to the domain of video games, the affordances of objects and their complementarities are taken on as the building blocks of the game situation. The perspective was adopted with the intention of addressing one of the challenges explored above – that of the unwanted changes that may emerge due to systemic interdependence. Viewing the game as a network of interdependent objects connected by their affordances places this feature of the game as a building block and thus intends to address the challenge of systemic complexity by maintaining the feature in constant view.

Peter Bayliss asserts that 'the world of Tomb Raider is constructed in Lara Units' (Bayliss, 2007, p. 2). This statement is a concise and elegant summary of the principal position of this approach. The observation of the formation, change, and dissolution of the networks of game objects enables an overview of the momentary engagement between the player and the game. The analysis of the networks can then follow a process of abstraction, by which the instantiating objects fall away from focus, and the configuration of objects remains at the center of the analysis. In its place, what remains is a network of objects through which influence is transmitted. Through it, one may observe the role of the player as a situation participant, acting on and through the game objects.

1.3 CHAPTER OVERVIEW

Chapter 2 reviews the theoretical assumptions used in the field of experimental game effects studies, with the aim of understanding the role attributed to the game and the repercussions of that role attribution in research practice. The aim of the chapter is to provide a foundation for understanding the requirements of an analysis framework intended for application in the domain.

Chapter 3 provides an examination of the practices of experimental research within which the video game takes a central position. A review of a corpus of 106 experimental studies provides the grounding for the discussion of currently employed game selection, and intervention methods, along with their drawbacks, advantages, and reason for utilization. The chapter aims to contextualize the lessons of the previous chapter and identify the ways the practices can be adapted to the challenges posed by the complexity of video games.

Chapter 4 reviews theoretical perspectives on the psychological situation and discusses the ways through which the concepts and perspectives can be adapted to the study of games. The chapter sets the groundwork for the development of the game situation as an analytic concept. Finally, the game situation is described as a momentary configuration of game objects linked by their affordances.

Chapter 5 presents the methods employed for the analysis of the games. The chapter has a dual purpose of being both a methodology chapter for the current work and a roadmap for the application of the analysis framework. The methodology chapter illustrates the processes through which the games were selected and analyzed, as well as the process through which the procedure was verified.

Chapter 6 presents a macro analysis of the distribution of influence through the game networks. The chapter examines the most influential and the most influenceable objects in the networks to provide an overview of the types of control the player and the game are provided with during the course of the game engagement as a whole.

Chapter 7 provides a typology of situations encountered in the games analyzed. The typology consists of three types of control distribution, within which nine situation configurations can be distinguished. The typology is intended to provide a model for analyzing brief segments of the game, according to the distribution of influence, and showcase the possibilities of cross-game and intra-game comparisons relying on this unifying variable.

Chapter 8 presents an overview of the current work, and draws comparisons between it and other works of similar scope. The comparative analysis intends to provide alternatives for mitigating the limitations of the framework, as well as incentivize a more reflective application. This is done with the belief that their joint applications may provide a richer analytic overview. Finally, the chapter closes with an overview of the limitations of the work, and suggestions for future research.

Chapter 2. Challenges of the video game as stimulus

2.1 INTRODUCTION

Digital games, through their reliance on multimodal representation, as well as their systemic complexity (Kontour, 2009), pose particular challenges to the internal and ecological validity of such studies, particularly those relying on experimental designs (Gundry & Deterding, 2019; Adachi &Willoughby, 2011a; Adachi &Willoughby, 2011b; Elson et al., 2015). The first aim of the current chapter is to provide an overview of the role of games in research carried out in the social and cognitive sciences. Following this, the focus will center on the role of the game as a stimulus. The aim of the examination is an understanding of the effects that the concept of the stimulus has on the use of games in experimental conditions. Following that, a series of theoretical frameworks built for the examination of game effects will be reviewed. The review will be done in conjunction with the analysis of challenges that video games bring to the role of stimulus. The purpose of this examination is to assess the possibilities of reframing the role attributed to the video game in game effects studies, to that of a situation. Finally, the possibilities and consequences of doing so are assessed.

Prior to this, however, a series of terminological clarifications will be provided, with the aim of ensuring that the reader will have the tools necessary to follow the discussion.

2.2 TERMINOLOGICAL CLARIFICATIONS

Experimental practices in the domain of psychology highlight the physio-biological foundations out of which the discipline splintered. In the incipient stages of the field, the focus fell on the ways that humans make sense of the world surrounding them and the necessary preconditions for that sense-making – not from a metaphysical standpoint, but from a biological one (Gibson, 1960). Within the domain of the perceptual capacities of the individual, the experimental method proved fruitful in distinguishing concepts that resided at the boundary of physical capacity and psychological processes (Goodwin, 2003). The fit of the method for studies looking into perception and sensation proved productive and provided the field its early empirical pillars, such as the Weber-Fechner law of sensation and perception (Freedheim & Weiner, 2012, pp. 2-3). The method moved along with the evolution of the domain from its psycho-physical origin towards the behavioristic schools. Along with that evolution, the focal stimuli moved too, from being located in the close proximity of the receptors to being located in the environment, changing from being a molecular stimulus, such as the one present in a reflex arc. to a molar one (Gibson, 1960).

The expansion and change in focus brought with it challenges to the experimental method as well. Although the study of perception and sensation is more pliable to quantifiable measures, the same cannot be said for more complex constructs. Human thought, speech, and social life do not naturally use quantifiable concepts but qualitative constructs. A game is enjoyable for a player, but that feeling of enjoyment is a qualitative construct that cannot be made sense of in a quantitative paradigm. Such complex constructs must then undergo a process of being assigned a measured operational definition in order to be quantified through proxy measurements. Likewise, when undergoing manipulation in the context of an experimental study, the stimulus must be assigned an experimental operational definition (Kerlinger, 1986 pp. 29). Operationalization is a necessary procedure for experimental practices, as observed effects of a stimulus or process cannot be objectively assessed in the absence of standardized parameters. While attributes such as length, height, and weight have undergone historically lengthy processes of standardization, the same cannot be said for individual psychological processes or cultural artifacts such as games (Stangor, 2015, pp. 67-71). When placed in the context of a research design, an operational definition is transformed into a variable. A laboratory-based experimental design comprises, at minimum, an independent variable, the variable that changes across conditions, and a dependent variable, one that changes according to the influences of the independent variable (Kerlinger, 1986 pp. 32). The dependent and independent variables define the conditions of an experiment. A very brief explanation of the research design is that the condition in which the independent variable is introduced (e.g., violent content) represents the intervention, or experimental, condition, while a condition in which the independent variable is not introduced (e.g., engagement with a digital game that lacks the conditions to be categorized as violent) represents the control (Smith, 2014). The use of a control condition helps reason that the measured effect is not attributable to an alternative explanation. In the absence of a control group, the effects could be attributed to any other number of influential factors, from the time passed between measurements, the participants’ adaptation to the experimental methods, or the so-called maturation effect (Kerlinger, 1986 pp. 296). The experiment participants consist of a representative sample, randomly extracted from the population relevant to the study. Participants are generally randomly distributed in the conditions to ensure that person-related variables do not cause the observed effects (West et al., 2014). For example, in the absence of the step of randomized distribution, a researcher could be challenged on the grounds that the experimental condition included more experienced video game players.

A complete discussion of the different types of experimental designs falls outside the scope of this section. Instead, a brief overview will be given with regards to the procedures encountered therein. An experimental design generally involves the observation of the effects on the dependent variable, following the introduction of, or modifications to, an independent variable (Stangor, 2015, p. 10). The manipulation of the independent variable is achieved either by employing a between-subjects design or a within-subjects design. In the between-subjects design, the experiment will consist of two or more groups of participants, where each group will receive a specific variation of the stimulus. A between-subjects design consists of an experimental group, which receives the stimulus, and a control group, where the conditions are similar to the experimental group in every way, other than the presence of the stimulus. The dependent variable is consequently measured, and the effects of the stimulus are compared between the two groups. A within-subjects design generally includes preliminary measures of the dependent variable, followed by the exposure to the stimulus, and finally, a subsequent measure of the dependent variable. The analysis then consists of the comparison of the results of the participant before and after the exposure to the stimulus.

In studies looking into the effects of playing video games, generally, the independent variable consists of a stimulus of interest to the researcher. This can be the nature of the content presented in the game, the difficulty of the game, or others. The independent variable is then introduced by having the participants play the game for a predetermined amount of time or until a specific condition is achieved, for example, finishing a specific level. The manipulation depends on the research design, as seen above. In a between-subjects experiment, for example, the experimental group will play the game featuring the presence of the stimulus of interest, while a control group will play a game that lacks it. Thus, the game takes on the role through which the stimulus is delivered to the experimental participants.

Experimental designs must comply with rigors verifying their internal and ecological validity. Internal validity of the research design focuses on the significance of the manipulation and its effects, particularly with concern to extraneous variables, maturation, or a regression effect. Game effects research criticism has highlighted the risk of third variable contamination as produced by person-related variables described through the uncontrolled but relevant difference between the groups assessed (Breuer, 2018; Roque & Boot, 2018). Aside from person variables, the systemically complex nature of digital games can also elevate the challenges to the internal and ecological validity of studies. Gundry and Detering (2019) productively summed up the challenges. They identified three characteristics of games that potentially affect study validity: systemic complexity, variance, and social framing. The first and second characteristics can impede the predictable control and isolation of variables, which can negatively impact the study's internal validity and the validity of the construct intended for measurement. Adverse effects on construct validity and internal validity can cast doubt as to what exactly is being manipulated during the intervention and can ripple out into difficulties in study replication and generalizability of results. To mitigate this risk, researchers have taken measures to better control independent variables, such as using different sections of the same game for the different study conditions (e.g., Allen & Anderson, 2019; Schmierbach et al. 2014), using mods as manipulation procedures (e.g., Gentile et al., 2016; Elson & Quandt, 2016), or, with the recent expansion in user accessibility of game production tools such as the Unity engine, developing their own in-house games (e.g., Shaw et al., 2018; Parong, Wells & Mayer, 2019).

Ecological validity reflects the possibility of generalizing the results across situations and the distance that exists between the natural condition of occurrence of the effects being studied and the laboratory conditions in which the experiment takes place (Kerlinger, 1986 pp. 292-301). McMahan et al. (2011) note the potential possibilities of improving ecological validity that off-the-shelf commercial games bring. They attribute this to the fact that the games being used in the experimental design would be the same as the games that the population at large also plays. However, this is not a panacea, as ecological validity can be impacted by factors related to the laboratory setting in which the participants would play the game, a setting that starkly differs from general play conditions (Gundry & Deterding, 2019). Ecological validity is also relevant to the potential of generalizing the results of the experiment across the population out of which the sample was extracted. Polit and Beck (2010) identify three models of generalization: statistical generalization, wherein results obtained from a representative sample of a population can be generalized across the population from which they were extracted; analytic generalization, in which in-depth, rich analyses of a case or a series of representative cases provide results which may be generalized towards a theory; and finally, transferability, where the results from a case can be extrapolated to proximally similar cases. Transferability will be, throughout the current work, the principal concern when referring to generalizability. Statistical generalizability is a frequent measure employed in experimental studies that use video games as stimuli, and while challenges have been brought to the homogenous samples of participants, its challenges are outside the scope of the current work. Instead, the questions regarding generalizability will center on the possibility of transferring the characteristics of the independent variable manipulation to other instances. This interest also ties in with the procedures of stimulus sampling.

Stimulus sampling refers to the procedure of using multiple instances of a stimulus category, particularly in the cases in which the stimulus can vary in an ecological setting. This matter seems particularly pertinent to digital games research, considering the breadth of existent digital games, as well as their continuous expansion and evolution. Wells and Windschitl (1999) note the threats to external validity that can occur due to a lack or misapplication of stimulus sampling and the uses that can be encountered in terms of the generalizability of results. The threat also extends to construct validity, when the correspondence between stimuli and conditions is made on a one-to-one basis as what can be construed as a category effect can be confounded by the individual characteristics of that particular stimulus. Operationalization of constructs via singular stimuli relies on the representation of the central tendency of the population. That means that for a reliable representation of the dependent variable within the title used, that stimulus should be qualified within the extant population out of which it was extracted. The lack of such a procedure and its qualification within the video game population has the noted repercussions of harming both internal and external validity through lack of clarity in the attribution of the observed effect, particularly in cases in which the variation of the instantiation of the stimulus across individual representatives is salient. Both Järvelä et al. (2015) and McMahan et al. (2011) note the heightened care that researchers should take when selecting games to use in an experimental setting. They note that these requirements are made even stronger by the diversity of games, and the diversity of modes that a game might present. Added to this is the contextualization of the stimulus of interest among other game structures, highlighting the systemic complexity that games espouse as a necessary factor to consider in the process of stimulus selection.

While not intended as a comprehensive review of the rigors imposed by experimental research, the current section focused primarily on the workflow of transforming constructs into measurable variables and briefly touched upon the procedures of intervention and control groups as well as the concepts of internal and external validity, with the aim of ensuring that the reader will be able to follow discussions concerning the procedures of operationally defining digital game-based interventions in an experimental setting.

2.3 The roles of games in research designs

The uses and roles of digital games in the social and cognitive sciences are varied, ranging from being behavioral or attitudinal stimuli (e.g., Adachi et al., 2016) to environments in which skills are acquired (e.g., Okagaki & Frensch, 1994) or assessment tools, either using performance metrics as a proxy for the measurement of a dependent variable (e.g., Rosser, 2007), or as a safe proxy measurement for performance that would otherwise be difficult to assess in real-life conditions (e.g., Delaney et al., 2018).

In his presidential address, discussing the history of psychological research with video games, Washburn (2003) noted four distinct roles of games in experimental designs. The game as a stimulus, the game as a means to manipulate target variables, games as instructive and educational sources, and games as a means of assessing performance. Later, in an effort to review the different roles that digital games have occupied in the field, James Ivory (2013) created a typology that distinguishes among four general categories: the video game as a stimulus, the video game as an avocation, the video game as skill and the video game as social environment. The first category, the video game as a stimulus, is comprised of studies in which the video game becomes an influence on the psychological states, affects, and behavior of participants. This includes, but is not limited to, studies on game-induced aggression (e.g., Barlett et al., 2008), prosocial behavior (e.g., Breuer et al., 2017), attitudes towards minority races and cultures (Saleem & Anderson, 2013), and susceptibility to in-game advertising (e.g., Glass, 2007). The second category, games as an avocation, includes studies that look into the motivations reported by players for playing games (e.g., Yee, 2007; Przybylski et al., 2010), coming from a perspective that treats participants as selective players and consumers who make choices in regards to their time investment into games based on individual preferences. The third category, games as a skill, includes studies in which games are used as training environments for cognitive and behavioral skills, such as hand-eye coordination (e.g., Rosenberg et al., 2005), the participant response time (e.g., Goldstein et al., 1997), and distractor discrimination (e.g., Green & Bavelier, 2006). The fourth and final category includes video games as social environments and looks at studies that focus on the social networks enabled and sustained by online games, particularly Massively Multiplayer Role Playing Games (MMORPGs) (e.g., Castronova, 2001).

A decade of new research led to the emergence of new roles enabled by the popularity of MMORPGs but also by the acknowledgment and rise of interest in the motivations of players to choose a specific game. However, the role of the game as a stimulus and the game as a means of assessment persisted. While the inventories present a valuable insight into the diversity of social studies research using games, they assume a high level of abstraction and do not offer an in-depth examination of the operational definitions given to the stimulus games in the research design. In this sense, they only describe the role of the game as a stimulus and not the reasoning behind the role and consequences of the perspective. With the confirmation of the existence and prevalence of the role, however, the inquiry can move on to understand how the role of stimulus is approached by the theoretical frameworks employed in the field.

2.4 THE CHALLENGES OF THE VIDEO GAME AS A STIMULUS

While acknowledging the potential of games as stimuli, Washburn (2003) also notes the risks to data accuracy that come with embedding video games into experimental designs. Specifically, he notes that the researcher may not have full control of the variables that may affect performance, including motivational, attentional, and psychomotor factors. Järvelä et al. (2015) also note that the complexity of the game adds to the complexity of the experimental designs and that great attention to detail is required when anticipating potential confounding factors, interpreting the results, and communicating them. Echoing the benefits presented by Washburn, with a higher emphasis on off-the-shelf games, they note the advantages of using computer games in experimental research due to their high level of approachability and familiarity, which reduces the requirement for instructions. Their commentary skirts the line between recommendation and cautioning. They note that, for instance, games can be used as ecologically valid instruments for eliciting emotions. At the same time, they state that most games do not focus on a single emotion and that emotions are not intrinsically connected to specific genres or game types.

Their caution is not unfounded. Cultivation theory, initially developed for the study of the effects of television (Gerbner, 1986), has seen a restrained presence in the field of game studies. This can be attributed to the noted necessity of adapting the theory to the field of video games due to differences in selectivity of the audience and the heterogeneity of the field (Van Mierlo & Van den Bulck, 2003; Williams, 2006). Cultivation theory posits an effect by attrition, where exposure to specific media content does not directly determine behavior, but the perceivers' attitudes and beliefs. The fundamental unit of cultivation theory is the cultural indicators present in works of television, which can be determined by a descriptive analysis of what is present, what is portrayed as important, what is portrayed as right, and what are the relationships between the messages presented. To acknowledge the selectivity of video game players and the aforementioned heterogeneity of the field, cultivation theory has adopted the use of video game genres (Van Mierlo & Van den Bulck, 2003). This stance, also encountered in Catalyst Theory (Ferguson et al., 2008) and the Player Experience of Needs Satisfaction (Ryan et al., 2006) models, is a response to the need for a more granular assessment of the player's engagement, not with games in general, but with a particular type of game. The adaptation proposed by Van Mierlo and Van den Bulck's (2003) study was then splitting the exposure to games into violent and nonviolent via genres. As such, exposure to combat games, action games, and adventure games, while exposure to puzzle games, sports games, racing games, and simulation games were considered not to be a measure for aggression. This type of categorization implies attributing a characteristic generally derived from presentational features to genres that do not utilize presentational features as criteria of categorization. This utilization of genres is not limited to the perspective of cultivation theory but also adopted by theories that study motivation for game engagement, such as the uses and gratifications theory (Sherry et al., 2006). Unlike cultivation theory, needs and gratification theory does not view the media object as a behavioral determinant but assumes that the individual's engagement with a media object is an effect itself – the individual satisfies their personal needs through the engagement with a specific piece of media. Naturally, within this paradigm, the first step is to ascertain the reasons for playing video games. Sherry et al. (2006) uncovered six dominant dimensions of reasons players engage with video games, namely Arousal, Challenge, Competition, Diversion, Fantasy, and Social Interaction. In a subsequent study relying on the uncovered needs, Sherry et al. (2004) related the uses and gratifications with the number of hours playing various genres.

The reliance on constructs such as genre, as observed in the case of cultivation theory and needs and gratifications theory, highlights the need for tools designed to categorize the potential experience of the players. However, issues emerge due to genres being themselves a contested concept. Discussing the adaptation of the concept of genres to video game categorization, Wolf (2002, pp. 113-134) notes iconography to be an insufficient means of characterizing video games. However, representational factors are one of the most utilized means of selecting games in experimental research, particularly in studies focusing on violent acts performed by the player (e.g., Barlett et al., 2008). This points towards a mismatch between the requirements of the field and the currently existing tools. Thomas Apperley (2006) takes on a stronger position with regards to the configuratory role of the player. He notes that due to the concatenation of digital games and previous media, the notion of genres has not yet been adapted to encompass the players' active input. This leads to a disproportionate reliance on their presentational characteristics and the conflation of different criteria in their categories. He suggests that games based on ergodic performance are contingent on the player's success in understanding the information presented about the game's rules. The player is thus not only selective of the games they engage with but also actively reflective, a role that clashes with the susceptibility assumed by some of the theoretical frameworks discussed.

Noting the fluidity and impreciseness of the concept of genre itself, Arsenault (2009) states that the conflation of criteria in establishing video game genres is not something that can be solved, as the concept of genre is not meant to convey something specific but rather something that denotes a vague resemblance. Genres, then, are deemed to be multidimensional and multifaceted phenomena, denoting different aspects under the same categorical name across different media. Tracing the evolution of a genre in the history of video games, Arsenault instead notes an equivalent of biological evolution, where a genre emerges from imitations of a popular game. For instance, the success of *Doom* (id Software, 1993) resulted in the production of so-called 'Doom clones', which in turn crystallized into the creation of the first-person shooter as a named genre. This genealogical tracing enables the observation that the name of the genre, in this case, first-person shooter, is not indicative necessarily of the activity that players engage in (in this case, shooting), but of 'fighting someone directly in the field' through various means. He goes on to note that if the emerging genre had been exclusively tied to shooting, *Wild Gunman* (1984) and *Duck Hunt* (1984) would have been its ancestors instead. As Arsenault notes, 'Far from mindless itchy-fingered shooters – as their detractors like to portray them –, FPS players are involved in a multitude of actions, of which shooting does not necessarily hold the lion's share.' (Arsenault, 2009, p.168). Genre, and its imprecise nature, brings challenges to the assuredness of finding the desired stimulus in the chosen title, the context in which the stimulus will be found, and across what types of games the results can be generalized.

The caution brought to using genres as selection methods is not the only one brought by Järvelä et al. (2015). They also note the variability of experiences, within the same game or game segment, between players with different levels of skill and preference. This variability is not limited to factors intrinsic to the player but can also be found in the built-in features of the game. Gundry and Deterding (2019) note the variability between starting conditions in which the players are granted the option of customizing their characters, as well as the random events embedded in the game, and the choices the players can make in the appointed section as sources of experiential variation. This potential for variability is often discounted in theoretical models that examine the game as a stimulus. This can be attributed to the use of randomized sampling and randomized distribution into experimental groups, which are standardized methods of ensuring that person-related variables do not imbalance the experimental groups (West et al., 2014). However, while addressing person-related variables, the method does not ensure equivalence in the experiences that players have during the course of playing the game as part of the experimental conditions. A potential source of this oversight can be attributed to the role of passive, susceptible participant attributed to the player (Heide-Smith, 2006), in conjunction with the homogenous character attributed to the game. To further unpack this assessment, let us start with the role attributed to the player.

The General Aggression Model Anderson & Bushman, 2002; Carnagey & Anderson, 2003; Bushman & Anderson, 2002) or GAM, and its more wide-ranging counterpart, the General Learning Model (Barlett & Anderson, 2013; Gentile et al., 2014), or GLM, have both seen wide application in the field of game effects studies (e.g., Carnagey, N. & Anderson, C., 2005; Bushman & Anderson, 2002; Carnagey, N., Anderson & Bushman, 2007). Both models incorporate social learning theory, schema theory, script theory, excitation transfer theory, and cognitive neo association theory, becoming integrative models that posit both proximal and distal effects to exposure following the exposure to digital games. The principal influence of social learning theory on the models is the assumption that the player learns from models that are framed as desirable for emulation. Thus, for learning to occur, the individual must grant attention to the model of behavior, they must find them attractive, and observe that their behavior is rewarded in some way after it is finalized (Bandura et al., 1961). Sherry notes that proponents of the social learning theory application for the examination of video game effects rely on structures of the video game, such as the selection of a character ‘which then **becomes** the player,’ (Sherry, 2006 emphasis in original) who then engages in repetitive and rewarded behavior, serving as the model which satisfies the conditions. Likewise, Sherry (2006) notes that the learning preconditions are met through the heightened levels of attention that video games require and that the first-person perspective may enable identification with the playable character, thus increasing the desirability for emulation. A third learning mechanism noted is the immediate feedback that the player receives when finalizing a task.

Both models assume a dual input learning process. The first input system is represented by the person and their intrinsic factors. This is comprised of the present state of the individual, their primed concepts, genetic predispositions, personality, and attitudinal traits, as well as previous learnings. The second input is represented by the situation in which the person acts. This includes the physical environment, co-present actors, and all other physical cues currently existent in the surrounding environment. Thus, the influence of situational inputs on learning occurs on multiple levels. On a sensorial and perception level, describing the short-term learning potential, the participant makes sense of the stimuli present in the situation and can further discriminate between salient features. Following that, classical conditioning may be activated if the situational stimuli trigger a reflexive arc. On a cognitive or emotional level, the percepts or concepts may be sequentially or conceptually associated, contributing to learning.

With respect to the long-term learning potential, the GLM proposes three categories of effects. The first includes the perceptual and cognitive constructs which may be transferred from short to long term memory, behavioral scripts, and perceptual schemas. Within the confines of the GLM, the game exerts ‘situational’ influences represented by the current, momentary factors in which the interaction is developed, being singled out due to characteristics that make them ‘exemplary teachers’ (Gentile & Gentile, 2014).

Several aspects of games are highlighted as situational variables that influence the player’s learning. These include game content (violent, nonviolent, educational), exposure time, whether the game focuses on drill and practice, or on simulations of reality. The situational variables named to be particularly relevant for violent video games are aggressive cues, provocation, frustration, pain, and rewards. As in the case of the GLM, person variables, such as traits, moods, and present states, are posited to moderate the effects of the situation variables, thus not granting the content of the video game the sole responsibility for the influence exerted. The role of the media content is considered to be an influence on the knowledge structures retrieved when the individual is exposed to a familiar situation. They thus influence the degree to which the momentary encounter is perceived as hostile. Engagements with aggressive media are thus seen as learning trials, rehearsals, and reinforcements of the learning structures. The repeated exposure is assumed to influence the attitudes, perceptual and expectations schemas, and behavioral scripts and desensitize the individual to perceptions of aggression. These effects become embedded into the individuals’ personality, thus being felt long-term. From there, they enter into a new proximal feedback loop. The GAM, thus, essentially posits a continuous and exponential feedback loop that results in a perpetual escalation of aggression, as aggressive behaviors are continuously learned and reinforced.

While receiving a wide amount of attention, the two models have also received some criticism. Critics generally focus on the model’s uncertain differentiation between real and fictional situations, as well as the overt reliance on the notion that aggression is mainly a learned, cognitive, automatic behavior (Ferguson, 2010; Ferguson & Dyck, 2012). Another point of criticism comes to the GAM’s reliance on cognitive schemas and behavioral scripts while doing little to account for competing cognitive schemas that can be gathered over the entire course of a persons’ life (Ferguson & Dyck, 2012). Comparatively, the time spent playing video games, particularly in an experimental laboratory session, is insignificant to the amount of time spent engaged in and learning from daily tasks (Fanfarelli, 2018). A further criticism is brought to the role granted to the player in the model. The perceiver, or player, is given a passive role that does not account for behavioral intentionality but only the mechanistic activation of scripts (c.f. Gentile, 2011).

The notion of 'script' is frequently employed in discussions surrounding the structures of games that may affect the player's behavior. Gentile (2011) discusses four theoretically independent but practically interdependent dimensions of video games that have the potential to affect the individual's cognitive, behavioral, or affective states. These are time, content – or the aforementioned scripts -, context, and mechanics. The first of these is the amount of time played, which, he mentions, is interlaced with the other dimensions, and functions as a prerequisite to them – no dimensions can elicit an effect if the amount of time played is zero. The second dimension is the content of gameplay. This dimension includes the 'script elements or themes of the game' (Gentile, 2011, p. 77). The choice of the word script denotes the perspective that the player enacts a predetermined scenario. Aside from the perspective attributed to the player as a passive actor, the dimension itself can be seen as an umbrella category, subsuming multiple structural elements of the game. This points to a lack of regard for the structures of the stimulus game, interest lying instead in the experience as a whole. However, as Järvelä et al.(2015) and Gundry and Deterding (2019) state above, it is these structures, as support of the experience, that lie under the researcher's powers and responsibilities of control. The third dimension, the game context, seems equally broadly defined. The game context consists of moderating variables to the ones provided by the game content, including, for example, the social context in which the game is played. The first variable category is relevant mainly to the laboratory setting of experimental studies, especially considering potential ecological validity factors, and is a relevant addition, also noted by Gundry and Deterding as one of the challenging factors to the use of games as a stimulus. The fourth dimension, game structure, refers to the means of structuring the presentation of information as a means of managing their psychological meaning. Gentile exemplifies this through the use of jump scares in action games, thus tying the dimension to the sequentiality of events. This dimension highlights, once more, the reliance on the notion of scripts and the expected repeatability of the player's experience. The final dimension discussed is that of game mechanics. This dimension encompasses the physical interface and the control scheme that the player uses. Like the aforementioned game structures, this dimension is discussed in conjunction with the realism provided by the game, either in terms of control scheme, or the scripts provided. In this specific understanding of the concept, realism reflects the perceived possibility that an observed event presents the likelihood to occur in ordinary life. This description is consonant with research interest in the effects of control schemes (e.g., Barlett et al., 2008; Markey and Schere, 2009).

The dominant role of the game over the susceptible player can also be observed in other models discussing the structures of video games. Wood et al. (2004) define structural game characteristics as ‘those characteristics that induce gaming in the first place or are inducements to continue gaming irrespective of the individual's psychological, physiological or socioeconomic status’ (Wood et al., 2004, p.2). This stance can negatively impact the experimental designs. If the experience enabled by the game is considered to be dominant, scripted, and invariable, then the engagement can be black-boxed, due to the equivalence between input and output. This can impact both the internal validity of the experiment due to the possible individualized experiences of the participant during the engagement, as well as the external validity through the assumption of homogeneity in the heterogeneous field of digital games.

However, it is worth noting that not all theoretical frameworks examining the game as a stimulus adopt this perspective. The Catalyst Model developed by Ferguson et al. (2008) gives more weight to factors external to the game engagement, such as day-to-day social connections, like peers and family, as well as biological and motivational predispositions of the individual. These factors act as a baseline and are moderated by proximal factors when the individual is confronted with a specific situation. The catalyst in the name of the model refers to proximal situations that act as stressors to the biological and personological predispositions of the individual. Unlike the role attributed in the GAM, the video game is not seen to be in a relationship of causality with the individual's behavior but acting as a potential 'stylistic catalyst' (Ferguson et al., 2008). Thus, the role of the behavioral determinant is attributed to the non-game-related individual and environmental factors, while the influences elicited by the game can potentially be observed in the specific instantiations of the behavior. Thus, video game influences are seen as signatures, instead of behavior-altering factors, which is more likely to determine the verbal reply that imitates a video game character bark, more than a bite. The catalyst model assumes a perspective more akin to the active player model (Heide-Smith, 2006), within which players are actively seeking out models which suit their motivations and predispositions. This outlook, shared by the Player Experience of Needs Satisfaction model (Ryan et al., 2006), makes a move towards a more ecological approach to the game, where the engagement with the game is approached as an elective activity, driven by the intentionality of the player. By taking a non-causal stance to the influences of video games, the catalyst model casts the game in a different position than the GAM, not that of strong behavioral determinant, but that of potential symptom which may signal the prospect of further exploration in the biological and personological predispositions of the individual.

Likewise, the Game Transfer Phenomena model or GTP assumes a holistic approach to the influence of engagement with video games on sensory perception, cognition, and behavior (Ortiz de Gortari, 2015). The GTP relates to cultivation theory through the requirement of the existence of corresponding real-life objects, stimuli, and triggers which can be associated with the content of the game that the participant has been exposed to, as well as its neutral stance with regards to the effects of the video game stimulus (Ortiz de Gortari, 2019). While assuming a strong determinant position to the game stimulus, the effects proposed by the GTP are more highly contextualized in the specific idiosyncrasies of the source game, as well as the supporting structures and features. It does not assume a positive or negative valence to the influences of engagement with the video game, focusing on the exploration and contextualization of what has been colloquially referred to as the Tetris effect following Stickgold et al.'s (2000) study, theoretically and empirically expanding the inquiry into perceptual, behavioral and cognitive effects of engagement with video games.

The structural characteristics acting as potential stimuli are distinguished based on the observed effect. The model does not attempt linking particular characteristics to an increase in the occurrence of GTP, and instead note four broad categories of characteristics (Ortiz de Gortari, 2019):

- Sensory perceptual stimulation — the category encompasses predominantly sensorial stimuli with a heightened degree of repetition over a prolonged period.
- High cognitive load— encompasses the activation of multiple high-level processing abilities to manage the demands of the activity, which involves a large variety of stimuli.
- Dissociative states— encompasses states such as losing track of time, flow, and embodiment, transferred outside of the context of engagement with a video game, and preserved outside of the engagement
- High emotional engagement— generally related to arousal states derived and preserved once the engagement with the video game has concluded.

The Game Transfer Phenomena model avoids categorizing game structures that may elicit effects on the player. Instead, the model highlights the heterogeneity of video games and the variety of contexts that might lead to the expression of transferred phenomena, thus incorporating assumptions underlying both Cultivation and Catalyst theory.

The two principal challenges discussed so far can be attributed to two categories: how are games selected and how their structures influence players. However, another process remains to be discussed: how that influence takes place. For a game to elicit its influence on players, players actively engage with the game. This process generally takes place in a laboratory for a predetermined period of time. This process of active engagement is frequently at odds with the concept used to describe it, which is frequently that of 'exposure'. The use of this term should not be considered only a misnomer, as the reasoning behind its use can be located across both the previously discussed challenges. A homogenous artifact selected according to a specific criterion can be delivered to a passive participant who will be exposed to it. This issue and the problems it raises in the case of game effects research cannot be discussed in the absence of a more in-depth exploration of the stimulus.

As noted above, as the domain of experimental psychology moved from its physio biological foundations, the types of stimuli of interest moved as well (Gibson, 1960). Following this perspective change, Pervin notes that, as the perceiver's environment and their reflective capabilities become more complex, the possibilities of determining the precise stimulus become more and more difficult. This observation was also noted by Brunswik (1956). He described the responses to social objects, namely, in his case photographs, utilizing the concept of the distal stimulus. Brunswik notes the inadequacy of classical design experiments in cases where objects present a multidimensionality of traits. This multidimensionality is resonant with the cautions towards the variability of the experience mentioned earlier and resonant with the active engagement between the player and the game during experimental studies. However, it is dissonant with the practices of selecting the game relative to its characteristics as a static, homogenous object. This artificial dichotomy between the game as an object and the game as a process has been encountered previously. Aarseth and Calleja (2015) put forward the analytic model of games as cybermedia objects, a class that is not limited to games but includes them. The model consists of a matrix of four elements – the sign system, the mechanical system, the material medium, and the player. The first three elements constitute the game as an object, while the player accesses all three in the process of playing. Their global interaction with the three elements of the cybermedia objects thus establishes a relationship of interdependence between their instantiation in the engagement process. This analytic perspective thus separates the player from the object while acknowledging the role of the constitutive elements in the experience.

The conceptualization of the game as a stimulus has so far, however, considered the disparate elements of the game that contribute to the playing experience as a homogenous whole. An extension of the role of the game in the experimental setting, however, can account for the active engagement between the player and the game. Examining the distinction between the concepts of stimulus, situation, and environment, Pervin (1978, pp. 79-80) describes the stimulus as ‘a specific object of the organism's attention or response pattern.’. This description resonates with the unitary perspective attributed so far to the game in the role of stimulus. A situation, according to Pervin, ‘the organism's engagement with an array of objects and actions which cover a time span.’ This reframing relates closely to the active engagement between the player and the game during the experimental procedure. I use the word ‘reframe‘ here to signal that attributing the characteristics of a situation to the game does not change its role in the research, the game still being the means through which variables are manipulated. The effect, however, is a recognition of the context in which the stimulus emerges in the game experience. As Baumeister and Tice (1985) state, a situation can be better looked at as the configuration of the stimulus determinants. This contextualization allows movement between the layers of the experience. As Pervin notes, variables can be considered either a stimulus, a part of the situation, or a part of the environment. The consideration attributed to them is changed according to the perspective adopted. As he notes, noise may be defined operationally and considered a stimulus, in which case it is the focal variable, and thus, its effects on the behavior post-intervention, or within the intervention, being considered in isolation. In the case in which noise is considered part of the situation, though, it is required to be contextualized within the broader aspect of the situation. If the target situation is a party, noise is an expected, even pleasant occurrence. If, however, the target situation is a lecture, noise can be considered disruptive. Similarly, a stimulus manipulation in a game condition can be attributed a characteristic of violence, but that would decontextualize it from the broader systems and presentational elements that exist in the behavioral space.

2.5 Conclusion

The current chapter sought to examine the role of the video game as a stimulus within the experimental paradigm. The first step of doing so was examining a series of characteristics that make games a challenging object to use in experimental studies. The challenges were then contextualized within the theoretical frameworks applied in the field. The chapter aimed to understand how the challenging aspects of games affect experimental research practices in the cognitive and social sciences. Three principal challenges were explored in depth. The first one concerns the practice of selecting the game that will be used as a stimulus. This stands as a requirement for the field, as a stimulus must be chosen and justified. Currently, that requirement is met, generally by genres. However, due to the contested position of genres within games, this is not considered to be a best practice. The second challenge examined was the experiential variation that games may provide. This was found to be largely discounted, as the role of games as a stimulus encourages its blackboxing and treatment as a homogenous object that acts on a passive participant. The perspective was found to be discordant with the practice of active engagement that takes place during experimental studies. Finally, the perspective on the game as a stimulus was examined, and it was concluded that while the concept of stimulus is a functional one in terms of the position of the game in the research design, it has the added negative effect of enabling the aforementioned process of blackboxing the experience. A reframing of the game's role, from a stimulus to a situation, is offered as an alternative. It is posited that attributing it to a status of a situation allows the variables of interest to be in focus while at the same time acknowledging the active engagement between the player and the game during the experiment.

The role of the game as a situation is the focus of Chapter 4. For the time being, however, the two procedures identified as central to the use of games in experimental studies, the selection of the game and the participant's engagement with the game, will be further examined. As the current chapter identified them as being the parts of the research design where the challenges brought by games are most visible, the research practices that they enable will be the focal point of the next chapter.

Chapter 3. Operationalization of the video game stimulus

3.1 Introduction

The analysis of the challenges that video games bring to experimental designs, explored in the previous chapter, identified two procedures most impacted by the game. The first one is the process of selecting the game that will be used in the study. Scholars point to genres as a solution to the adaptation of theoretical frameworks emerging from other domains to the more varied field of games. However, as genres are themselves a contested concept, the process of game selection must be further examined and contextualized within the processes adopted by researchers that conduct experimental studies. Likewise, the procedure of engaging with the game was identified as a challenging process due to the participants‘ active engagement with the game. A series of experimental studies will be reviewed to examine the procedures further. The principal focus will be answering the questions:

- What characterizes the process of selecting the stimulus games?
- What characterizes the process of having participants engage with the game?

The results of the review, together with the conclusions drawn in the previous chapter, will function as the foundation for building a game analysis framework intended for application in the field of experimental research. To ensure then that the needs of the field are met, current procedures of using games as a stimulus will be inventoried and analyzed in terms of their necessity, advantages, and disadvantages.

3.2 Procedure

To understand the practices surrounding the process of selecting the stimulus game and having participants play it, a broad review of experimental studies was necessary. The process of gathering the corpus of studies followed four steps and ended at a point in which data saturation was observed. This was dictated by the point where no new processes of game selection and game engagement were observed.

The first step of obtaining the sample consisted in reviewing the articles used by Ivory (2013) in creating his typology of game roles in the quantitative social sciences. I consider the use of his corpus to be an adequate starting point due to the convergence in topic focus and the comprehensive nature of the work. However, while our focal interests were similar, our aims differed. Ivory's goal was to create a high-level typology of the role of digital games, while mine was more granular, focused on the actual procedures employed within the studies. As such, the corpus needed to be filtered and amended to fit the scope of the research. Metanalyses (e.g., Ferguson, 2007b) were filtered out of my corpus as their methods do not involve the use of games. Decidedly qualitative studies that examined aspects such as the economy of virtual worlds (Castronova, 2001) or epidemiological studies triggered by events such as the *Word of Warcraft* (Blizzard Entertainment, 2004) blood plague (Balicer, 2007; Lofgren & Fefferman, 2007) were also filtered out. The decision to filter them out was due to a mismatch in the object of study. As the role of the game in the aforementioned studies was mostly that of virtual environment (Ivory, 2013), it did not match my research interests in the game as a stimulus.

Following the analysis of the articles employed by Ivory (2013), the corpus was amended with a sample of studies collected from the American Psychological Association article database ("APA PsycNET, "2020), Taylor and Francis ("Taylor & Francis Group," 2020), and Springer ("Springer - International Publisher Science, Technology, Medicine," 2020). The keywords 'video games', 'digital games', and variations thereof were used to search for articles published until the cutoff year of 2019. The same filtering procedure was applied, with metanalyses being discounted, alongside letters to the editor and retracted articles.

During the analysis phase, the studies that used noncommercial games designed and developed specifically for use in the respective study were also filtered out (e.g., Joeckel et al., 2012; Frank & Macnamara, 2017). The case of custom-made digital artifacts poses an interesting challenge for the review and the development of the current framework. With the popularization of development platforms like Unity (Nicoll and Keogh, 2019), Game Maker (YoYo Games, 1999.), Twine (Kilmas, 2009), and others, which create opportunities for crafting digital games without extensive knowledge of programming and digital art creation, the entry bar for game development and creation has significantly lowered. This development, along with the possibility of modding, has offered researchers the possibility to control for confounding variables (Elson & Quandt, 2016) with far greater precision than before, as well as to create artifacts that target in a more precise manner the focal variables that the researcher is interested in. However, the practice is still in its infancy, with the number of studies using commercial titles far outnumbering the custom-made ones[1]. While falling outside the scope of this work, it would be valuable to observe the standards and structural requirements according

[1] The number of noncommercial studies filtered out of the final sample was 22, compared with the final sample of experimental articles of 106. However, it is worth noting that the studies using noncommercial titles have increased in numbers, particularly in the last 5 years.

to which these bespoke games are designed, particularly as a means of assessing the ways in which the researcher-developer operationally defined and implemented the variables of interest.

The final step of the sampling procedure consisted of snowball sampling of articles, following bibliographic suggestions until a satisfactory level of data saturation was reached. The final sample consisted of 106 experimental studies. As multiple publications contain multiple studies, particularly in the experimental studies category, the final unit of analysis was studies and not articles. This brought the count of experimental studies to 133.

The articles were reviewed, and a database was developed that included the identifying data of the study (authors, article title, year of publication, and journal) along with the methodological procedures involved. In the case of experimental studies, the ones that will be most heavily relied on from here on, the procedures accounted for were the game titles and the total number of games employed, the procedure of selecting the games and rationale for the selection and the procedure for establishing an equivalence between experimental conditions, as well as any modifications brought to the game. The article database can be found in the appendix.

3.3 RESULTS

The sample used included articles published over a large period of time. The earliest article reviewed was published in 1983 (Gwinup et al. 1983) and investigated the cardiovascular changes suffered by digital game players during play. The article opens with the statement:

‘Video-game mania has affected millions of Americans in recent years.’

The investigation of the biological repercussions of this new activity over the afflicted is thus framed and justified by the outlook on playing video games as an outbreak. It could be argued that this perspective can also act as a justification for blackboxing the activity, as closer examination might heighten the risk of infection. Fortunately, and expectedly, the last published article reviewed (Allen & Anderson, 2019) demonstrated an interest in transgressing these boundaries and took the game out of the black box, examining structures that might affect the behavior of players, such as the aggression levels of non-playable characters (NPCs), their visual representation, and the visual representation of the playable character.

While research on aggression and violent effects dominates the sample, with 42 out of the sample of 106 investigating that effect, more recent research has also seemingly brought forward new focus on the experience of play, such as the relationship between the player and the playable character (Banks, 2017), or the effects on moral competence when exposed to moral dilemmas (Sofia & Klimenko, 2019). The most frequently encountered research interests were the effects of video game play on the player's aggressive behaviors (e.g., Chambers & Ascione, 1987), thoughts (e.g., Tamborini et al., 2004), and attitudes (e.g., Allen & Anderson, 2019) and its effect on brand recognition and brand awareness. (e.g. Glass, 2007; Lewis & Porter, 2010), with 12 of the sampled articles investigating it. This speaks to an unfortunate, if passing, state in which games are highlighted either in light of the negative repercussions it may have on individuals and society or the means through which they can be exploited. However, the diversification of themes mitigates such worrying conclusions, particularly with the emergence of research on experiential factors overtaking the interest in in-game advertising in the later years.

The research subjects broached in the studies see a diversification over time as the field becomes more established. The game structures that present an analytic interest become more granular and more specific to the domain of video games. Also, the acknowledgment of a separation between the behavior of the player during play and the behavior of the individual outside it becomes more pronounced. Such research interests include the exploration of soundtrack music on the gameplay experience (Klimmt et al., 2018), investigating the effects of the congruence of the soundtrack on the experience, mediated by emotion spatial presence or identification with the protagonist. Investigations relying on particular modes of manipulation, for instance, exergames (Kim & Timmerman, 2018) or gameplay modes (Breuer et al., 2017), also appear as the themes diversify.

3.3.1 Game choice rationale

The majority of the studies[2] reviewed employed only one title in their research design. The reasons for this choice are varied and depend on the aim of the study. Some studies (e.g., Behm-Morawitz & Mastro, 2009) chose to use only one title with the explicit desire to maintain the mechanics available to players constant throughout the conditions. For other studies, such as Skalski et al. (2011), the independent variable targeted dictated the choice. In this case, the variable of interest was the controller scheme, and the game was chosen due to its support for the different controller types. The same motivation and choice strategy is found in studies where the variable of interest is the number of players (e.g., Greitemeyer, 2013). A criticism that can be brought to this strategy, and which will be explored further in the latter part of the

[2] This particular analysis is based on the number of studies, not on the number of publications. This is due to the multiplicity of studies that are contained by some articles, and the difference in number of games and game titles that each study has, even if part of the same publication. 70 studies out of 133 used 1 game.

chapter, is the lack of analytic space afforded to the actual title used, beyond its possibility of supporting the variation in independent variables.

The second-largest category, studies using two different titles, generally do so to enable a comparison between two discrete categories of games, for example, a violent or a nonviolent digital game. Along with the previous types of studies employed, this category raises questions with regards to stimulus sampling and the possibilities that effects that are observed can be attributed to the individual (artifact) or to the independent variable (Wells & Windschitl, 1999).

As a response to issues raised by stimulus sampling, studies using upwards of two games per condition (e.g., Hasan, 2017; Carnegey et al., 2007) do so with the stated desire of improving the generalizability of results. However, as video games are such heterogenous artifacts, this attempt at improving generalizability can be challenged if it is aimed at specific titles and not the targeted game structures. For instance, Hasan (2017) investigated the effects of playing a violent or nonviolent game on the voice stress displayed by the participants. The games used were *Condemned 2: Bloodshot* (Warner Bros. Games & Monolith Productions, 2008), *Call of Duty Modern Warfare 4* (Infinity Ward, 2007), and *The Club* (Bizzare Creations, 2008) for the violent game conditions and *SBK Superbike* (Milestone, 2010), *Dirt 2* (Codemasters, 2009) and *Pure* (Blackrock Studio, 2008) for the nonviolent condition. This brings the total number of titles used to six. The games were evaluated by participants across a series of criteria, including how realistic the game was, how enjoyable, entertaining, difficult, frustrating, boring, or violent. This measure was taken as a means of ensuring equivalence between conditions across variables that were not the intended independent variable. While it is stated that multiple games were chosen to improve generalizability, the author does not provide further reasoning for choosing the specific titles. The games chosen are not described beyond a nominal category (shooter and racing) and their age rating (18+ or 10+). In the absence of such descriptions, it is difficult to clarify across what population the results can be generalized. While a welcome improvement of stimulus sampling strategies (Wells & Windschitl, 1999), more clarifications are required in terms of qualifying the representative titles among the population out of which they were extracted. Using a racing game as a representative of non-violent game play does little for the generalization of results across the heterogeneous genre of racing games, which incidentally is at the heart of one of the first video game moral panics (Kocurek, 2012).

In terms of the rationale provided for the section of games, the most prevalent justifications were the face validity of the game to the independent variable of interest, the possibility of changing the independent variable, and the commercial rating of the game. Unfortunately, the majority of studies did not provide a report on the selection procedure, merely stating the games that will be used and relying on a commonsensical understanding of face validity. In the following, each type of rationale provided for the procedure will be discussed, along with its benefits and drawbacks.

3.3.1.2 Face validity

The most commonly reported[3] method in choosing the stimulus game is face validity. Face validity describes a subjective appraisal of the possibility that a measure targets the stated construct (Stangor, 2015, p. 96). In this case, it reflects the appraisal on the part of the researchers that the game, or games that have been selected as a means of independent variable manipulation, are relevant to the said variable. While other categories are more precise in their justifications, the current one includes more broad gestures towards the reasoning, such as:

> 'GoldenEye for the Nintendo Wii was selected as the stimulus game because it features human-on-human violence in realistic settings and a simplified control scheme that is welcoming for non-gamers. It has a short in-game training level that displays instructions to help guide the player.'
>
> (Krcmar et al., 2014)

Like in the above example, the justification for the choice of stimulus game often goes beyond its relevance to the independent variable. In the example above, the face validity of the game was amended by the usability necessities imposed by the laboratory setting and the unknown familiarity that participants may have with games. The example above is not unique, with multiple researchers mentioning the intuitiveness of controls being a factor in the game choice (e.g., Breuer et al., 2017; Dorval & Pépin, 1986).

Due to its subjective nature, the appropriateness of game selection based on how common-sensically appropriate the game is for the research design situates itself on a spectrum and is highly dependent on the definition given to the independent variable. Examples like the one above relate the actions that can occur in the game to a severe act of serious harm being deliberately enacted, a perspective often adopted by researchers (Scharrer et al., 2018). The same is true for studies that can trace the presence of the independent variable within the game structures, such as:

> 'This game was selected for the two following reasons. First, Zaxxon presents face validity

[3] 39 out of the 132 studies reported a description of the game that would justify the title as being relevant to the study due to specific features.

for spatial visualization; for instance, Zaxxon is, at the moment, one of the few games commercially available that simulates three-dimensionality.'

(Dorval & Pépin, 1986)

The same cannot be said for studies that briefly justify their game choice in regards to content and popularity without reviewing specific possible actions and relating them to the focus variables (e.g., Hummer et al. 2019). While the mention of popularity provides a measure of ecological validity due to the similarity of the stimulus to the games played in a natural setting, it offers no insight into the relevance of the game in the research design at large and impedes further knowledge building across the field.

This selection procedure can fall into the trap of what Wells and Windschitl (1999) refer to as typicality judgments. They describe this pitfall in the following:

'One stimulus characteristic that is likely to make the need for stimulus sampling less obvious is the appearance of typicality or class resemblance for the stimulus selected. For instance, if one were testing the hypothesis that background rock music interferes with learning more than does background classical music, it might seem acceptable to compare the Rolling Stones with Beethoven because they resemble or seemingly typify these categories of music. However, this use of the representativeness heuristic to make judgments about the lack of a need for stimulus sampling may be just as questionable as making use of the representativeness heuristic for making judgments of probability (as demonstrated by Tversky & Kahneman, 1971). In this case, neither the Rolling Stones nor Beethoven may be particularly representative of their respective categories because both are closer perhaps to their ideals than they are to the central tendencies of their categories. Representativeness judgments of this sort are insensitive to base rates and other properties of statistical distributions.' (p. 1117)

This risk becomes all the more pronounced in cases where the categories out of which the stimulus game was extracted are not well defined formally. Would the act of human-on-human violence described in *GoldenEye* (Eurocom, 2011) be equivalent to the act of killing demons in *Doom*? Is the humanity of the opponents a defining characteristic? There are no guardrails provided as to the methods through which the stimulus's typicality or outlier nature can be determined. However, such matters could be established through study reproduction and better contextualization of the variable of interest within the supporting game systems.

In their description of the process of selecting *Mario Kart Wii* for their study concerning the effect of natural controls on the player's performance, McMahan et al. (2011) describe the process through which they rejected the first stimulus game candidate. Their first candidate, *Mercury Meltdown Revolution* (UVT Ignition Games, 2006), included varying control possibilities– either via tilting the Wiimote or using a controller. *Mercury Meltdown Revolution* was rejected because, ultimately, the researchers considered the procedure of tilting the game environment not to be a natural engagement with a familiar task. The game stimulus choice was then revised. This example demonstrates the risk of choosing the stimulus game based solely on the appearance of a variable of interest and the changes in that perception that may occur when the variable is contextualized.

3.3.1.3 Built-In Variable Control

The following category can be considered relatively self-explanatory but, the repercussions it may have on the research design are not as straightforward. Studies in this category generally reported the choice of stimulus games according to the built-in option of varying the independent variable. This includes, for example, variations of 'blood levels,' where the presence of the blood is proposed as a primer for an increased number of aggressive thoughts (Barlett, Harris & Bruey, 2008), cases where the chosen game title is made available on multiple consoles that use different types of controllers (Limperos et al., 2011), or where the game provides both single-player and multiplayer modes, in the case of studies which focus on cooperation, and in-group vs. out-group perceptions (Schmierbach et al. 2012).

The method has multiple advantages. It is cost-effective to use a commercial game that has built-in variations across variables. Implementation of those variations in a bespoke game would increase the time and cost of development exponentially. Second, and most importantly, it grants researchers a higher level of control over possible confounding variables. By using the same game and manipulating non-mechanical variables, the likelihood of emerging confounds is diminished.

However, diminished does not mean eliminated. This is true particularly in the case where the variable manipulation involves complex constructs, such as difficulty (e.g., Schmierbach et al., 2014). Often, the difficulty does not involve only one change in the game experience but targets multiple mechanics. In the case of the study conducted by Schmierbach et al. (2014), which used *Bloons Tower Defense 4* (Ninja Kiwi, 2009) as a stimulus game, the change involves variations in both the number of enemies present, their types, and spatial layout of the level. Changes across each of the factors mentioned imply characteristic behavioral changes and variations in required behavior, preventing the possibility of establishing a causal relationship between the variable change and the observed behavior. Such a wide, unstable construct also prevents generalization across titles where changes in the difficulty setting might imply changes across other dimensions of gameplay. Thus, while a cost-effective and appropriate means for some instances, the selection of games based on the possibility of varying the independent variable is not a wholesale solution. This is doubly true for complex constructs, such as the abovementioned difficulty rating.

3.3.1.4 Commercial ratings

Perhaps the procedure with the biggest claim to objectivity is appealing to the games' ratings established by legal entities such as the Entertainment Software Rating Board (ESRB) or the Pan European Game Information (PEGI). The ESRB provides game ratings based on 'content cues' that are tied to age suitability. The source material examined by the raters generally takes the form of video recordings of gameplay provided by the developers. ("Ratings Process - ESRB Ratings," 2020). The information provided by the developers is intended to target all the game structures perceivable by the player, including mechanics, reward systems, and unlockable content. The information is then presented to a team of coders with diverse demographic backgrounds, who rate the game according to the video material provided. Content is assigned to categories like violence, cartoon violence, nudity, blood and gore, and others. Category descriptors are provided for clarification; however, the clarifications seldom make things clearer. For example, a game rated E for everyone and deemed to be suitable for all ages may contain cartoon violence, where cartoon violence represents violent actions involving animated characters and situations, where a character remains unharmed after the action has been inflicted ("Ratings Guide - ESRB Ratings," 2020). The wording here becomes problematic, as all digital game characters are constructed, drawn, and animated, and the repercussions they suffer following violent actions taken upon them depend on their programmed routines of reacting to said violence, not only on the act being performed. In *The Elder Scrolls V: Skyrim* (Bethesda Game Studios, 2011), the player can shoot arrows at non-playable characters from a hidden position. If the player is detected following the arrow being hit, and if the hit does not deplete their health pool, the victim may proceed to walk around, with an arrow sticking out of their head and a bark[4] that states, 'Huh. Must have been the wind'. The interaction is comical and would fall wholly under the cartoon violence category as the victim appeared unperturbed by the violent act. In *Super Mario Odyssey* (Nintendo, 2017), jumping on an enemy Goomba eliminates the NPC from the world in a puff of smoke. Following the guidelines, the elimination of the Goomba, the fact that the entity is no longer perceptually active would mean that it has been forcefully eliminated, 'killed,' and thus has

[4] A 'bark' colloquially defines a short audio or written reaction on the part of an NPC, to a player action.

suffered harm with visible repercussions. However, *Skyrim* is rated M for Mature, while *Mario Odyssey* is rated E for Everyone. While this comparison may seem pedantic at first, it only serves to highlight the difficulties in assessing game content and the problems posed by using ratings developed for commercial use as scientific guidelines. The ESRB has a responsibility to inform parents and other consumers of the *possible* content that may be encountered in the game. That responsibility does not extend to the stringent controls that should be present in scientific research.

Thus, the principal reason for the inadequacy of commercial ratings as a tool for stimulus selection is the difference in scope and unit of analysis. Commercial ratings assess the game as a homogenous unit, all the assets, and mechanics that the developer (under obligation) discloses. The research intervention, however, takes place on a much smaller scale – often on a 15 to 30-minute section of the game. This difference in scope invalidates the appraisal put forward by the raters, as it is not guaranteed that all if any of the correspondent assets that have warranted the content description be present in that interval. This particularity of scientific trials calls for a far more granular approach in appraising the content that the player *can* traverse and the content that the player *does* traverse in the segment that is used in the study. Secondly, the appraisal performed by the ESRB raters relies on video footage of the game and the information provided by the developers. The focus is not equivalent to the focus of scientific studies, where the participants actively engage with the game.

3.3.1.5 Pilot studies

The second means of providing standardization and accountability in the selection of the game stimulus is through exploratory pilot studies in which a sample of participants evaluate a larger sample of games, out of which the final stimulus titles are chosen. The method is used as a means of enhancing variable control, ensuring equivalence between titles on potential confounding variables, and verifying that the stimulus fits the intended criteria. The pilot study participants are usually randomly distributed into groups and assigned a wide range of games or simply just the title that is intended for use in the main experiment. Following a brief (15 or 30 minutes) engagement with the game, they respond to a questionnaire in which one or more items assess dimensions across which titles should be equated. This can include enjoyment derived from the game, frustration, action, or difficulty, as well as the targeted stimulus criteria, such as levels of aggression (e.g., Anderson and Dill, 2000; Konijn et al., 2007). The practice of using pilot studies to ensure equivalence between titles and the presence of focus variables in the experimental title is a great control measure, and its use despite the added time and data processing costs speaks well of the researcher's commitment to the internal validity of the study. However, the procedure brings with it its own validity challenges.

The most pressing issue is represented by the operationalization of the constructs assessed through the questionnaire items. Constructs such as 'enjoyment,' 'pacing,' or 'aggressiveness' are all unmeasurable concepts – they cannot be meaningfully quantified without transformation (Kerlinger, 1986, pp 395-396). Relying on questionnaires as the principal means of variable assessment implies that the player's perception and interpretation of the variable is the grounding factor of the operational definition. Without ensuring the validity of the operational measurement definition of the constructs, there can be no certainty that the items measure the same thing over time and across respondents. The practice of having only one item measuring a construct is particularly detrimental to validity as there are no checks in place to ensure that the formulation of the item has been appropriately interpreted (Fowler Jr. & Cosenza, 2009).

Using self-report measures that rely on the reflective capabilities and interpretations of participants has the potential of investing studies with circularity in the assessment of variables (Rauthmann et al., 2015a) where the game's attribute is defined through the reflective capabilities of the participants, that bring with them uncontrolled for person-related variables. The practice seems reflective of the assumptions of social learning theory that a situation can be defined through person-related variables (Rotter, 1981). However, the caveat to that approach is that in such a case, the situation cannot be used predictively (Rotter, 1981). This assumed reliance could be gleaned from the co-occurrence of theoretical models derived from social learning theory and pilot studies (e.g., Anderson & Dill, 2000). Without identifying, describing, and critically accounting for the game structures that act as a stimulus, independent of the participants' personal assessments, the results will remain land-locked by the perception and interpretation of the study participants, and generalizability across different game titles is questionable.

The practice of selecting games based on the results of pilot studies bypasses one of the issues mentioned in connection to commercial rating systems, namely that of the scope of the evaluation. While the commercial rating system considers the entirety of the game, the scope of assessment through pilot studies is much more appropriate and similar to the intervention used in the experimental trial. However, other issues remain. While the scope of the pilot study, its targeted focus on potential confounds and on the presentation of the focus variables places them as a more accurate, if less cost-efficient methods of stimulus selection than commercial ratings, if the goal is to ensure generalizability and meaningful production of knowledge through a network of studies that build upon each other's work, it is necessary to establish methods of stimulus selection that do not rely solely on the evaluation of the participants, and instead, take into account the distinctive features of the game.

3.3.1.6 Choosing not to choose

Unlike the previous sections, which discussed extant procedures of stimulus selection, the following section will discuss the lack of such a procedure, or more accurately, the lack of its reporting. It is unfortunate that such a section should even exist. However, the proportion[5] of articles reviewed that reported no procedure or rationale for the selection of games, along with the small space given to the description of the games, makes such a section a necessity. Unlike the previous sections, which reviewed practices of the operational definitions to game engagement in quantitative research, the current section is much more general.

It is an undeniable reality that researchers must comply with certain limitations when reporting results. Publications impose word or page limits that force a prioritization and culling of what will be reported in the final article. Likewise, reviewers have suggestions and requests that will invariably highlight their own areas of expertise. This unfortunate prioritization often results in very brief descriptions of the game, frequently not longer than a couple of sentences, and a lack of clarity or justification with regards to the procedures through which the game was chosen, the traits that qualify it as an appropriate stimulus, and the presence of the independent variable within its bounds. The practice seems to reflect an approach of convention and convenience. Relying on definitions of concepts formulated to reflect human behavior, such as the operational definition of aggression, researchers seem to find it unnecessary to translate those definitions to actions in a virtual space. It thus becomes common sense that a First Person Shooter is a violent video game, and the necessity of qualifying the violent acts within the multitude of internal structures of the game and within the mass of existent titles of the same genre becomes superfluous, a section that can be cut when faced with word restrictions.

Perhaps it would fall in the realm of common sense to say that results in a study on aggression produced by engagement with a violent video game, where the stimulus representative is *Call of Duty 4* would generalize to *Condemned 2* because the actions performed by players are similar. However, lacking a formal operational experimental definition of the stimulus, its representation and salience within the individual title, and the stance of the individual title within the broader population of games, such a conclusion is invalid as neither of the criteria is formally defined.

[5] 56 out of the 133 studies reviewed, in other words half of the sampled articles, did not report on the process of selecting the stimulus game.

The lack of reporting sampling procedures and the commonsensical rather than scientific approach given to stimulus sampling speaks to the lack of distinctive procedures established in the domain, even in the presence of works that bid caution on the part of the researchers (e.g., McMahan et al., 2011; Järvelä et al., 2015). Researchers that demonstrate a higher degree of interest in comprehensive sampling rely on categories such as genre (e.g., Reinecke et al., 2011). However, as previously discussed, genre categories are themselves a contested concept. Often, the genre categories used in the sampled articles are not formalized, a factor often reflected in different studies utilizing a different set of genre categories. The assumption of generalization of the stimulus within a group relies on group homogeneity (Wells & Windschitl, 1999), which in the case of digital games is disputed by the inconsistency of categories and the co-occurrence of genre attributes within one title.

For instance, Lucas and Sherry (2004) describe the following genres, complete with games examples:

- Strategy - Games that use strategic planning skills (Command & Conquer, Civilization, Age of Empire)
- Puzzle - Games that can be solved, no element of chance (Tetris, Free Cell no element of chance)
- Fantasy/role-playing - games that let you assume a character role (Final Fantasy, Legend of Zelda, Diablo)
- Action/Adventure - Games where you go on an adventure (Resident Evil, Tomb Raider)
- Sports - Games based on athletic teams and events (Tony Hawk's Pro Skater, NBA Jam)
- Simulation - Games where you create a simulation (Rollercoaster Tycoon, SimCity)
- Racing/speed - Games that focus on going fast (Super Mario Kart, Grand Turismo, Need for Speed)
- Shooter - Games where you shoot other characters (Quake, Duke Nukem)
- Fighter - Games that focus on martial arts or hand-to-hand combat (Mortal Combat, Tekken)
- Arcade - Games based on original arcade games (PacMan, Frogger, Pinball)
- Card/dice - Games that have an element of chance (Solitaire, Vegas Fever 2000)
- Quiz/trivia - Games that test your knowledge (Jeopardy, Who Wants to Be a Millionaire)

- Classic board games - Video game versions of old-time favorites (Monopoly, Checkers)

According to the examples provided, some game features seem to be more salient than others. However, the problem emerges when no formal reasoning is given to the means that salience was judged. Surely, parts of *Legend of Zelda: Ocarina of Time* (Nintendo, 1998) can be solved and are not reliant on chance, falling under the puzzle description, and Lara Croft has shot many NPCs, while players have assumed her role. While a singular example, given that many of the papers sampled rely on distinctive genre lists, it speaks to the mismatch between selecting the stimulus game based on criteria that evaluate the entire experience and the limited engagement that the experimental intervention consists of.

The lack of stimulus sampling procedures and their reporting seems to be suggestive of a missing evolutionary link in the field of experimental games research, where the source of the assumed effects has not gone through the necessary procedures of formalization before the expansion of the field, which may be what resulted in the breadth and chaos of results described by Sherry (2006).

3.3.2 Segmentation of engagement

Following the exploration of stimulus selection practices, the next two sections will explore the practices of limiting the players' engagement with the game during the experimental study. One of the realities of laboratory research is the necessity to extract a section of the game to be used during the intervention. The general reason for this is the time restrictions of interventions compared to the time required to complete a standard commercial digital game. In an outlier example found in the sample, Williams (2006) mailed participants copies of the MMORPG *Asheron's Call* (Turbine Entertainment, 1999), allowing them to play at home and, as such, ensuring a closer similarity to natural settings. The intervention period stretched to one month, with participants playing the game for an interval of 5 to 375 hours, with a mean of 65 hours. Other outlier cases present in the analysis did not impose a global segment of the game to be played by participants, but conditional states, such as playing until all NPCs in the assigned zone of the game are killed (Allen & Anderson, 2019), or until a certain number of points is reached (Greenfield et al., 1994). This type of segmentation is chosen due to the specific requirements of the research objective or hypotheses. For example, in the latter case, reaching the appointed high score three times in a row is used as a marker for an acceptable level of skill in the game. This allows researchers to have a reliable and accountable proxy for skill. Likewise, for the sake of verifiability of manipulation, killing all the NPCs in the zone in the second example ensures that the player has committed what the study considers to be immoral in-game acts, acting thus as a manipulation check.

While notable, the outliers are just that – outliers. The overwhelming majority of studies segment the engagement with the game according to the time given participants to engage with it, followed at a distance by the procedure of segmenting the engagement through the intrinsic game sections. As the two most frequently encountered procedures[6], they will be given ampler space of discussion in the following sections.

3.3.2.1 Time based segmentation

While not many procedures are standardized in the use of games in quantitative social science studies, it seems that employing a time-based method of segmentation is among the few practices so frequent as to be considered a standard. The use of digital games as stimuli in experimental research requires them to be segmented into easily deliverable 'doses.' As such, it is common practice for researchers to segment the stimulus game into sections of several minutes. Those sections come in multiple shapes and sizes. The shortest segmentation encountered limited playtime to 45-second intervals (Gentile et al., 2016). Strapped into an fMRI scanner, players played alternately violent and nonviolent 45 seconds sections *of Unreal Tournament 2004* (Epic Games & Digital Extremes, 2004), with 10-second breaks in between. Such practices can have repercussions in the form of strict instructions regarding the desired actions, such as being instructed to kill all NPCs. This, paradoxically, puts the researchers in the role of script provider, determining the players' actions, a role previously attributed to the game.

Generally, the play sessions last 10 or 15 minutes. This practice has been previously criticized (Valadez & Ferguson, 2012) from the perspective of the detrimental effects it has upon the ecological validity of the studies. 'Exposure' that is limited to 15 or 30 minutes is not equivalent to a typical play session that players would generally engage in. In response to the issue, they varied the playtime across experimental groups. The study did not find statistically significant differences along the dependent variables (hostile feelings, depression, and visuospatial cognition) between the two groups. The researchers concluded that there are either no differences between the two time frames, or that the time span was not large enough to be representative of average gameplay. In closing, they caution against confounds that may arise from time-based segmentation in the form of frustration on the part of the player due to the

[6] The sample included 133 out of which 14 used game based segmentation, 99 used time based segmentation, 2 used a combination of both and 18 did not report the type of segmentation used.

reduced time given to mastering the controls, and advise researchers against generalizing conclusions from a short experimental session, to standard gameplay sessions. A similar criticism has been put forward by Grizzard et al.(2015), who posit that habituation plays a role in measurements of arousal. When arousal is measured by proxy, biometric assessments, repeated exposure finds that arousal decreases over time, following a peak. This signifies the importance of novelty as a confounding factor of the measures employed. Criticism addressing the short time span of engagement has also emerged from the subdomain of positive game effects on cognitive functions. While 'brain training' games have seen a period of expansion, relying on common-sensical assumptions that engaging in intellectually challenging activities in a regular fashion may alleviate symptoms of degenerative brain illnesses such as dementia, attention is drawn to several potential issues that may leave the assumptions scientifically invalid. The first is the issue of knowledge transfer, which highlights that the skills derived from playing a 'brain training' game are task-specific and cannot be abstracted across other types of tasks (Fanfarelli, 2018). The second issue, and more relevant to the current discussion, is the criticism surrounding the limited time that participants spend playing the game (Fanfarelli, 2018). Assuming that the role of the game is to improve neural connections and brain plasticity, the reduced amount of hours spent in the endeavor is exceptionally low compared to the multitude of tasks through which the brain is trained throughout life through seemingly minor but crucial tasks.

While the issues highlighted above target mainly threats to the ecological validity of the works, namely how well they would generalize across contexts, I am chiefly concerned with the impact of time-based trials on the traversal of the game structures. Employing this method, as has been noted, can negatively impact the equivalence of experience of the participants with the game. The continued use and apparent ubiquity of the procedure make it a necessary, even fundamental aspect, to consider if a methodology concerning the quantitative study of games is to be standardized. The dissimilarity in experiences has been previously noted in content analysis research. Karazsia & Muller (2018) switched from a content analysis of gameplay to content analysis of video gameplay trailers due to intercoder reliability issues derived from the variance in experiences that the raters were having in the game. Leaving aside such matters as the length of exposure, standardizing engagement based on objective time may truncate game experiences in an artificial manner, exacerbating the already varied experience that games may offer. Speed of learning, understanding, and integration of mechanics, ease of game controls use, change from being integral necessities to gameplay to potential confounding factors when the context requires equivalence in experience (McMahan et al., 2011). When time restrictions are introduced into a research design concerning digital games, time becomes an artificial resource whose expenditure, if implemented, should be tracked by researchers.

To this end, researchers (Järvelä et al., 2015) have proposed event-based coding of the participant's engagement with the game. This measure would offer a greater degree of control over the actual occurrences during the play sessions and may aid researchers in establishing an equivalence between the experiences of the participants. Event-based coding is suggested as a method of reviewing factors such as the repetition or co-occurrence of events, as well as contextual change between events. While a useful control tool, the method has unfortunately not seen widespread mainstream use. Tracking game events is seen sparingly and generally only in relation to the variables of interest (see Carnagey & Anderson, 2005). It is possible that the practice of coding events is considered a time-consuming endeavor when the events are not seen to have a direct link to the independent variable or cannot be linked to particular physiobiological events (e.g., Kivikangas et al., 2010). However, not acknowledging the occurrence and context of the activity taking place in the virtual environment is detrimental to the generalizability potential of the results and changes the perspective on the engagement from one of active participation to one of passive reception.

The use of time-based segmentation is not only an issue of individualized, ungeneralizable experience but also reverberates in other decisions concerning the research design. A popular way of bypassing assumed differences in skill is the use of God Mode[7] or other such rule modifications (e.g., Krcmar et al., 2011; Tamborini et al., 2004). The explanation for these modifications is that not doing so would result in the participants being stuck in fail states or having to repeat the same section an inordinate amount of times. Another reason is that having the participant be stuck in a fail state loop can increase the levels of frustration and thus contaminate the results by involving a third variable as a potential source of heightened aggressive behavior, states, or affect. However, the use of God Mode or infinite lives results in the elimination of goals that the game sets forward to players, and as such of the multitude of emotions that can be elicited through gameplay via the balance between goal achievement, fail state avoidance, and optimal usage of the mechanics (Järvinen, 2007). Coupled with instructional procedures such as directing participants to kill all NPCs (Allen & Anderson, 2019), such rule alterations can have the undesired and unaccounted for effect of no longer using a digital game as a stimulus, but the researcher's requests. It would not be reasonable to

[7] God Mode describes a modification in the game routines that either prevent the player from taking damage, or eliminate the state change that is generally consequential to depleting the health pool of the playable character, thus effectively eliminating the possibility of fail states.

put all of the methodological ramifications on the shoulders of time-based segmentation; the connections are only made through conjecture. However, the necessity of a type of controllable segmentation that ensures similarity of experienced events and brevity in application is a need of quantitative games research that an analytic framework should meet.

While lengthening the play session may aid in mitigating ecological concerns, the issue of individualized experience remains. The aspect that should instead be highlighted is the acknowledgment and awareness of the activity taking place in the virtual environment, and its contextualization. The formalization of this practice could aid both in the mitigation of individualized experience, as well as the previously discussed issue of stimulus sampling.

3.3.2.2 Structural segmentation

Although proportionally dominant, time-based segmentation is not the only type of segmentation encountered in the studies reviewed. Several studies operationalize engagement with the game based on intrinsic structural segments, for instance, levels, laps, or rounds (e.g., Glass, 2007; Limperos et al., 2011). This type of segmentation mitigates some of the issues encountered in the time-based segmentation discussion by eliminating time as an artificially occurring resource. It also ensures the global traversal of certain compulsory game structures and the fact that players will abide by the same success or failure conditions. However, the issue that segmentation based on the internal structures of the game does not solve is generalizability across titles and experience variability within the segment.

Generalizing the experience of a level across titles, for example, is made difficult by the informal nature of the concept of level. A level can colloquially mean many things – it can be a virtual location, a numerical marker for progression – and it can occur within and across multiple layers of the game (e.g., visual, mechanical, spatial) (see Zagal et al. 2008). Using different levels for different experimental groups (e.g., Schmierbach, 2014) may involve changes in the spatial layout, the type of enemies and frequency with which they appear, as well as the actions at the player’s disposal. All of the factors are impactful to the game experience, and it is challenging to subsume them in a decontextualized manner under a singular construct.

The player actions and events occurring between the start and the end state cannot be presumed to be similar, nor the fact that the players will behave uniformly within the game structures. The dissimilarity of those actions within game segments is a well-accepted fact, evidenced by the establishment of its own subdomain of research in the area of player personas and player types (Yee, 2007; Canossa & Drachen, 2009, Hamari & Tuunanen, 2014). The seminal publication of Bartle's *Hearts Clubs Diamonds and Spades* (1996) brought with it widespread application and misapplication, but maybe most importantly, it brought attention to the diversity of behaviors that are enabled, constrained, and supported by game structures. While the same issues regarding generalizability are faced by persona and player types research as by experimental quantitative studies (c.f. Hamari & Tuunanen, 2014), the breadth of results produced by the subdomain point to the conclusion that game structures do not produce a uniform type of behavior.

We can thus conclude that solely limiting segmentation to game structures and maintaining the types of behaviors that can occur within them black-boxed can negatively impact internal validity by allowing multiple variables to vary across segments that can have different and accounted for effects on in-game behavior, which in turn has been strongly suggested to vary across the population. Operationally defining gameplay engagement into segments that can be administered during an intervention should thus not only take into account the structural segments of the game but also have in view the possible behaviors enabled by the segment and include them in the analysis and reflections made on the engagement.

3.4 Conclusion

Based on a sample of experimental articles produced primarily in the fields of social and cognitive sciences, the current chapter wished to establish a series of guidelines that a formal method for operationalizing a digital game should try to adhere to in order to both satisfy the requirements of experimental designs, and the particular characteristics of digital games. The complexity of games results in a resistance transference without translations of methods and operationalization strategies employed in the study of media that utilize a more passive type of engagement. The article review focused only on the procedures of experimental operationalization of the digital game stimulus, without looking into other aspects of the research design or reporting, such as assessment of effects, reported effect sizes, or human population sampling. Two significant areas of criticism were described: stimulus sampling procedures and game segmentation as part of the intervention procedure. Issues identified within these areas point towards several requirements that should be satisfied by such a framework, as well as cautions against procedures that may impact validity.

First, the artifact and the process of play that it enables must not be black-boxed. Understanding the process of engagement and the actions available to participants in the virtual environment is essential for the reflective choice of independent and dependent variables and their control methods. Lacking those, the second process that should be cautioned against will occur, conflating characteristics of the game object with the characteristics of the brief engagement that takes place during the study. Doing so raises the risk of using stimulus sampling methods that do not adhere to the requirements of scientific work and may not guarantee the presence of the targeted variables in the segment selected. Likewise, it may lead to the uncontrolled appearance of third variables, as the systemic interdependencies present in the game embed the targeted variables into modular networks that cannot be manipulated without unwanted secondary changes. Another risk that may arise is appealing to stimulus sampling methods that solely rely on the participants' interpretation of experiential constructs.

Stimulus sampling that considers from the outset the engagement parameters would help bring the two procedures into accord. Currently, the most prevalent method of segmenting the engagement, temporal segmentation, artificially modifies the engagement without acknowledgment of experiential variation. As such, a bespoke analysis framework should provide researchers with the means of distinguishing between game segments as behavioral spaces.

Shapiro & Peña (2009) put forward a general but functional definition of generalizability, which highlights this necessity of a conclusion that goes beyond the individual stimulus:

'a study contributes to generalizability if it leads directly or indirectly to an enhanced understanding of social phenomenon and human behavior.' (p. 578)

It is an open question whether or not generalizability in the context of digital games is even possible, in view of the breadth and variety existent in the domain, nor if it would stand the test of time, considering the rapid evolution with which the field expands. Calling digital games 'an unstable stimulus,' Shapiro & Peña (2009) note the many factors that contribute to the gameplay experience and which have evolved as the technology supporting video games has progressed. Among such factors, they note the control scheme and the audio-visual representations. Unmentioned but related are the mechanical changes emergent from the same control scheme changes. Not limited to controller scheme evolution, mechanical changes occur on the foundation of variation in the economic scheme or simply out of experimentation and innovation on the part of the designers.

In view of that, it would be recommendable that generalizability should not be imposed on the scale of game titles but on the same scale on which the intervention occurs – the unit of player-game interactions and transactions. Standardizing the intervention stimulus sample will, over time, allow for validation of the effects occurring in the behavioral spaces sampled, as well as for intra-game and inter-game comparisons of variable manipulation within similar behavioral spaces. The article review results can be summarized as a need for a game analysis framework that can be used for the selection and comparative analysis of brief segments of the game and enables the separate and comparable assessment of the individual and the structure.

Chapter 4. The Game Situation

4.1 Introduction

The recurring discussions regarding the procedures of experimentally defining video games centered around two poles: the stimulus selection and the intervention. Before examining the reasoning behind the necessity of a framework that brings the two procedures into accord, Chapter 2 proposed reframing the role of the game as one of a situation, as a solution. To begin analyzing how this might be achieved, the current chapter will briefly review works developed in the field of social psychology and symbolic interactionism to understand the previous efforts made in defining and formally analyzing psychological situations. The chapter will open with a discussion of the parallel development of the situation, and games analysis frameworks. Further, the most prevalent situation analysis frameworks that have been applied in games research will be examined, with the aim of determining the fit of the situation perspectives, with regards to the purposes of the current framework. As outlined in the previous chapters, the purpose of this work is to move from the game's perspective as a unitary stimulus to a more granular understanding of the engagement with the game. Chapter 2 closed with the mention of Pervin (1978), who described the game situation as a gestalt of who what and where acts in the situation. As the components cannot be appropriated without translation to the field of games research, the current chapter must first present an inquiry into what are the correspondents of the 'who', 'what' and 'where' in the game situation. To negotiate this discrepancy, the identification of the components of the game situation will rely on the concept of affordances as put forward by Gibson (1979/2014) and extended by Turvey (1992), as well as Latour's theory of the actor-network (Latour, 1994a; Latour, 1999; Latour 2005). The two theories will form the groundwork for understanding the formation of game situations via the existing game objects. On this grounding, a functional definition of the game situation will be proposed, wherein it will be understood as a temporary configuration of game objects that enables the observation of the influence exercised by the player and the game system. Identifying the relationships formed between the player and the game through the configuration of objects will rely on analytic concepts developed in the field of network analysis. As will become visible in Chapters 6 and 7, this will provide an overview of the roles individual objects have in the formation of the situation and the influence of different situation topologies on the player-game relationship. The chapter lays the groundwork for the empirical work, which will be further explored in the next chapter, by providing the basis for the analysis schema according to which the games will be analyzed.

4.2 GAMES IN SITUATION ANALYSIS

Games have served as inspiration for the research of psychological situations, most likely due to the assumption that games can function as isolated, controlled models of the possible environmental influences on behavior. In 'The structural elements of games', Avedon (1971) asks, 'What are games? Are they things in the sense of artifacts? Are they behavioral models, or simulations of social situations?' (p. 419)[8]. One of the most notable contributions to the study of situations inspired by games is made by Graham et al. (1981). Their taxonomy of situation characteristics identifies the goal structure, the repertoire of elements existent in the situation, the rules, the sequences of behavior that can be performed, the concepts that the actors operate with, the roles the participants take, the skills that must be employed in the actions performed, and the environmental setting in which it all takes place. Likewise, Argyle (1981) states 'The hypothesis I want to develop is that each basic kind of social situation has a characteristic repertoire of elements. To some extent, these elements follow the form, and could be deduced from the goals of the situation, the elements are the moves that are needed to attain the goals.' (p. 66). Both Graham et al. (1981) and Argyle (1981) place attribute goals in a special standing, putting them in the role of the principal characterizing factor of the situation. The perspective on games as goal-defined activities offer the authors the possibility of intuitively identifying the other constitutive elements of the situation relative to the goal structure. While enlightening as to the strategies of identifying situation structures relative to an apparent constitutive element, their perspective, as will be discussed at more length in a later section, cannot be translated directly to the current framework due to the conflicting role attributed to rules. The perspective adopted in this game-inspired situation framework is that more than one set of rules could be adopted in the pursuit of a goal. While valid for their object of study, the day-to-day situations in which humans find themselves, the lack of mutability embedded in the rules of video games prevents their relativization to the goals provided. While games may offer players alternatives towards achieving a goal, those alternatives are not left up to the discretion of players but are crafted sets of behavior possibilities embedded into the game system. The analytical exchanges between games and situations can further be attributed to the perceived similarity in participant role between situations and games. Graham et al.'s

[8] Essay reprinted in Furnham, A., & Argyle, M. (1981). The Psychology of social situations. Pergamon Press.

(1981) examination of the goal structure of situations assumes active participation on the part of the 'player' stating that 'It may be assumed that people enter situations because they are motivated to do so, i.e., they expect to be able to attain certain goals, which in turn lead to the satisfaction of needs or other drives.' (p. 57). The reflective, active role of the participant noted here is concordant with the active role of players during play, however discordant with the role they are given in other experimental research processes.

However, the field of research examining person-environment exchanges is not the only one displaying an analytic interplay between games research and psychological situations. Eric Berne (2010) describes transactions between people as a game-like exchange, where people address and respond to their interlocutors according to their corresponding roles. Berne's framework consists of interactional dyads, where the participant's roles are their defining characteristic. Berne's examination, born out of psychoanalysis, bears a structural, but not theoretical, resemblance to Kelley et al.'s. (2003). Kelley et al.'s (2003) situational dyads present two participants who follow their individual goals, but their actualized interaction is modified by the roles undertaken. The focus on personal interdependency separates Berne and Kelley's work from that of Graham et al. and Argyle, who adopted structural markers as situational focal points in the form of goals. Whereas the former authors' framework utilizes the formal elements of games as inspiration, Berne's framework draws its parallels with games via their potential for ludic mimicry (Caillois, 1961 p. 36). Thus, situation or game participants take on the role of a parent, adult, or child and endow their co-player with one of the same roles in their exchange. While a valuable perspective, the dyadic view of relationships between participants becomes more complex in the case of video games, where the game system assumes the role of both participant and container of the situation. This complication will be further examined in a future section.

The integration of the concept of situation and games analysis does not occur solely in the field of situation analysis but also appears in the field of game studies. Markku Eskelinen put forward the idea of the game situation, which he defined as a combination of ends, means, rules, equipment, and manipulative action, not bracketed by time, but by a specific end-state (Eskelinen, 2001). He does not assert that the end state is desirable but that the actions have a finality, which can result in the transition to a new situation or a final state. A game situation requires and involves multiple practices on the participant's part, including reflection on action, action potential, action selection through reflection, and the sustained attention necessary to accomplish the action engaged. All of the aforementioned prerequisites are necessary for undertaking a configurative role, a role he considers to be primary in the game situation and which distinguishes it from other types of entertainment. Importantly though, he does not consider the configurative role to be the sole role, underscoring the existence and importance of the reflective role. Eskelinen’s perspective on the game situation requires that its identification occur bilaterally – through the identification of the constructed structures the player operates in, and the role that the player is attributed and fulfills within the structure. His assessment of the situation falls in the middle ground between assertions of the objective situations bracketed by structures that influence behavior and the individual perception and interpretation of it.

The field of game design has also been notably intertwined with situation research. Developed by Brian Upton, situational game design (Upton, 2018) is a method created both for the design and the analysis of games that seeks to center the experience of the player as the analytic focus and not the formal game system. Bringing the player's experience into focus, it tries to move away from centering on the situations in which the player and the game interact and considers those situations that create anticipation, interpretation, and introspection for the player. Instead of analyzing the formal game system in a player-agnostic fashion, which in its conceptualization makes the interaction with the purpose of achieving a goal a primary motivation, the framework wishes to recognize the individual’s motivational complexity in interacting with the game. Thus, Upton states, ‘In situational design, the nexus of play does lies not in the interface between the player and the game but inside the player’s mind.’ (Upton, 2018, p. 4). However, as a design framework, it still functions with the conceptualization of an assumed player in mind. Instead of considering the assumed player as an active system component, the focus, however, falls on the moments of reflection and inaction. This enables analyses, such as the ones carried out by Farber and Schrier (2021), which considered how specific design elements communicate, support, and enhance specific experiences, in their case, empathy and compassion. Upton’s conceptualization of the situation aligns with what will be discussed in the following section as the conceptualization of the situation in symbolic interactionism.

As observed in the situation analysis frameworks developed by Graham et al. (1981) and Argyle (1981) mentioned in a previous section, the translation of game characteristics to situation analysis leads to the emphasis of the structural characteristics of games in the formation of the situation. Other researchers, such as Hacker (1981), also place a heightened value on goals as a byproduct of the task-centered perspective taken on the situation. Hacker describes the principal dimensions of situations as being the goal structure, the action sequence, and the possibilities that situation participants have on deciding between procedures with differing levels of efficiency. This is followed by the assertion that tasks are accomplished through purposeful actions. This highlights the principal difference – while in the frameworks developed for the analysis of psychological situations, game structures function as a model, the situation structures take on that role within the game analysis frameworks. Other discrepancies are caused by the differences between the constructed environment in which the players act. For example, while action intentionality can be present, it cannot be considered an inherent attribute of the actions taken by players. Bruteforcing and decisions made in the absence of information are all likely events that do not necessarily lead to task failure in the case of video games. Upton's situational game analysis framework also has, as a core concept, the player's non-goal-related actions and reflections. The deterministic stance that Graham et al. and Argyle take regarding situational goals is also in need of adaptation due to the interdependent relationship between game objects that are not necessarily related to formal goals. Like Bayliss (2007) states, goals are not presented without the possibilities of attaining them, linking the objective with the attributes of the objects that the player can access. Unlike the directed, determining relationship that Argyle observes between goals and rules, the relationship observed by Bayliss is bidirectional, the attributes of the goals and rules being situated in a relationship of co-determinacy

The current section offered a brief overview of the intertwining fields of situation and game analysis. While the two fields have exchanged concepts and inspired each other, there has been no conscious effort of knowledge translation across the disciplines. In other words, while games have inspired inquiries into the psychological situation, and situations have inspired analytical frameworks of games, there has been no explicit effort to examine the psychological game situation. The following sections will provide a more comprehensive overview of the schools of thought that produce inquiries into the study of psychological situations and the applications of the utilized theories in the field of game studies. The next section aims to provide a grounding to the choice of theories appropriated and carried forward in the development of the game situation framework.

4.3 The study of situations

The status of the situation in the field of psychology has taken many forms, from the principal unit of analysis within social psychology's perspective that behavior is a function of the person in a specific environment (e.g., Fiske, 1981) to that of being a personality modulator (e.g., Mischel & Shoda, 1995), or an intersubjectively identified social construct (e.g., Blumer, 1969). Perhaps as a function of the breadth of the field, defining the concept of the psychological situation has proved to be a tenuous endeavor. The matter has been highlighted by the literature reviews striving to formulate a unified definition of social situations (e.g., Rauthmann et al., 2015a) as well as endeavors to differentiate it from other units of analysis such as the stimulus or the environment (Pervin, 1978). Bellows (1963) provides a taxonomy of social situations based on the dimension of cooperation and authority. His reasoning is that while the incipient stages of the field of quantitative psychology emphasized the influences of the situation on a person's behavior, the focus has gradually shifted to intrinsic person characteristics. As such, he considers the authority-cooperation variable, as a broadly universal situational influence, to present the incipient stages in more space being afforded to research on situational influences. Later, Furnham and Argyle (1981) provide an overview of six methods of analyzing the social situation across different academic traditions, data types, and units of analysis. The units of analysis and methods employed differ with the purpose of the study, whether it concerns a person-situation match, for example, or the development of situational taxonomies. More recently, Alaybek et al. (2018) review conceptualizations of the situation across research traditions, taxonomies, and situational units of analysis and distribute them across three categories according to their research focus: situational demands, affordances, and situational strength. Each tradition espouses a different, appropriate unit of analysis from the momentary event, to a more lengthy episode, to the environment surrounding the person, and finally to the culture within which they reside. Rauthmann et al. (2015a) collate the different research traditions into two broad categories: subjectivist and objectivist approaches. Games studies' overlap with situational research occurs across both categories.

Symbolic interactionism (Blumer, 1969) approaches the situation from the formula put forward by Thomas and Thomas (Bakker, 2007) that 'if men define situations as real, they are real in their consequences.' (Thomas and Thomas, 1928: 571, as cited in Bakker, 2007). The focus of the approach is that the situation resides in the meanings derived by the individual through the social construction of their reality. The situation is then not a passive construction, and its physical, quantifiable features are not of interest, becoming instead dynamic and processual, negotiated, and renegotiated by the situation participants (Argyle et al., 1981). Blumer's account of symbolic interactionism highlights the generative nature of social interactions, wherein human conduct is not only an expression of the participants in the situation but is formed by the social interaction itself. The constitution of the situation as instantiated in the surrounding objects becomes thus irrelevant, as he states 'the environment consists only of the objects that the given human beings recognize and know' (p.11). The method is developed as a response to the pervasiveness of survey-based methods as the gold standard of data gathering, which in Blumer's conception attempt an artificial truncation of the participants' account to fit their own limitations (pp. 26-27; 48). Thus, obtaining more rich and expansive data, centering the description of the situation on the participants' interpretations, is an attempt to course-correct the process of undermining the empirical world in favor of instrument precision. The primacy of the meanings constructed by individuals with regards to the situation has not persisted solely in the field of symbolic interactionism, being transferred into more quantitatively minded traditions as well. Rotter (1981) considers the psychological meanings identified by the individual as the primary unit of analysis of the situation in social learning theory. Thus, the situation is understood as a complex set of interacting cues that act upon the individual for any specific time period, and determine the expectancies for reinforcement. In Rotter's view of the situation, cues can either be implicit or explicit, and can have a relational value given by previously encountered cues. This, in turn, determines implicit responses. Like previous researchers examining the role of molar stimuli in the psychological experiment (Sells, 1963; Brunswik, 1956), he assumes that any meaningful variable of interest to researchers is bound to the situation. Thus, he follows, a baseline must be established with regards to the situation prior to the occurrence of the behavior. This echoes the necessity of bypassing the circularity risk highlighted by Rauthmann et al.(2015a). Notable, though, is Rotter's statement that while social learning theory allows the definition of the situation via person-related variables, and through the appraisal of the situation participants, he also notes that doing so precludes the predictive use of the situation. A problematic notion emerges here with respect to the role of the participant/player. Game players have been considered active, configuratory participants, taking on many roles in accordance to the type of engagement within which they are situated (Aarseth, 1997; Aarseth, 2017), but nevertheless agential or striving for agency (Wardrip-Fruin et al., 2009). The active player examines, reflects, and acts. Yet, their examination and reflection can become a liability to the process of selecting a controlled experimental stimulus.

Within games research, the perceived situation has been utilized primarily in inquiries regarding the situated relationship forming between the player and the game, modified by the social frames within which the interaction occurs (e.g., Deterding, 2009 Stenros, 2010; Deterding 2016a). Deterding (2014) provides a systematic account based on Goffman's frame theory (1974). He describes frames as 'nexuses of actors, actions, communications, experiences, events, objects, and settings' (p. 379), which collate into a situation when they are delimited across space and time. The process of framing then is conceptualized as 'a temporary self-organizing set of actors, actions, communications, objects, settings, and events being attended to, perceived, understood, organized, and enacted as a specific type of situation.' (p. 379) The concepts are then applied to the understanding of a ''video game frame' as a time-and-space spanning nexus of actors and their dispositions, objects, and settings and their features, actions, communications, and events that reproduces-and-changes its reoccurrence as types of situations, and of 'video gaming' as a situated activity system or framing that constitutes a situation as belonging to the video game frame.' (p. 385) The inquiry thus provides a framework for understanding the situated process of gaming as perceived and enacted by the participating actors. Deterding goes on to articulate five different modes of gaming, which may shift during the course of engagement with the same game, according to the external situational factors. The gaming modes differ across characteristics such as their motivational relevancy, attentive absorption, telicity, and arousal. While the differentiation across these characteristics can occur within the virtual environment, the focus in the context of the work remains on the external, situated factors. The two are, however, interdependent. For example, an individual may choose a game that they know would provide an engagement that matches the social circumstances. When situated on a bus, that choice may be of a non-intrusive round-based mobile game. This connection has been noted as relevant to laboratory game research, where the autonomy of the individual in choosing a game that is concordant with the external situation is impaired by the authority of the researcher and the directive of the research task (Gundry & Deterding, 2019). The psychological laboratory experiment has been previously compared to a situation. Argyle et al. (1981) state:

> 'It should not be forgotten that in much of their experimental work experimental social psychologists actually create social situations, often highly unusual ones, such as in the Asch conformity experiment. Many have criticized the laboratory experiment (Mixon, 1972; Silverman, 1977), not least because of the experimenter's neglect of the subject's perception of this unusual circumstance. Although 'situational' variables are often manipulated, an insufficient number of experimenters bother to check afterwards as to whether the subjects 'defined' the situation in the way the experimenters had hoped. In fact critics of the experimental laboratory approach have revealed a consistent 'subculture' of the situation with its implicit rules, roles, concepts and goals.' (p. 26)

Factors such as the nature of the relationship between the experimenter and participant, test anxiety, and the isolation from variables that may impact behavior in situations that differ from the archetypical version of the laboratory situation are noted as critical points examining the laboratory situation. Likewise, Hacker (1981) notes the importance of the degree of autonomy present in a situation, which may have an impact on the coping activities in which the person engages. As the autonomy given to a participant engaging with a game in a laboratory situation differs from the autonomy present in other gaming frames, the impact it has on coping strategies as presented both in the person's state, as well as their in-game behaviors, require assessment.

Viewing this development in the context of Deterding's gaming modes, it would not be far-fetched to assume the existence of a 'gaming research mode' nested within the laboratory situation, which impacts the aforementioned characteristics. The influences may also extend to repercussions on the engagement between the player and the game, like in the case of brief engagement times or rule modifications. Ecological validity would become, in this case, a more thorough approximation of the focal mode of gaming expected from the stimulus game. Comparing the gaming modes across the dimensions would nevertheless provide the means of accounting for potential modifications of person-related factors as a function of the perceived situation.

4.4 THE ECOLOGICAL APPROACH AND AFFORDANCES

Aside from the frame analytic approach revised in the previous section, the second situation-centered assessment method employed in game studies is ecological psychology. Ecological psychology relies on the interaction between the individual and their perceived environment (Gibson, 2014/1979). While the field presents multiple theoretical positions with regards to the level of granularity, directionality, and position of the person, in the person-environment transaction, the most prevalent perspective in the field of game studies relies on the work of James Gibson. This prevalence can perhaps be attributed to the concept of affordances which provide an intuitive framework for analyzing the relationship between the player and the game. Gibson's inclusive definition of affordances reads, 'The affordances of the environment are what it offers the animal, what it provides or furnishes, either for good or ill (Gibson, 2014/1979, p. 119). Built in the definition is a dual character of affordances, as both an intrinsic property of the object, and a property that emerges relative to the perceiving individual (Heft, 2005). While this does not mean that affordances exist solely due to the assertion of the individual, it gives them a non-abstract quality where the objective properties in potential are being actualized relative to the properties of the perceiver.

However, the concept of affordances is a contentious one, criticism arising from Gibson's purposefully dualistic description (Heft, 2005 pp 132-135; McGrenere & Ho, 2000). The relational property of an affordance, wherein its actualization is relative to the particular individual (e.g., stairs might not possess the affordance of being climbable by an individual in

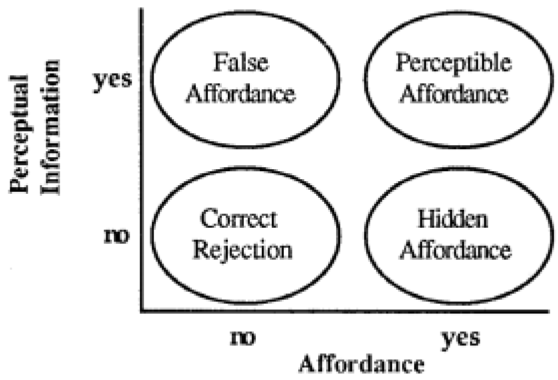


Figure 1. Gaver's model of technological affordances (Gaver, 1991)

a wheelchair), and its other property, of being inherent to the object, are seemingly at odds. This purposeful contradiction is made by Gibson on the grounds of the perceptive abilities of the individual, which do not require them to be filtered through a process of conceptualization. This maintains affordances in the realm of behavior, relative to an action, and not fixedly determined by a specific category of objects (Heft, 2005, p. 130). In other words, a chair does not first have to be thought of and categorized as an implement devised for sitting, to be sat on. To reject this contradiction, then, is to bring the concept of affordances into the realm of abstract, cognitive thought by imposing on the perceiver the necessity to distinguish the affordance from the information they receive about it. Norman, who popularized the concept in the field of design, does so by separating the property of the object from the way it is signaled to the user, a property he calls the signifier (Norman, 2013). Gaver's translation of the concept of affordances for the field of HCI also distinguishes affordances from perceptual information *about* affordances (Gaver, 1991), naming the modified concept 'technological affordance'. Thus, he creates four functional categories of affordances based on the information about them and their existence.

Relying on Gaver's work due to the necessity and desire to account for the individual's judgment of the difference between the property of the object and the way the object is presented in the game, Cardona-Rivera and Young (2013) develop a cognitivist theory of affordances for games, in which they highlight the ways in which players construct mental representations and apply previously acquired knowledge to the actions they take in the game. The analysis thus modified allows for a more prescriptive attitude towards the implementation of affordances, which should match the player's pre-constructed, expected affordances. The affordance as means through which an action becomes available to an individual, separated from the communicative aspect attached by Norman and Gaver, is also utilized in Mateas's (2001) proposal of examining the agency experienced by players when engaging with the game. Here, the concept of affordance describes the match between the expectations of the player and the affordances of the object to elicit the experience of agency. The resulting conceptualization of agency thus embeds the necessity for the concordance between the information provided by the system, and the actual possibilities the player has to act. As stated by Wardrip-Fruin et al. (2009): ‘Agency is not simply “free will” or “being able to do anything.” It is interacting with a system that suggests possibilities through the representation of a fictional world and the presentation of a set of materials for action. Designing experiences toward the satisfactions of agency involves balancing the dramatic probabilities of the world with the actions it supports. In other words, the design task is to entice players to desires the game can satisfy’ (p. 7)

Another application of ecological psychology and Gibson’s concept of affordances in games research has been as a proposed means of providing a medium agnostic method of analyzing gameplay. Linderoth (2013) puts forward a functional description of gameplay from the perspective of ecological psychology: ‘Gameplay is to perceive, act on and transform the affordances that are related to a game system or other players in a game.’ (p. 8). The description highlights the property of affordances to be discovered and to be created by the individual engaged in the action. For example, an individual may use a ladder to reach a high, originally unreachable shelf. Through the action, the person utilizes the affordances of movability and climbability of the ladder to create another affordance – that of reaching the high shelf. This process is translated by Linderoth to games, most clearly in a discussion related to the movement of the camera attached to a playable character, which, while not directly providing affordances to act in the game, allows the player to create them through their discovery (p. 6). Linderoth and Bennerstedt (2007) also employ the same concepts to examine the means through which players learn from and through playing a game by exploring and discovering affordances and creating a universe of meaning intrinsic to their engagement.

The popularity of the separated model of affordances can be considered a symptom of the recognition of the designed, constructed nature of both the system and its representation. In his original theory of affordances, Gibson strived for a non-mechanistic approach to perception as a function of its lacking capacity in explaining the perception of stimuli. As a stimulus does not transmit mechanical energy in its perception, the perception of the features of the environment is best understood in terms of their formal causes (Heft, 2005 p. 423). However, while games are used as stimuli, the manipulation of the independent variable still occurs in a virtual environment, where the player acts and is acted upon. Therefore, the current work does not focus on uncovering how the stimulus is perceived by the player. Rather, the focus lies in discussing the conceptualization of affordances as opportunities for action and how they can form the foundation for analyzing the game engagement.

Unlike the macro analysis of the social context that symbolic interactionism enables, the application of ecological psychology in the study of games offers a micro-lens of examining the virtual environment and the behavior that it enables, supports, and facilitates. In the following, the concept of affordances and its application in the domain of video games will be examined more closely.

4.5 Affordance relations in games

Embedded in the definition of affordances, as we have discussed, is the relational quality of affordances. This relational character was also noted by Turvey (1992), who notes that an affordance is a disposition that can be complemented. The complementarity of affordances is what makes a certain property of the object to become manifest. For example, light has the disposition to be refractible. A prism has the disposition to refract. Together, as a result of their complementarity dispositions, light is refracted. Turvey goes on to differentiate between complementarities between dispositions of objects, and the dispositions of organisms. The disposition of organisms that can complement dispositions of objects he refers to as effectivities. This differentiation is made to create the potential for distinguishing between manifested properties, such as the refraction of light, and actions or behaviors, such as walking, grabbing, or sitting on a surface.

This differentiation can be paralleled to distinctions made in games research with respect to actions performed by the player and actions performed by the game system. Zagal et al. (2007) note that game objects possess abilities that designate the actions that they can perform. They further distinguish between abilities as actions that objects can perform and attributes as adjectives of objects. They present a heuristic used to distinguish between attributes and abilities – if the player is the one utilizing the attribute or ability, then it is an ability; otherwise, it is an attribute. Björk and Holopainen (2006) also differentiate between events as 'game state changes that are perceivable to players'(p. 20) and actions as 'the means through which the player can make changes to the game state.' (p. 20).

However, the distinction between the manifest property and the action is challenged by the requirements for action in the game environment. While a person may grab a pencil sitting in front of them, the action of a player in the game environment requires the contribution of multiple objects – at the very least, the contribution of a physical interface and a locus of manipulation. In that case, then, do we speak of the avatar grabbing an object as an action/effectivity, or as a manifest property/event? The default stance would be to consider it an action. This is due, I argue, to the close relation of the locus of manipulation to the player and their role as a necessary object for the player to act in the virtual environment. However, adopting this position as primary, while diminishing the perspective of the action as a relationship between game objects has analytic consequences.

Aarseth (2012) categorizes objects in games according to how malleable they are to the players' inputs and actions. He distinguishes between static, changeable, destructible, creatable, and inventible objects. The categories created emerge principally as a result of the degree of perceivable change they can receive from the player. This relationship is notably unidirectional and is resumed to the examination of the relationship between the player and the object. However, as noted, the player cannot act directly in a video game. Several other objects, among which the physical interface and the locus of manipulation, act as gatekeepers to the players' access to the game environment. Limiting the analysis of objects to the unilateral relationship with the game does not provide a comprehensive account of their role in the environment and game as played. A gun can be changeable – alterations and upgrades can be made to it, but in a different situation, it is also usable, becoming a tool for dispensing bullets that harm enemies. Likewise, an inventible object in *Minecraft* (Mojang Studios, 2011) can also be destructible in relation to an exploding creeper. The categorizations thus become permeable depending on the relations in which the objects are embedded.

Discussing game entities, Debus (2019) distinguishes between agents, objects, and objects with attached mechanics. Objects, he notes, are all the items in the game, including structures, scenery, and stories. Agents are divided into operator agents and non-operator agents. While operator agents are capable of executing actions that are not prescribed by the game system, non-operator agents can only execute prescribed mechanics, but they can do so without input from an operator. This distinguishes them from objects with attached mechanics as entities that perform an action as a reaction to operator input. With this classification in mind, how can we better examine the distinction between the manifestation of an action as a result of effectivity-affordance complementarity and manifest property as a result of affordance-affordance complementarity? If the distinction between the two was made due to a desire to differentiate between actions and manifest properties, what happens when a non-operator agent encounters an object? In *The Legend of Zelda*: *Breath of the Wild* (Nintendo EPD, 2017), if a hobgoblin grabs a club, are they performing an action or manifesting a property? Whose property is manifested? It would be valid to say that the property of the club to be grabbable is manifested, but what of the action of grabbing? If the hobgoblin starts running as Link approaches, what happens then? Technically, since Link is the avatar of a human entity, the action should belong to them, but it is the hobgoblin who is running. The distinction between the performance of an action and the manifestation of a property is then not a consequence of a human being involved in the relationship but an agent.

The agency of non-human game elements has been previously noted, Giddings and Kennedy (2008) stating that

> 'Games configure their players allowing progression through the game only if the players recognize what they are prompted to do and comply with these coded instructions. The analysis of the pleasures of gameplay must take the respective agencies of the players and the game technologies as central, as well as those between the player and the game' (p. 21).

Likewise, Fizek (2017) states that

> 'In most digital games, the role of the human player is to actively participate in gameplay, and that of the machine to enable, sustain, and facilitate play; record its progress and communicate the outcome to the player. In many of the examples mentioned above, the human becomes a witness to the system's agency, and a delegator of play onto the algorithms (bots, mods, ludic system)'. (p. 5)

It would seem then that games do not afford the clear distinction proposed by Turvey. But a flattening of the distinction in either direction does not afford much analytic potential either. The avatar's capacity to run in contact with a solid surface would be impossible without an active input on the physical interface. Likewise, it is difficult to argue that a ball bouncing off a wall in *Breakout* (Play Google Atari Breakout Game - elgooG, 2022) is the result of an action. Instead of flattening the distinction towards a unilateral notion of agency, or a lack of agency, perhaps the solution is the recognition of the multitude of agencies exercised by the diverse game objects present in the game environment.

4.6 THE AGENCY OF GAME OBJECTS

Actor-Network Theory puts forward the proposes that non-humans, as well as humans, are agential if their existence, attributes, or actions modify the actions of the other agents with which they come into contact (Latour, 2005). This proposition is illustrated most clearly in Latour's (writing under the pseudonym Jim Johnson) description of a door groom (Latour, 1988). A door groom, which provides resistance to opening a door and returns the door to a closed position, has an effect on the actions of the people that interact with it. The door groom can stop working, requiring that people perform the action of closing the door instead. In other words, the agency of humans who would otherwise have the given function of opening and closing doors is delegated to this technology. Likewise, a door groom that provides an increased level of resistance requires more strength from the people pushing the door. It is apparent that the influence the door groom exerts is through its affordances, which are complementary to the door's and person's affordances. This perspective on technology highlights the modifications to the programs of action adopted by humans when engaging with non-humans (1994a). To have a clearer overview of this proposition and its relevance to understanding the structures of game situations, a brief review of its concepts is necessary, including the notions of mediators, intermediaries, and technological mediation. Latour (2005) puts forward the notion that the world is made up of intermediaries and mediators. An intermediary is that which transports meaning without transformation. Knowing the input of an intermediary is enough to predict its output. On the other hand, mediators transform and modify the meanings that they carry, their inputs not being a certain predictor of their outputs. The notion of intermediary then couples with the notion of game objects that present no affordances within the game situation, neither latent nor active, which in Latour's words is a black box that stands for one. Such elements can be pieces of scenery that stand only as scenery and do not perform other functions, as opposed to being solid walls that impede movement. Mediators, however, enter into a process of action modification through what Latour calls Technical Mediation (1994a). The concept of mediators and intermediaries in this context presents commonalities with Leino's concept of deniable and undeniable object meanings (2010). He defines deniable meanings as 'A deniable meaning can be denied without affecting the possibilities to choose and act', whereas 'An *undeniable meaning* cannot be denied without affecting the possibilities to choose and act' (p. 266). Thus, he states, 'The shape of Bismarck's moustache in *Sid Meier's Civilization IV* is among the deniable meanings, whereas the attack strength of military units in the same game is not'(p.265).

Latour puts forward four meanings of technical mediation whose brief review will provide more information to the role attributed to game objects in this framework. The first proposed meaning of mediation is that of translation. Translation entails the modification of the original goal pursued by an agent via its coupling with a different agent, becoming thus a composite new actor. The composition modifies the original goal, to one achievable by the composite actor. To illustrate this process, Latour discusses a situation in which an angry person is seeking revenge. This goal may be interrupted by attributes inherent to the agent, such as lack of strength. The second agent, for instance, a gun, is enlisted in the pursuit of the goal. A new actor emerges in the form of 'man-with-gun'. The goal is then modified from one of non-specific revenge to shooting – a goal unavailable to either agent separately, but only to the new emerging actor. The example leads to the second meaning of translation, that of composition. The performance of an action, such as the one illustrated above, would not be possible without the contribution of all the agents implicated. Likewise, the action of an avatar walking is impossible without the contributions of the player, the physical interface, and other additional properties of the surrounding virtual environment, such as the solidity of the surface (c.f. Fetzer, 2019). The third meaning of translation, which has been touched on previously, is that of blackboxing and reversible blackboxing. A blackboxed object is one that does not produce a trace in its interaction with other agents. A functional object can be blackboxed, for example, if its existence does not affect the actions of other agents. However, if a breakdown disrupts the function of the blackboxed object, the blackboxing is reversed, and the object's network of attributes connects with the affected agents. The relevance of the concept of blackboxing to game object relations was touched upon briefly in the discussion related to latent attributes such as health and solidity, which function as latent prerequisites for the activation of other attributes. The fourth and last meaning of translation is that of delegation. To illustrate this meaning and the effects that it has on humans and nonhumans alike, Latour uses the example of a speedbump placed in front of a school. The existence of the speedbump changes the behavior of the driver by making them slow down, but it also changes the internal scripts with which the driver operates. While the driver's moral considerations might have been the reason for their prudent driving, the speed bumps' attributes may change their motivation as not driving cautiously might damage their car. Likewise, through the behavioral changes that it produces, the speedbump is now not merely a heap of concrete but the durable and silent avatar of a policeman.

Applying the ideas put forward in the theory of technical mediation allows an understanding of game objects as agential entities, which modify and translate actions through their attributes. Agents, as Latour notes, become analytically relevant when they affect the course of action or state of another agent. Thus, they become discernable through what he refers to as traces (2005). This trace may be at face value taken as the perceivable aspect of the effects of the agents' affordances. Indeed, it is difficult in this context to extricate agents from perceptions, as both the player and the researcher analyzing the game generally only have access to a black-boxed run-time version of the game. However, the purpose is not to elide the reliance on perception but to prioritize the traces left by agents instead of their perceptual representations.

4.7 Directionality of complementarities

As the conceptualization of agency holds that the objects that have an observable effect on others are agents, the differentiation between effectivities and manifest properties is no longer a necessary distinction. Affordances can present opportunities for behavior for both human-controlled and autonomous, non-operator agents. Still, the differentiation between player-performed and game-performed actions persists. However, as it is accepted that the difference does not emerge by virtue of the agency elicited by the player, another means of distinguishing between the two is necessary.

While playing *The Missing*, one of the puzzles to be solved requires the player to navigate the avatar in a position where she collides with a harmful, moving chainsaw blade. Once the avatar collides with it, she is dismembered, and her head is propelled up, allowing the player to move it in the air to a previously inaccessible area. The only way of accessing said area is through the action of the blade. Although having performed the initial action of moving the avatar towards the blade, the player does not have direct access to the propulsion of the avatar to the inaccessible area. The action is performed as a consequence of the juxtaposition of the affordances of the harmful blade and the avatar. The puzzle discussed can then be summarized as a rapid exchange of actions and events. But is this differentiation in-kind necessary, solely as a means of differentiating the source of the action?

Following the traces left by the objects involved in an example, directional relationships between the object complementarities can be observed. Neither Turvey's conceptualization of affordance complementarity juxtaposition (1992) nor Latour's conceptualization of composition (1994a) account for the directionality of effects. Both view the relationship as symmetrical. Neither the gun, nor the person, independently, cause the formation of the 'man with gun' actant. However, a directionality in the relationship can still be identified. The person needs to pick up the gun. In the example above, the avatar needs to be moved towards the blade. While both objects involved have the same contribution to the resulting composite actor, of affordance complementarity, a directional impulse is necessary for it to take effect.

The directionality should, however, not be confused with intentionality. While the player may intend to move the avatar, we cannot ascribe intention to the blade propelling the avatars' head to the inaccessible area. The affordances of the blade complementing the affordances of the head are symmetrical. Like the 'man-with-gun', neither can be said to have a higher contribution in the affordance complementarity. However, it is apparent that the affordance of one determines the behavior of the other. Thus, while maintaining the lack of necessity for an impulse to originate from an operator, which is as discussed the means through which Debus (2019) differentiates between operator agents and objects with attached mechanics, the implicit distinction he makes between action and reaction remains relevant. As such, while the complementarity between affordances is symmetrical, a directional relationship can still be observed by following the effect of that complementarity.

Considering the reformulations of differentiation between player-performed actions and actions taken by the game system as a matter of directionality, the player's position can now be discussed. Aarseth (2007) describes the implied player as a role constructed by the game, infused with behavioral expectations towards the active individual who will engage with it. Intrinsic in the implied player model is a concrete, material existence through which they may act within the game. This material existence, named by Bayliss the 'locus of manipulation' (2007), puts at the disposal of the player the means to act within the game world. This perspective will also be the one adopted within this work as a consequence of the desire to maintain a separation between the assessment of the situation and the assessment of the individual. Doing otherwise would increase the chances that a circularity in assessment would emerge, wherein it would be uncertain if the assessment targets the characteristics of the individual, or the characteristics of the situation.

Prior to accessing the locus of manipulation and thus the role attributed by the game, the player must access the physical interface of the game. This relates to what Aarseth and Grabarczyk (2018) term the physical interface sublayer, and includes all the hardware that makes the engagement possible, including but not limited to controllers and visual apparatus. Thus, the physical interface becomes the primary point where the relations between objects involved in the player-game engagement can be observed. Murphy (2014) describes the controller as 'the yoke between the player and the game' (p. 19). Much like the yoke described, the physical interface constrains the player's actions and expands their action possibilities by allowing them to act within the game. However, for any action to have a chance at taking effect, the player must make the appropriate gestures, ones that the controller will recognize. Only the gestures that are recognized as valid will be transmitted further. Thus a relationship must be present between the affordances of the individual, the affordances of the controller, and the affordances of the locus of manipulation. All the keys on the keyboard afford pushing. However, not all keystrokes are recognized. Their recognition occurs due to the linkage between their attribute of being pushable and a subsequent, associated attribute of the locus of manipulation. Within Turvey's framework of affordances, then, an action effected within the game is a composite of the dispositions of the individual player to push, the button to be pushable, and the locus of manipulation to the effect that action.

The locus of manipulation becomes then the secondary point, following the physical interface through which the player can act. The player can push a pushable button, for example, W, and the avatar, representing the locus of manipulation who possesses the associated attribute of movability, will walk. Here, it is worth noting that the use of the term 'avatar' in the following discussion is not concerned with an anthropomorphic representation that the player controls. The object being referred to in close resemblance to the term locus of manipulation, described by Peter Bayliss as 'the in-game position of the player's ability to assert control over the game-world, whether this is a visible character, an implied avatar, or a graphical user interface cursor.' (2007 p. 1). However, many games present players with multiple, parallel loci of manipulation. A player in *Stardew Valley* manipulates both a playable character and a cursor, both with different affordances and relations. The following discussion uses avatars with the aim of discussing the virtual object that is closest to the players' control.

The necessary linkage between the attributes of the locus of manipulation and the attributes of the controller clarify thus the role of the player in the engagement. The player does not perform the action of walking; the player exerts control over the activation of the attribute of movability via two nested action possibilities. Throughout the current framework, the role of the player is condensed to being the operator who performs the activation of the attributes of the elements they can access through more, or less direct pathways. The role of operator is similar to the one appointed by Debus (2019, pp. 245-255) with the intention of attributing a player agnostic means of differentiating between agents that are operated by an entity intrinsic to the game system such as an AI-controlled NPC, and an entity extrinsic to the game system. The operator role has the function of enabling a categorical distinction between agents. This framework does not distinguish between the human and non-human agents involved in the game, except by virtue of the directionality of the activation of affordances or attributes. Thus, a relationship that originates with the player will be attributed to them, and one that does not require their input will be attributed to agents controlled by the game system. While following the distinction made by Debus, the current framework does not do so categorically but relationally. This enables, as it will be discussed, a more nuanced perspective on the different agencies involved in the actions performed in the game environment. In order to distinguish between the operator role and the role attributed to the player within this framework, the role will be referred to as that of activator. The activator role can be attributed to either the human player or the game system, and it is simply intended to designate the source of the relationship.

Compressing the player's role to that of an activator may seem, and in some senses is, reductive. Aarseth, for instance, describes four types of user functions – textonic, configurative, explorative, and interpretative. The functions given are relative to the actions enabled by the system with which the player engages, for example, 'the configurative function in which

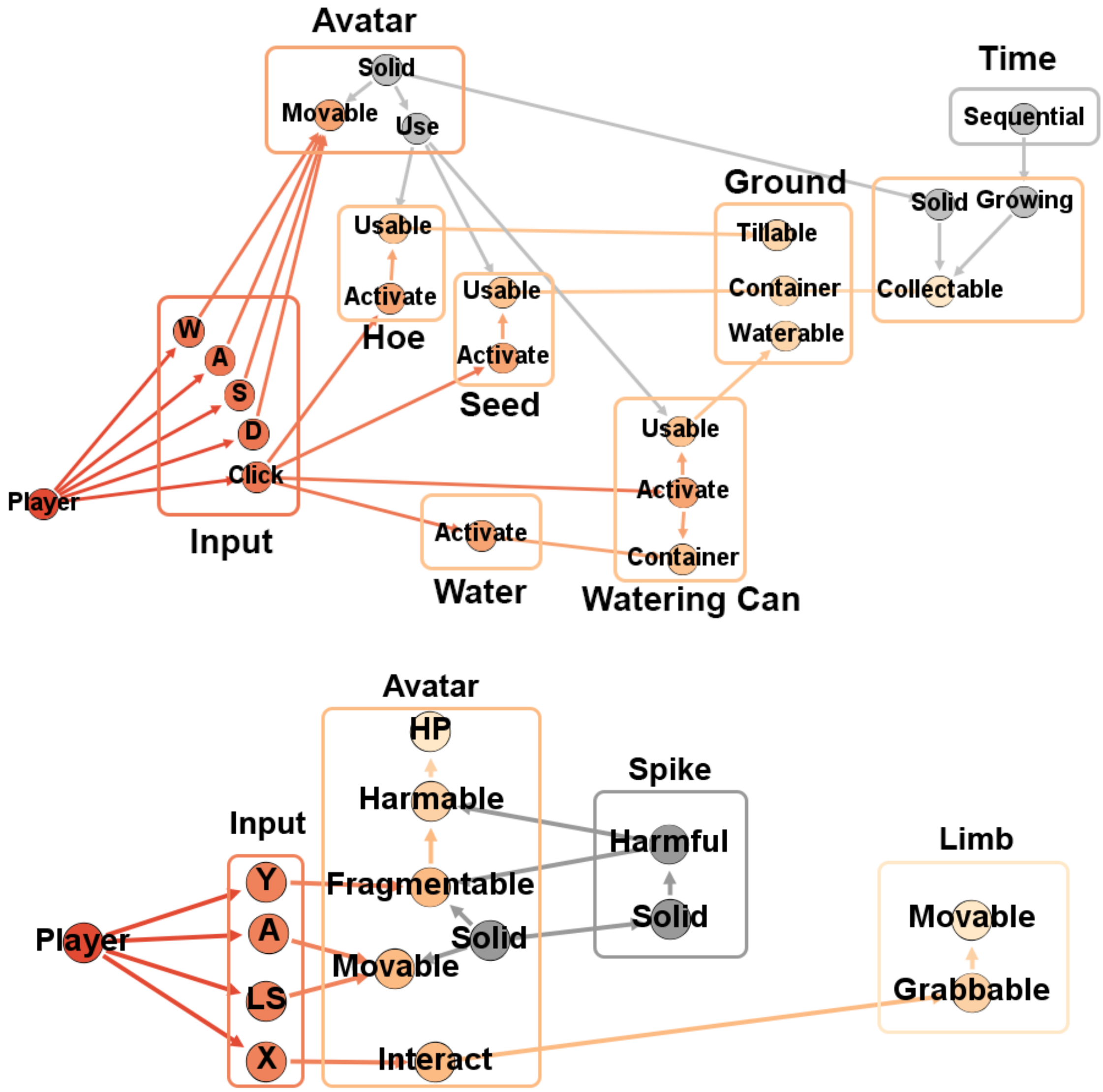


Figure 2. Comparison between the process of object creation in *Stardew Valley* and *The Missing*

scriptons are in part chosen or created by the user' (1997, p. 64). The differentiation between Aarseth's user functions and the function of the player in this framework is only dictated by differences between a categorical and a relational perspective. While one describes user roles in terms of categories, the other simply describes the user function as distributed through the elements linked via juxtaposed attributes. To illustrate this differentiation, we can compare the configurative user function as illustrated through two player activated actions in two different games: *The missing: J.J. Macfield and the Island of Memories* (White Owls Inc., 2018) (henceforth *The Missing*), *Stardew Valley* (Concerned Ape, 2016). In *The Missing*, the player can move the avatar in a position in which if a collision between the player character and a harmful environmental object occurs, the avatar is dismembered. The result of the collision creates an object in the world that is the playable character's limb, which can then be grabbed by the playable character and thrown, highlighting the avatar's attribute of being fragmentable. The collision also harms the playable character who, upon colliding with a harmful object five times without regenerating, dies. The pathway to creating the new object traverses the attributes of the playable character to be movable, fragmentable, and harmed. Each of the avatars' attributes juxtaposes with the attributes of the spikes to be harmful. The result of the association creates a secondary object in the environment and harms the playable character. Thus, the creation of the object is the result of the juxtaposition of the aforementioned attributes. In *Stardew Valley*, creating a vegetable requires that the avatar uses a hoe to till a piece of land, activates a seed packet, and plants a seed in the tilled land. Following that, every day, a watering can must be used to water the seed. After several in-game days, a plant is created in the environment. The vegetable can then be accessed via the cursor and picked up by moving the playable character to collide with it. The result of the action is, like in *The Missing*, the creation of a secondary object in the game environment. However, the trajectory towards the creation of the object is much longer, interposing more objects in sequence, between the original attribute activation and the object creation. Both examples provided contain a configurative user role relative to the creation of scriptions. However, the structure of the relations through which the user gains the function illustrates a differentiation in the distance between the user and the object created, as well as the effect of the multiple agents in the relation.

Following the discussion of the agency of game objects, their traces, and the directionality of those traces, a clarification is necessary with respect to what a game object is within the bounds of this framework. Several works, as mentioned, discuss game objects. Aarseth (2007) examines the various ontological levels that may and should be examined, since they might be real, virtual, or fictitious. Debus uses the term to refer to 'all the items in the game system and those necessary for its operation.' (2019, p. 300). Zagal et al. (2007), using the term 'entities' refer to 'the objects in the game that the player manages, modifies, or interacts with on some level.'. Björk and Holopainen (2006) describe game elements as 'the physical and logical components that contain the game state and are manipulated by players to achieve their goals. Players influence the game state through actions performed on the game elements, which they can control.' Aarseth (2012), likewise, while not providing a definition of objects exactly, categorizes them with reference to what they mean to the player. Finally, discussing how players differentiate between mere aggregates of pixels, and game objects, Juul (2021) points to the relevance objects have to the players' actions as the differentiating factor.

A common theme among these varied discussions is the possibility of action that objects offer players. This is a common characteristic attributed to affordances (Gibson, 2014/1979;

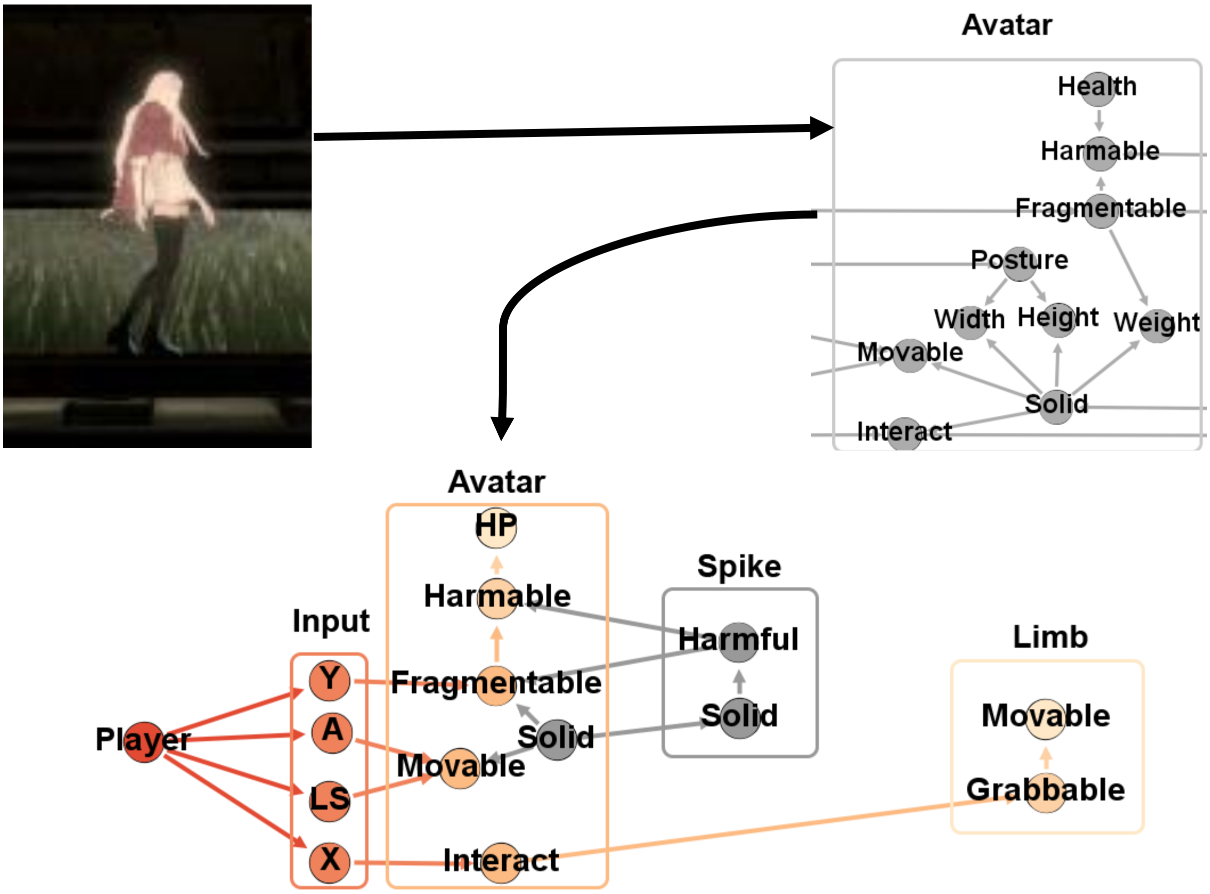


Figure 3. Example of Blackboxing – the avatar possesses attributes of height, width, and height which are relevant in certain situations, but if stable and unconnected to other objects in the situations, they may be blackboxed, thus easing the analytical

Turvey, 1992). An object could thus be considered to be identifiable via its affordances. However, the primary role is attributed to the player's actions in these frameworks is not shared by the current work. Instead then, while accepting the former proposal, the referential position will be reframed from that of the player, to that of any agent in the environment. In this sense, then, game objects can be understood, in this work, as conglomerates of affordances.

As illustrated in Figure 3, affordances do not necessarily need to exist between two visually identifiable elements. A spike can be both solid, and harmful. These dispositions are relevant due to their status as prerequisites for the activation of other dispositions. For instance, it is generally necessary for health to be above zero to be able to access other attributes, such as mobility. Without a stable, positive relationship with the health attribute, the other attributes could not be activated and thus not become a part of the game situation. However, another general characteristic of this relationship is that they are generally so persistently stable that they become unnoticeable when observing relationships between game objects. Instead, they are in a latent state of complementarity with the other attributes. In this sense, the relationship between attributes of this kind and the secondary attributes they enable can become blackboxed

(Latour, 2005). Blackboxing occurs when agents are in a stable alignment which, in the absence of disruption, allows for the stable components of the relationship to be ignored. A functioning projector, in Latour's example, does not require the examination of the components which make it functional but is taken as one item. The heightened stability of such relationships is made apparent in cases where it breaks down. In the case of the projector, a malfunctioning lens will prompt an inquiry into all of the connected components in order to recreate the stability which prompts the functionality of the projector. In the case of games, stable relationships, such as that of an object being solid, are taken as default until a bug that causes the solidity of a wall gives way and the avatar clips through it.

Sometimes, the destabilization of a blackboxed attribute is used to accentuate or make explicit certain narrative events, or to provide characterization to the playable figure (c.f. Vella, 2015) via their attributes (Willumsen, 2018). During the final boss fight of *Hellblade: Senua's Sacrifice* (Ninja Theory, 2017), the avatar becomes impervious, thus breaking a stable link between health points, enemy hits, combat, or mobility attributes of the avatar. This stable relationship is broken, and the necessity for health points to be above a certain threshold becomes observable through this destabilization. The destabilization of the relationship occurs during a part in the game's narrative in which the character accepts her strength and lets it overcome her. This relational change, as opposed to a change in degrees or values of the attribute, signifies a more transformative occurrence. Thus, while affordance relations may occur within the same game object, they might often be stable enough to be blackboxed. This process, however, is not implied to occur throughout the entirety of the playthrough, and more granular analysis should be applied when necessary.

In the case where objects can be identified only as conglomerates of affordances, how do we differentiate between two objects? The working assumption followed through this work is via the same stability characteristic that allows the black-boxing of latent affordances. However, in this case, the opposite condition is necessary. For two objects to be considered separate, the affordance relations must be unstable and occur as a consequence of an action impulse, either originating from the player, or from the game system. I am specifically referring here to an action impulse, and not a direct action, as to recognize the possibility of multiple objects being necessary for the transmission of the action. Thus, objects are identified via their affordances, and perceived as separate entities due to the instability of their complementarities.

The reliance on the identification of traces as a means of recognizing objects has a secondary consequence. It privileges the observed affordance complementarity, and not the visual representation of the object. Instead of being an exclusionary decision, however, this is an inclusionary one, as it allows the integration of ‘invisible’ objects in the analysis. Such ‘invisible’ agents that are not represented visually may be time, gravity, or other instantiation of game rules (cf. Järvinen, 2008, p. p 31) that are traceable through their observable effects but not through a particular source representation.

In summary, game objects are considered to be affordance conglomerates that are identifiable through the observation of their affordance complementarities, and discriminated as individual objects by the instability of those complementarities. While they may be bound by a visual representation, this is not necessary. With this conceptualization of game objects in mind, the game situation can be revisited.

4.8 The game situation

The ‘who’, ‘what’, and ‘where’ described here by Pervin appear to take shape in the context of video games as a distributed multitude of agencies, traced via their affordance relations. Bayliss states that ‘The game-world of Tomb Raider is constructed in ‘Lara Units, gaps between platforms are either standing jump or running jump distances, or otherwise impassable.’ (2007, p. 2). The statement highlights the interdependence of elements that together form the virtual space of behavior and the possibility for actions to occur and be performed via complementary dispositions. Summarizing thus the conclusions of the inquires made thus far, it can be concluded that, rather than defining the game situation as a gestalt of who acts, what is present, and where is everything taking place, a more apt and inclusive description would be that the game situation is a momentary configuration of game objects linked by disponibilities.

However, Pervin’s description of the situation is not limited to its structure. He also highlights a temporal component, stating that the situation reflects ‘the organism's engagement with an array of objects and actions which cover a time span’ (p. 79). Limiting the situation in time designates an endpoint to the situation and allows it to be an applicable analytical unit. The bracketing of a situation with a beginning and an end allows for comparisons to be drawn between situations deemed equivalent along relevant variables. However, the temporal aspect is another component that cannot be directly translated to the game situation. As observed in Chapter 2 of this dissertation, having the players engage with the game for a predetermined time not only does not guarantee an equivalent experience, but it may exacerbate the discrepancies between the experiences. For the determination of end and starting points of the situation, it should thus be advisable to not examine external factors that have not come into the structural identification of the situation, such as temporality.

Like Pervin, Magnusson (1981) appeals to temporality to describe four nested units of analysis which may play an influential part in the behavior of the situation participant: the actual situation – comprised of the immediate psycho-biological factors existent in the environment and available to the perception of the participant, the perceived situation which is construed by the participant, the life situation which corresponds to the conditions under which the individual leads their life, and the momentary situation, which persists solely until the individual departs. Magnusson's differentiation of units of analysis occurs thus not only along the dimensions of time but also the accessible, perceivable environment.

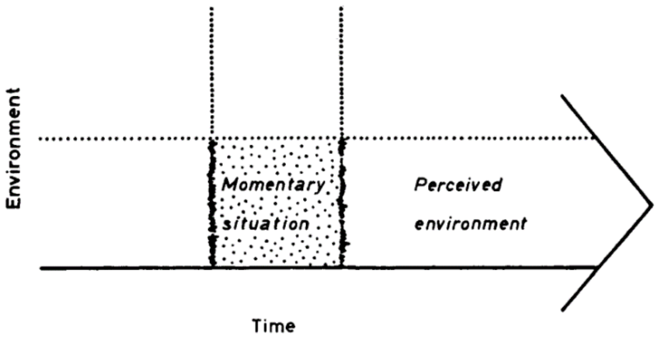


Figure 4. The momentary situation (Magnusson, 1981)

Other researchers, such as Graham et al. (1981) and Argyle (1981), as well as Hacker (1981), utilized the achievement of goals as the defining endpoints of a situation. Within the bounds of the frameworks proposed, however, goals are also the points of characterization and identification of the situation. The proposed framework, however, relies on the network configuration as the primary means of identifying the situation. As the wireframe of the situation is dependent on the object relations that constitute it, its defining start and endpoints can also be considered to depend on that. The game situation can be observed to change when the network configuration is altered by the emergence or disappearance of game objects. As the situation is also utilized as a method of observing the negotiation and distribution of control that the player and the game system exert, the destabilization of that distribution will invariably result in experiential variations. This strengthens the choice of considering an emerging structural change as the appearance of a new situation. It also highlights the sequentially of the situation in the game as played. For example, the element creation in the game *The Missing* discussed earlier presents a change in the network configuration when the act of creating a new object is achieved. Now, with the newly available object and the changed affordances of the game character, the node configurations in the present situation have changed. While the player's participation as an active perceiver is not required for object relations to occur, the aim of observing the distribution of control through the situation network cannot be undertaken without including the active player position. As such, the game situation describes a momentary configuration of objects that accounts for the engagement of an active player.

As the momentary situation occurs on the foundation of the perceived environment, so too does the game situation occur on the foundation of the game network as a whole. For example, the possibility of gifting items to other villagers in *Stardew Valley* may present a momentary situation. However, contextualizing the item within the network of the game provides more insight into the role and value of the item given, as measures of node centrality can be performed. As such, one may conclude that gifting a vegetable, which is central to many object relationships, requiring the use of tools, the passage of time, and the tending of crops to obtain, may be more valuable than gifting a gem that presents a lower node degree and centrality.

Thus, taking forward the reliance of the game situation on the configuration of objects, the functional means of discerning the start and the ending of a game situation will be considered the change in the network of objects through the appearance, disappearance, or dispositional change of objects. In the most basic sense then, when Mario collides with a fire flower, gaining the disposition of shooting projectiles, a new situation emerges. One of the core assumptions in this functional definition is the stability of object relations and the possibility of blackboxing relationships that are stable, inactive, or irrelevant to the situation. For instance, while traversing the world of *INSIDE*, the avatar moves in a 2-dimensional environment, unable to

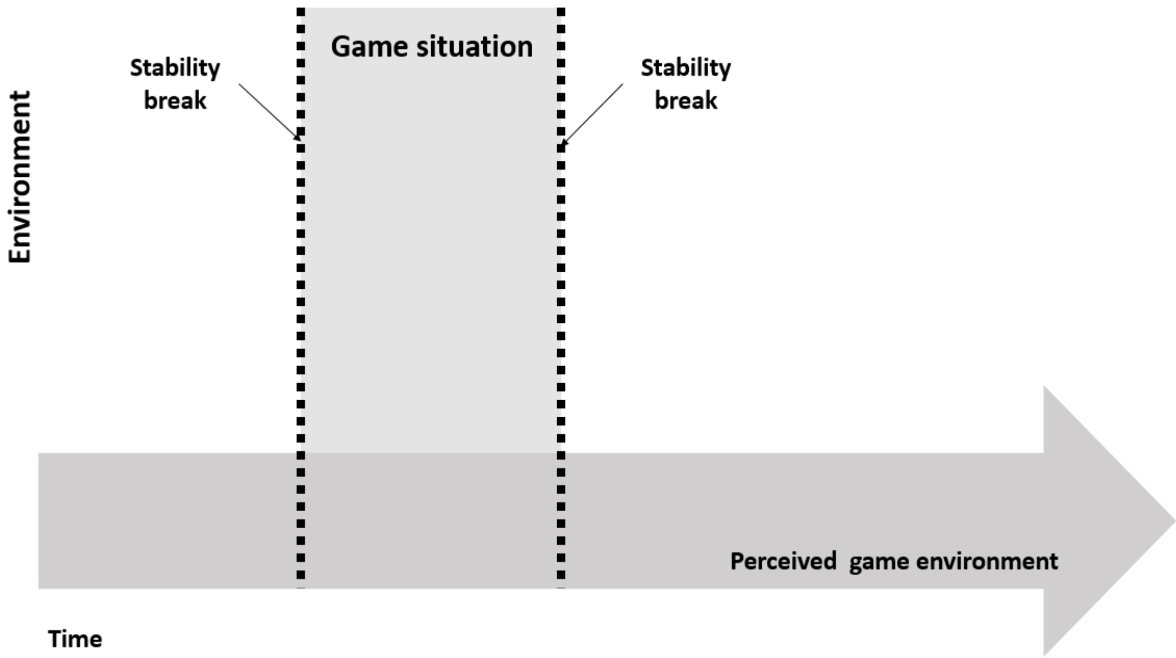


Figure 5. The Game situation

move in the background or foreground. However, other objects may exist in the background, which may affect the avatar. In one instance, a shockwave coming from the background may kill the avatar if caught in the open. The avatar may hide behind objects which, by their newly emerged relationship with the shockwave and the avatar, enter into the network as cover. The appearance of the sound and the relationships it forms with the surrounding objects describe the emergence of a new situation. While hiding from the shockwave, the player may use different objects as covers, which have a stable relationship with the sound, but which themselves may have different dispositions, such as static, movable, or mobile. The relationships they have with the sound source, whose emergence has prompted the network change, are stable, irrespective of their other dispositions. The disappearance of the shockwave, in this case, due to the avatar moving out of the area, designates the reconfiguration of the network, the end of the situation, and the emergence of a new one. A dispositional change, like Mario acquiring the fire flower power, for instance, is a network reconfiguration involving the locus of manipulation. The salient factor in the situation thus becomes the new relationships formed by the new disposition and new objects (the projectiles). A situation does not need to be defined by changes in the locus of manipulation or physical interface. However, what is important is the contextualization of the changes relative to the configuration of the situation. However, the examples illustrate the most basic of instances of situation identification.

The current section crystalized the inquiries made thus far in the adaptation of situational research frameworks, to the development of the game situation framework. The functional definition of the game situation provided at this point is that of a momentary negotiation of control between the player and the game, observable through the configuration of object relations. A situation is defined by stable configurations of objects, and a new situation can be observed to emerge when a new object or disposition appears or disappears within the network. The game situation exists in a relationship of superimposition with the game system, which presents the dispositions of objects and relationships in a static, snapshot manner. The game situation is then the sequential instantiation of those relationships, which through this process creates new observable topologies. The analysis of the game then involves an analytic loop between the particular sequence analyzed and the greater game network.

4.9 A UNIFYING RELATIONSHIP

The current work has thus far discussed the agency of game elements that impact the actions of the player as they engage with the game. Agency has been a frequent subject of discussion within game studies, both from the perspective of the agency provided to players (e.g., Wardrip-Fruin et al. 2009) and the agency that the game system exerts over them (e.g., Giddings, 2007; Giddings & Kennedy, 2008). By moving the focus on a more granular level of analysis, the current work accepts the assumptions of the agency exercised through the game objects on the players that engage with the game and further aims to trace the exercise of that agency, and understand its instantiation during the engagement. To understand the implications of examining agency on a more granular level, it is necessary to go back to the statement that 'rules are embodied into game elements' (Järvinen, 2008, p. 31). Embedding rules into game objects puts objects in a position of being constraining to player action, as rules have often been relegated to the role of behavioral limitation, instruction, and submission (Tulloch, 2014). Suits equates playing a game with engaging in an 'activity directed towards bringing about a specific state of affairs, using only means permitted by the rules, where rules prohibit more efficient in favor of less efficient means, and where such rules are accepted just because they make possible such activity' (Suits, 1978, p. 34). Salen and Zimmerman likewise reaffirm this position by stating that 'Rules are ''sets of instructions,' and following those instructions means doing what the rules require and not doing something else instead.' (Salen & Zimmerman, 2004, p 122). Björk and Holopainen further claim that 'Rules limit the players' range of actions while they are playing, enforce certain actions, and describe the order in which actions should be taken. Rules also describe and lay out the boundaries of the game and govern exactly how all the other components of the framework are instantiated in the game itself' (Björk & Holopainen, 2006, p. 15).

However, the generative potential for behavior has also been noted. Juul considers that 'The rules of a game also set up the potential actions, actions that are meaningful inside the game but meaningless outside. It is the rules of chess that allow the player to perform a checkmate - without the rules there is no checkmate, only meaningless moving of pieces across a board. Rules specify limitations and affordances.' (2005, p. 58). In the same text, Juul goes on to note the lack of efficiency in highlighting the denial of more efficient means in achieving goals in the case of video games, as the constructed environment would make this impossible. The impossibility of breaking the rules without appealing to material modifications such as altering the game code has been previously noted (e.g., Leino, 2015), leading to the question, when discussing video games is it necessary to state that rules specify limitations and affordances? If, much like Juul states, the video game adaptations of soccer require a reconstruction of the laws of physics, the physiology of the players, and the procedures of soccer, what is implemented as a rule remains only in the realm of affordances, the limitations only appearing as an absence.

Moving away from the perception that rules are a constricting apparatus, Tulloch (2014) explores the relationship between the player and the game as one of power. Understanding power through the lens of Foucault (1977, 1978), as a generative force that creates and privileges certain kinds of behaviors, Tulloch provides a criticism to the dominating and restrictive purview granted to game rules and reframes their role to a generative one, a channel for the formation of the relationship between the player and the game system. Within this frame, the player is not acted upon by the rules but also acts through them with various degrees of directness. Likewise, Leino (2015) notes that the freedom to act granted to players is found in the material affordances of the game artifact. Thus a symbiotic relationship between the rules and the player's freedom is engendered in video games.

Game objects then carry on this dual position of generative constraint, being not only agential in themselves, but relaying the agency of the source of the transmitted action. Game objects enable the player to exercise their agency, and translate actions whose activation comes from the player via their affordances. However, game objects not only translate players' actions from the player, carrying them forward via their affordances, but sometimes they disrupt or obfuscate them. As mentioned in the discussion of the example, this does not entail a reduction in agency, but a reformulation of it. A change in the presented affordances does not equate with a diminished agency, as agency is not, within the current framework, viewed as a quantifiable resource. The network reconfigurations highlight the transformation of agency, and provide information regarding the role that separate objects have in the transformation. Thus, while player agency may not diminish, the reconfiguration of the network may change the modes through which it is exercised. The configuration of the network becomes a means of observation of the source and transformation of the actions, as well as providing information to the role of certain objects in the relationship.

On a higher level of abstraction, by relying on the source and directionality of the activated attributes, we can conceptualize the player and the game system as two participants in the game situation, their roles being neither fully oppositional nor collaborative, but negotiations of control observed via access to specific game objects. Dyadic situational relationships have been studied previously, as mentioned, by Eric Berne (2010), but also by Kelley et al. (2003), from the perspective of interdependence theory. Interdependence theory offers a game theory inspired view of situations, within which the situation structure is operationalized as a matrix of needs, goals, and power of each of the two situation participants. The outcomes of the situational interactions are based on the participants' satisfaction of needs. The outcome matrix allows for the assessment of the control an actor has over their own outcome, as well as the control they have over their partner's outcome, the joint control they have over each other's outcomes, and the extent to which their interests differ. Based on variations across these parameters, Kelley et al. (2003) generate a series of situational prototypes, abstracted patterns of interaction resting on dimensions of mutual independence, mutual interdependence, and corresponding and conflicting mutual control. At first glance, such an examination seems appropriate for analyzing the distribution of control between the player and the game system. Instances in which the player is constrained into the performance of undesirable behavior without a means to take a different action may point to a misalignment in goals.

In one of *Spec Ops: The Line*'s (Yager Development, 2012) most harrowing and well-known scenes, the player's actions result in the dropping of white phosphorous on a group of civilians. This action occurs in the absence of knowledge of the civilian status of the population and is followed later by the reveal of the consequences. The action of dropping the white phosphorous also occurs in a context in which the player's progression through the game is contingent on their interaction with the white phosphorous cannon and the elimination of the appointed targets. The players' individual goals, for example, that of not committing war crimes, may here be at odds with the possibilities made available by the game. Such an eventuality may place the player and game system dyad in a situation of conflicting goals, with the game possessing unilateral control over the outcome of the player. Such a case becomes, in this context, an exemplar of diminished player agency (Mateas, 2001), as the desires of the player are not met by the game. As the only move at the player's disposal to deny the achievement of their partners' goal is to not play, examining this event within the framework of interaction interdependence requires moving from the implied player position to assumptions regarding the individual person momentarily engaging with the game.

Thus, a purely dyadic conceptualization of the situation participants in the spirit of Kelley et al. (2003) and Berne (2010) is prone to moving the player position to one where their personal attitudes and individual differences are central to the analysis. This would conflict with the aim of this network of offering an analysis method of the stimulus game. As such, the player's position as one of operator needs to be maintained. To do so, a potential avenue of exploration rests in the acknowledgment and recognition of the participant roles as part of the network of object relations. As previously explored, game objects can act as relays of the action impulses. Tracking this diffusion of the action impulse can provide a picture of the diffusion of the influence of the operator's action through the network of objects. This can provide a perspective on the 'degree of control negotiation between the human and the non-human, between the player and the machine'. (Fizek, 2017, p. 6). To clarify, let us compare the example of the action of dropping white phosphorous explored above, and a scene in Playdead's *INSIDE*.

The action of dropping the white phosphorous occurs in a context in which the player's progression through the game is contingent on their interaction with the white phosphorous cannon, and the elimination of the appointed targets. The progression is thus funneled into the player's access to one object, which constricts access to the object allowing progression. Trying to bypass the use of the phosphorous canon results in continuously respawning aggressive NPCs. Their undeterred respawning means that at a point, the avatar will run out of ammunition and die, effectively soft-locking the player into using the cannon. The player is thus in a situation in which the NPCs cannot be accessed directly through the avatar, but only through the cannon, while at the same time, the NPCs affect the avatar through their state of being alive and barring progression. In *INSIDE*, in one of the sections of the game, the player is confronted with a harmful shockwave. Like the *Spec Ops* players' lack of access to the enemy NPCs, the *INSIDE* player has no direct access to the shockwave. They can, however, guard against it by using a cover object. Like in the *Spec Ops* situation, they cannot backtrack, being forced to continue and depend on cover objects throughout the section involving the shockwave. Thus, the topology of object relations in the two game situations is quite similar, as seen in the figure below.

The directionality of the affordance complementarities allows tracing the control exercised by the player through the avatar, and onto the cover or the cannon, respectively. The game system exercises its control on the player through those objects can that autonomously affect the player, in this case, the enemies or the shockwave. To clarify, the analysis does not wish to interpret the situations found in *INSIDE* and *Spec Ops* as 'the same'. The representational characteristics of the games poignantly differ, and the examination of the situation within the entire network of game objects present in the game would undoubtedly illustrate a variety of differences. Instead, the analysis wishes to underline the possibility of using the configuration of game objects and the unifying characteristic of object influence, as a viable means of comparing segments of the games that do not rely on the participants' appraisal, or on purely representational factors.

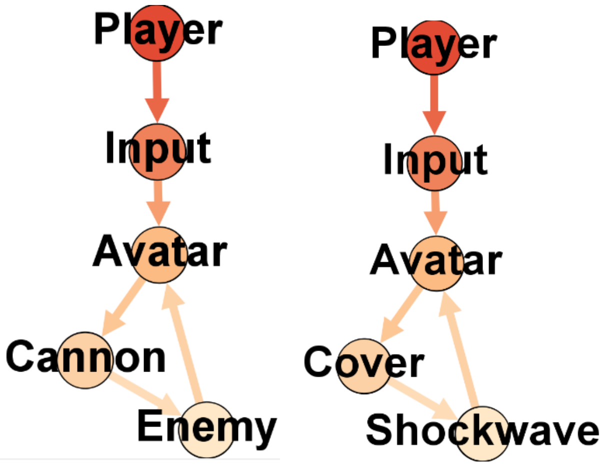


Figure 6. Comparison of the two situation. On the left is the situation found in *Spec Ops: The Line*, and on the right, the situation found in *INSIDE*.

At this point, some clarifications become necessary with regard to the conceptualization of control utilized in this dissertation. Control and perceived control are rich areas of research (Rothbaum et al., 1982; Trafimow et al., 2002). This puts the current work in a similar position as the one undertaken by Bellows (1963). With the aim of bringing more focus to situational influences, he approached authority as a unifying variable due to the ubiquity of the influence in daily engagements. Within games research, the perception of autonomy that the players have over their circumstances has made its way most notably through the adaptation of Self Determination Theory as a means of assessing players' motivations in engaging with video games (Przybylski et al., 2010). Further, video games have been posited to allow players to learn and practice coping strategies for emotional control, alongside the greater experiential control they provide in comparison to media like film and television (Grodal, 2000). This is not the same understanding of the notion of control as used in this work. This is mostly due to the lack of empirical assessment of player experience undertaken in this work. Instead, discussions surrounding control will have, at their core, the directed influence exercised by objects. As an object is situated in a gatekeeper position, such as the white phosphorous cannon in the example above, it is considered to control the player's access to other objects in the environment. The directed influence exercised by the player on the physical interface and the avatar is, likewise, considered an exercise of control. As such, the interpretation of the term within this work should be considered more similar to the understanding of manipulation than perceived control. The same understanding can be applied on the part of the control exercised by the game system.

4.10 THE NETWORK OF THE GAME SITUATION

Knowing only of the connections occurring between the game object via their interlinked attributes paints an incomplete picture of the structure of the situation in the absence of an analysis of the configuration of their linkages. To be able to provide an analysis of the linkages between game objects and the eventual topology of the game situation, the current work will rely on graph theory and measures of node centrality. Graph theory deals with the analysis of complex systems, focusing particularly on the connections between system components and the ways in which connections form and transform the network topology (Barabási, A, 2016, Knoke & Yang, 2019). Multiple domains such as epidemiology, social science, literature, and neurobiology utilize network science and network analysis. Within games research, network analysis has been applied in the analysis of player behavior within multiplayer team-based games (Nguyen et al., 2015), the players' subjective experiences of play (Banks, 2014), and the formation of social networks on game platforms (Loria et al., 2021). Generally, a component of a network is referred to as a node, and two connected components may be referred to as being adjacent (Freeman, 1979, p. 218). The connection between two nodes in a network may be directed, meaning the relationship between the nodes is asymmetrical, or undirected, in cases in which it is symmetrical. For instance, a network of acquaintances is undirected because to be considered an acquaintance, both persons must know each other. Directed graphs, on the other hand, designate a determinate relationship between the nodes, a sequential condition, such as the case of a family tree. The number of nodes that that node is connected to designates the degree of a node (Freeman, 1979, p. 218). The degree of a node designates the potential of its communication activity. The higher the node degree, the more nodes there are connected to it. The number of connections that must be crossed to get from a node to a specific other node describes the distance between them. The shortest distance between two nodes is also named the geodesic path, while the longest path found in a network presents the network diameter. The geodesic path can further be utilized to examine the nodes that stand in between two target nodes. For example, a node that stands in between multiple other nodes is deemed to have a high betweenness centrality, controlling the pathways of communication between other nodes. An agent located in that position may hinder, block or manipulate the information transmitted through it, to the nodes within which it is connected. Such a high degree of betweenness centrality generally puts the physical interface and the locus of manipulation in a place of importance in the network, relegating them to a more central position than other objects. The length of the path from one node to all other nodes in the network determines its closeness, and thus its dependence on other points in the network. The closer a point is to all other points, the more independent it is from the effects of other points. For example, if an avatar is required to push a button in order to open a door, the button's role in the process becomes more central. From these characteristics, we may discern a series of comparative analyses that may be performed with respect to the centrality of a node.

However, prior to that discussion, a clarification is required with regards to the correspondence between a game object and a network node. As previously discussed, game objects affect each other via complementary attributes. As seen in the previous sections, the conceptualization of game objects is that they are conglomerates of affordances. Stable affordance relationships that do not perceivably change during the course of the game can be black-boxed. Conversely, unstable affordance relationships that emerge dissolve and change

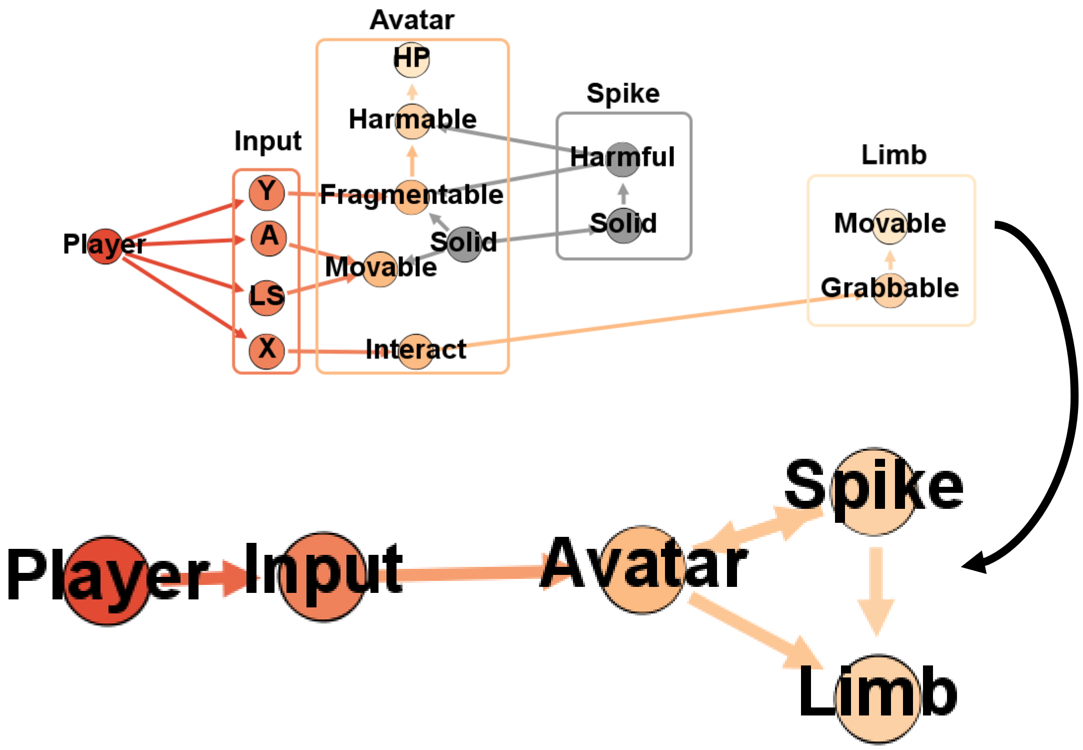


Figure 7. Stable Groupings of affordances become network nodes.

describe the distinction between two separate objects. In the context of this work, nodes are represented by individual objects, while affordance relations represent edges. As such, the connections made between them rely on their attribute juxtaposition, making affordances the functional network nodes. This decision has repercussions on the resolution of the analysis. Due to the subsumption of a multitude of affordances under one object, the valence of the relationship, the actual effect that the affordance complementarity has is no longer visible. Whether the relationship reflects the influence of a dangerous enemy on the avatar, or the positive effects of a health pack, the relation will have the same directionality, and look the same. Some resolution is thus lost in the process of providing a unified method of comparison. Thus, the examination of the specific relationship between objects can benefit from secondary methods of analysis if considered necessary.

Concepts used in the domain of network analysis can thus be used to examine relationships between game objects and provide an overview of how affordances juxtapose, modify and modulate a triggered action. The directionality of links, and degree measures of a node, as well as the shortest path between nodes, are descriptive measures of network analysis employed for the assessment of relationships between game objects connected by their affordances. The concepts and methods of network analysis will thus be explored further as the discussion moves towards the identification of game situations and their structure. Prior to that, however, a closer examination of the meaning of the object relations is necessary. The next section discusses the links between agents as a means of distributing and diffusing influence and control through the game network and the effects this perspective has on the assessment of the game situation.

4.11 Conclusion

As observed in the opening sections, research in the domains of psychological situations and games has had an intertwining history. However, their evolutions have been parallel, with concepts being merely borrowed across domains, without translation. Within games research, two broad perspectives on situation research have been applied – that of the perceived situation and ecological psychology, particularly through the concept of affordances. While the former may provide valuable analytic insight into the game research situation and thus potentially heighten the degree of ecological validity of the work, it does not provide the tools necessary for the stimulus selection and intervention procedures, which is the central aim of this dissertation.

Ecological psychology offers, however, a productive perspective in examining the player-game relationship due to the tools provided, which center around a more micro-level examination. Adopting the concept of affordances as employed by Turvey (1992) allows for the construction of such a micro-level examination method. Turvey describes affordances as dispositions of objects which exist in relationships of complementarity, resulting in effectivities or manifest properties. This distinction was considered to not be directly applicable to the video game environment, due to the overwhelming reliance on objects.

Instead, it was decided that, due to the agential characteristic attributed to entities beyond the player, the distinction would not be made. Affordance complementarities then are conceptualized as mere influences transmitted between the affordances of game objects. The framework thus functions on the premise that the sole salient verb present in the player-game interaction is that of activation, choosing to move away from a more granular examination of mechanics as verbs. The abstracted analytical level, placing the central role on object relationships instead, leaves room for the application of concepts adopted from the field of network analysis for the formulation of inquiries regarding the configuration of objects which make up the game situation.

Examining the relationship directionality, as well as the centrality of specific nodes, allows for the formulation of an overview of object relations and the examination of the role of particular objects in the game situation. The overview of the topology of the network, and the ways through which actions are modulated by central agents, allows the movement to a higher level of abstraction, towards the examination of the control distribution in the situation. The network of object relations can be contextualized as a continuous negotiation of control, as various agencies enable, disrupt, and modify the access of the two participants to particular objects and through them to particular parts of the network.

Chapter 5. Method

5.1 Introduction

The current chapter presents the methods of data gathering and analysis that were employed towards the formation of game networks, uncovering the game situations, and creating the situation typology. The steps of the method are presented in detail, starting with the game selection process, the game analysis process, and finally, the identification of the situation types. The chapter is intended to play a double role. First, it acts as a classic methodology chapter, presenting the route that was taken towards obtaining the results. Secondly, it wants to present itself as a roadmap to further application of the framework. As the final result of the current dissertation is a toolkit for the analysis of games for experimental applications, it seems necessary that an application of the toolkit be explored.

As presented in the previous chapter, the process of analyzing the games relied on the advice provided by actor-network theory to follow the traces that actors leave in the process of interacting with others (Latour, 2005). While actor-network theory has previously been employed in games research, the applications were generally concerned with the role of non-humans in the creation, restructure, and maintenance of relationships within and around games. T.L. Taylor (2009) most notably proposed a methodological approach to studying the game experience as an assemblage of play, wherein the players and non-human actors are all acknowledged as remodeling each other and forming a collective context of play. The proposition was made as a counterpoint to the separate examination of the player and the game structure, instead acknowledging the notion that 'we do not simply play but are played' (Taylor, 2009, p. 336). In the same vein, Giddings and Kennedy (2008) and Giddings (2007) recognize that there is a symbiotic relationship between the player and the game, that the player is being acted on and configured by the game just as much as the game is configured and acted on by them. Their work is a push forward to the adaptation of ethnographic methods for games research, methods that, much like T.L. Taylor states, are required to move beyond the separation between the player and the technology and instead recognize the continuous shifts that emerge in the players lived experience between the virtual world and their own 'offline' selves. Other applications of ANT in games research concern themselves with the role of games as actors in social situations between multiple players (e.g., Jessen & Jessen, 2014; Candy, 2012; Hung, 2016). The studies mentioned have generally centered on highlighting the human-nonhuman actor assemblages that are formed during play but have not applied an ANT-inspired method on the level of granularity necessary for the work at hand – that is, tracing the influences of each object present in the virtual world.

The method of identifying and tracing the actors was built primarily on the notions of intermediaries and mediators (Latour, 2007). An intermediary is considered to be an object that transmits information without changing its meaning, thus counting as a blackbox of one. A mediator, on the other hand, reconfigures the meanings that it transmits, thus leaving traces in the exchange. In the context of the analysis of game objects, the notion of modifying the meaning of information was interpreted as responding, via affordance relations, to the actions of another object that is either controlled by the player or controlled by the game system. in this sense, for example, the impulse transmitted by the push of a button, is modified by the affordance relations between the physical interface and the avatar and emerges as walking. Likewise, the affordance relationships between a solid mobile object and a static mobile object may result in the avatar stopping. A similar distinction is made by Leino (2010) between deniable and undeniable game objects. This was applied to all the game objects in the game that was analyzed. Every game object that was considered a mediator, or undeniable, was inventoried along with the relationship it has with other objects. The affordance relations were abstracted to relations between objects, as shown in Chapter 4, Figures 4 and 5. The current work considers game objects as attribute amalgamations and their complementary disponibilities as edges. The resulting object relations list can then undergo analyses that provide insight into the role of a specific object in the game network at large. The process through which the resulting list of object relationships was analyzed will be detailed throughout the following sections.

The resulting list of objects and relations was transposed into a graph format and underwent a series of node centrality measures to determine the roles of specific objects in the game. This provided an overview of the game structure, which will be explored in detail in Chapter 6. Graph analysis methods have been previously used in games research for multiple purposes. Partlan et al. (2019) and Carstendottir et al. (2020) used graph analysis notions to analyze interactive narrative via graph-based representations. The concept of progression maps uses interaction units as nodes, where an interaction unit contains all information presentation and mechanisms that are available to the player with that unit. This container may include several types of nodes, such as events, options, feedback, forks, constraints, and input. The collation of multiple types into a single node is similar to the approach used in the current work.

The distinction between their work and the current application emerges in the generality of the game situation and its focus on objects as opposed to narrative elements. As objects and their affordances are the principal units of analysis of this work, differentiating between affordances and constraints, for example, is no longer relevant. A constraint is simply considered to be the absence of a relationship between two or more objects. As will be discussed later, however, Cartendottir et al.'s work (2020) becomes more pliable in the case of narrative-heavy games that present multiple events, discussions, and Quick Time Events, such as *Detroit: Become Human* (Quantic Dream, 2018), one of the games included in the analytic corpus of this work.

Another application of graph analysis methods to game analysis is Cook and Raad's hyperstate space graphs (2019). The work is specifically intended for automated game analysis, a goal shared by Partlan et al. (2019). This model uses game states as nodes and irreversible player actions that transition from one state to another as edges. The nodes, or hyperstates, are conglomerates of all possible states connected by reversible actions, and in turn, connected in a graph by irreversible actions. The central focus on a specific game state is not compatible with the scope of the current work, however, which aims to bring focus to the roles that objects play in the experience of engaging with the game, and how the players' control is in the game is enabled and modeled by those objects. Of course, the scope of the two may be merged, with an examination of objects that enable reversible or irreversible actions being interesting and relevant to the formation of situations. However, for the time being, this is outside of the scope of the current work.

5.2 Networks all the way down! (and up)

In their book, *The Exploit – A Theory of Networks*, Galloway and Thacker (2007) note how the spread of a naturally occurring disease such as SARS implicates actors across various network types. The biological networks – the infection – interfaces with many other network types such as the local public transport system, international transport system, institutional networks, and professional ones. SARS and its spread is located both within and across these multiple layers of networked contagion. An analysis of the spread of SARS may be contained to one of the layers. For example, its spread via international travel routes may be examined in order to understand the most vulnerable locations and deploy resources accordingly. Localized layer analysis presents viable and actionable insights but, like any specialized analysis, does not illustrate the multitude of factors that occur when layers interface. For instance, observing the spread of the virus in the network of international travel without acknowledging the influences of institutional decisions on said travel may appoint certain actors within the first network with characteristics that they would have otherwise not gained. A travel ban in a specific country may force rerouting through different hub cities, giving an otherwise weakly linked node the potential of being an influential actor in the international travel layer

Applying this insight to the analysis of games allows a more precise identification of the scope of the current analysis and an understanding of the points where it can be broadened and clarified by augmenting it with examinations of different ontological layers of the game. Game ontology models, such as the one developed by Aarseth and Grabarczyk (2018), present a fertile ground for understanding the different layers within and across which games may be analyzed. Collating multiple perspectives under an 'ontological umbrella,' the authors introduce a model comprised of 4 main layers – physical, structural, communicational, and mental – each subdivided into three sublayers. These layers can be considered research foci, or the domain within which interdependent actor-networks are formed. As the above example concerning the separate analysis of the international travel network, an analysis can fall solely within the physical layer of the game and be concerned solely with the relations between the different pieces of hardware involved in supporting a multiplayer game session. Under this assumption, it is possible to examine and understand the research focus of scholars that have applied a networked perspective to the analysis of games, as well as the movement of their analysis across ontological layers. While some scholars engaged in this discussion have done so with the aim of examining the macroscopic human-nonhuman circuit in which the game and the player are embedded (e.g., Taylor, 2009; Giddings & Kennedy, 2008), others focus on specific layers. Aiming to draw attention to digital games as software and simulations, Seth Giddings (2007) presents an analysis of artificial agents in *Advance Wars 2* (Intelligent Systems, 2003), thus positioning the research within the mechanical layer of the game, which enables the actions of automated agents. Jessen and Jessen's (2014) analysis of board games as actors in social interactions intersects the mechanical, social, and mental layers. Their interest lies in examining how the cognitive engagement with the game's rules will mold the social interactions between players, thus placing the game in the position of social actor. Candy (2012) examines the technological networks that enable, support, and influence play, particularly across large swathes of space. A factor like lag, emerging from the connections within the technical layer of the game, will have repercussions on the social layer by forcing groupings amongst players with similar amounts of lag and excluding those with a higher or lower amount, for example. Similarly, Hung (2016) examines the social and physical assemblages that support gaming across different contexts in order to understand how they fit around the lives of different types of players. Loria et al. (2021) focused on the structures and characteristics of social connections that emerge around games with similar core mechanics. Their research thus crosses the social and mechanical layers of the game and is limited by the technical aspect of having examined only one gaming platform. While all the scholars mentioned highlight the assemblage of humans and nonhumans coopted into the player-game engagement, each focuses their research on specific ontological layers.

In terms of the current dissertation, the focus falls primarily on the mechanical layer of the game. While the intended scope is the mechanical layer, the process of gathering data through noting the observable relationships between game objects naturally places this analysis to a certain degree also on the mental – phenomenal layer. The relationships are only observed through play and the viewing of play recordings and not confirmed on a computational level, thus obscuring certain possible relationships. An object relation that exists only on the level of the game's code but that does not present itself in any form in the act of playing the game will not be observed during the game analysis. However, one of the principal concepts grounding this work is the concept of affordances. As Gibson writes, 'positive and negative affordances are properties of things taken with reference to an observer but not properties of the experiences of the observer" (Gibson, 2014/1979, p. 137)'. Taking affordances as described by Gibson as a guiding concept in establishing the game networks thus moves the focus of the study away from the phenomenal layer and places it within the mechanical one. The focus is necessarily narrow and aimed at accuracy in creating a common analytical ground, to the detriment of descriptive comprehensiveness. With the current analytical method, differences grounded in visual aspects of games would not be identified. *The Howard Dean For Iowa Game* (Persuasive Games, 2004) a game about influencing the opinions of as many voters at once, and *Kaboom! – The Suicide Bomber Game* (fabulous999, 2002), a game about killing as many people in a suicide bombing at once, will have the same structure (c.f. Bogost, 2008). Nevertheless, that is not considered problematic, as the possibility of analyzing the interface of different ontological layers already exists. However, what the framework can do is provide a foundation for discussing similarities and differences between games that are seemingly too different to consider. Aarseth (2014) states that 'A game such as *Tetris* (Alexej Pajitnov, 1985) has almost nothing in common with *World of Warcraft* (Blizzard Entertainment, 2004), or with *Super Mario Sunshine* (Nintendo, 2002).'. The current framework proposes that given a common unit of analysis of a low granularity, the game object and its relations, the example games are comparable across the desired variable. Chapters 6 and 7 will discuss and showcase this aspect in more detail. Before that, however, the following subsection will provide certain terminological clarifications aimed at explaining the scope of the analysis.

5.3 Scope and terminological clarifications

While the previous subsection clarified the ontological layer of the work, the current section will clarify its scope. The ontological metamodel presented above takes a high-level perspective on the layers across which the networks that support play practices may be established. However, a similar difference in analytic scope may occur on a smaller scale, for instance, game elements. Models such as the Unifying Game Ontology (Debus, 2019) seek to identify the smallest building blocks of the game engagement. The author identifies seven facets, including the game's mechanics, time, goals, space, randomness, and entities, alongside unattached facets that can be applied across game elements, such as their explicitness, fixedness, and continuity. It is not outside the realm of possibility to examine the relations of different spatial structures in the game or the relations between the different types of goals that players can or must complete, creating thus the grounding for a lower level of granularity for the examination of relational structures between games. Like the examinations of the social networks of characters in novels or television series (e.g., Jasonov, 2017), this can provide structural insights into the bearings of a particular actor's influence across the network of relations, whether that actor is a game goal, a character or a weapon.

As discussed in Chapter 4, the central unit of analysis in this work is the game object. Game objects take on the role of nodes in the network, and their complementary dispositions (c.f. Turvey, 1992), or linking affordances, take on the role of edges. However, this qualification is insufficient, as the notion of a game object may be contested on the grounds of granularity. When looking at a house in a game like *The Elder Scrolls V: Skyrim* (Bethesda Game Studios, 2011), for example, is the house an object? Are the component parts of the house – walls, door, roof - objects? The answer to this is that it depends on the context in which the house appears. Aarseth (1997, p. 40) distinguishes between code objects and expression objects, stating,

> ‘'Furthermore, what goes on at the external level can be fully understood only in light of the internal. [. . .] To complicate matters, two different code objects might produce virtually the same expression object, and two different expression objects might result from the same code object under virtually identical circumstances. The possibilities for unique or unintentional sign behavior are endless.’. (Aarseth, 1997, p. 40)

To clarify what is meant by a game object within the confines of this framework, we must go back to the clarifications of the previous section. The focus of the work is the mechanical layer of the game, thus placing itself in alignment with what Aarseth calls a code object. However, the observational nature of the work means that it relies on the expression object to make sense of the code object. So, in the context of this work, a game object is a stable conglomerate of affordances observable by their effects. An object can, but does not necessarily need to, have a coherent visual representation. When the conglomerate of affordances changes drastically, the object is also considered to have changed into a new object. For instance, while a boss enemy may be one narrative character, instantiated via one physical representation, but presents multiple phases during which its attributes change, each phase will be considered a new object. The house may be taken as a standalone object if its component parts do not present any distinguishable standalone affordances, activated in conjecture to other objects. A house standing alone in a field with the attribute of blocking the character's movement can be taken as a standalone object. In a context where the house's walls are used as construction parts, connecting to each other and other construction materials, they become objects linking to the resulting house object. More detailed discussions regarding game objects, and game object edge cases, such as those without a visual representation, are presented in the previous chapter.

Collating multiple attributes into a conglomerate called 'object' has several repercussions. The first one is that should one object act upon another, the specificity of the linked attributes is not considered at this level of analysis. Thus, if a wall acts on the avatar, stopping its movement, and an enemy acts upon the same avatar affecting their health pool and potentially killing them, the relational visualization will be the same. Some of the analytic resolution is thus lost in the process, requiring a further analytical step to be taken after the structural analysis, if one is deemed necessary. As will be seen in the following chapter, the object relation structure acts as a workable, comparative analysis starter point, providing insights that can then be contextualized across other ontological layers of the game.

The next concept that requires clarification is that of the game system. The notion of the game system has been used to generally refer to the conglomerate of rules that the player will encounter during play, which will dictate the possible and desirable actions to take, as well as their consequences (c.f. Salen & Zimmerman, 2004). While similar, my interpretation and use of the concept have more in common with Galloway's conception of 'the machine.' (Galloway, 2010) Galloway views the player and the machine as two actors in the process of gameplay. He clarifies:

> ‘One may start by distinguishing two basic types of action in video games: machine actions and operator actions. The difference is this: machine actions are acts performed by the software and hardware of the game computer, while operator actions are acts performed by players. So, winning *Metroid Prime* is the operator's act, but losing it is the machine's.

Locating a power-up in *Super Mario Bros*. is an operator act, but the power-up actually boosting the player character's health is a machine act.

Of course, the division is completely artificial—both the machine and the operator work together in a cybernetic relationship to effect the various actions of the video game in its entirety.' (Galloway, 2010 p. 5)

The game system has a dual role of being both the enabler of actions and container of rules, as well as a co-actor in the process. Given the focus of the current analysis, control, both roles of the machine, or game system, are observable through the influence exerted on and through objects. As a clarifying example, we can look at time in *Stardew Valley* (Concerned Ape, 2016). Time emerges from the network of relations as an influential object outside of the player's control. As the game system is the totality of rules in the game, and, as established in Chapter 4, it is assumed that rules are embodied into game objects, then time is an object that transmits the influence of the game system to the objects to which it relates. In the following discussions, the role of the game system as an actor will be highlighted. In contrast, its role as the container of all action possibilities will be sidelined, considered stable enough not to require constant scrutiny.

Finally, the last term that requires clarification is 'game environment.' The understanding of the game environment here is very similar to Willumsen's description of the virtual environment as 'the part of the software system of a digital game which is typically presented to the player through audio-visual means as a navigable space.' (Willumsen, 2020). The role of the term in the analysis is that of referencing the totality of the objects identified in the game. As illustrated in Chapter 4, the game situation emerges from the perceived game environment as a momentary configuration of objects. However, object relationships outside of the momentary situation will invariably affect the role of the objects in the situation. This speaks to the necessity of an overview and analysis of the entire set of objects encountered in the game. The concept of game environment then refers to the whole network of the game.

This section engaged in an exercise of clarifying the most common terms that will appear in the following analysis presented in Chapters 6 and 7, as well as their conceptualization during the analysis undertaken. This specifically concerns the concept of game objects, game system, and game environment.

5.4 GAME SELECTION

The process of selecting games in the context of a project that critiques practices of game selection is unsurprisingly difficult, being faced with the need for the tool before it can be developed. This is compounded by the fact that the model wishes to be applied generally and thus pose no starter constraints. That given, in lieu of more formal criteria, the requirements of the subsequent analysis were identified and given a decisive role in the selection. These were: the availability of secondary information sources about the game, familiarity with the game, variety in the control that the player exerts in the game, variety in scale, and finally, that the game was a single-player video game. The last criterion was chosen due to the complexity of multi-player games and the groundwork nature of this project. While the theory behind this project may be readily extendable to multiplayer games, producing a situation typology in which multiple players may be present would exponentially expand the scope of the typology beyond practically achievable goals at this point. However, future work may cover the ground of multiplayer video games as well as analog games.

Data regarding the games was obtained via personal playthroughs, as well as secondary sources such as the wikis of the game and recorded let's plays. The playthrough of the games involved a combination of styles of play as outlined by Aarseth (2003), including partial completion, total completion, and repeated play. The games were played to completion where completion was possible, such as the cases of *Portal* (2007, Valve), *Super Hot* (2016, Superhot Team), or *Nier: Automata* (2017, Platinum Games). Other games, such as *Tetris Effect* (Monstars Inc. et al., 2018) or *Snake Classic* (Jam, 2018), which do not feature a final state, were played repeatedly until a sufficient level of proficiency and familiarity was established. Other games still, such as *Detroit: Become Human*, disallow by design the exploration of the entire game, and as such, they were played to partial completion and supplemented with walkthroughs, playthroughs, and wikis.

While variation in genre was not considered a decisive criterion, the fact that personal familiarity with the titles combined with the entrenchment of genres as a means of categorization has inadvertently created variety across genres as well. A criterion that was considered necessary, however, was the scale of the games. One of the reasons behind the creation of this framework is that as games have evolved, so has their complexity, and as a result, preexisting markers of segmentation and categorization have gradually become insufficient. As games increase in scale, and they include the presence of many more game objects, the risks of introducing an uncontrolled confounding variable in the stimulus selection increases as well. It stands to reason then that the application of the framework be tested against large-scale, complex games. Games like *Nier Automata* and *Stardew Valley* (Concerned Ape, 2016), which were included in the corpus, fit that description. However, their scale and complexity also hamper the verifiability of the analysis and conclusions drawn, obscuring the process unnecessarily. Thus, variety in scale was deemed desirable, with the inclusion of games that have only a handful of objects, such as *Super Hexagon* (Cavanagh, 2012) and *Snake* be included as well-known accessible games that can facilitate the verification and comprehension of the analysis process. The scale of the games is also observable in the range of objects and object relationships they present, from the largest, *Stardew Valley* with 2751 nodes and 49.157 edges, to the middle-ground, *The Missing: JJ Macfield and the Island of Memories* (White Owls Inc. 2018) with 278 nodes and 460 edges, to the smallest, *Super Hexagon*, with 4 nodes and 3 edges.

For the analysis to be possible, the attributes of the objects along with their complementarities must be observable via a playthrough and verifiable via external sources. This created the necessity for the games that were included in the corpus to allow the possibility of accessing secondary sources, such as Let's Plays, or Wikis, through which the list of objects and object relations could be amended or rectified. This is made all the more necessary for this dissertation, whose purpose is that of laying the groundwork for the method. Without the possibility of reliably being able to identify objects and object relationships within the game, the possibility of identifying game situations would be at best flawed, at worst, impossible. Thus, due to the depth of the analysis and the necessity of an exhaustive list of objects and relations, the existence of multiple information sources and comprehensive documentation of the game objects was one of the selection criteria for the final game corpus. The best example for the decision is *Detroit: Become Human*, which features not only extensive fan-made documentation in the form of playthroughs and walkthroughs but also a built-in map of story branches, allowing the verification of the documented object relationships. Their existence allows the inventory of the objects to be more extensive and closer to being exhaustive, which would have been unlikely in a game with the narrative complexity of *Detroit: Become Human*. The game's complexity is intended to engender replayability and narrative exploration, but this also poses a risk to exhaustive documentation as I, due to lack of proficiency or a propensity towards or away from a certain playstyle, may not have been able to fully explore the game.

Aside from the practical aspects of the analysis, there was also the matter of the robustness of the resulting situation typology. As this project is chiefly interested in observing variations in the distribution of control between the player and the game via the different game objects, this was used as an amending criterion for title selection. This criterion is incompatible with traditional genre categories, which generally use an experiential (e.g., Role Playing Game) or aesthetic (e.g., Fantasy) salient feature to characterize the entirety of the title. However, the criterion of control variety is itself fairly vague and insufficient. It is difficult, if not impossible, to establish the existence of such variation from the description of a game prior to engaging with the game. As previously discussed, the current project maintains that games are not monolithic but dynamic, the experiential range engendered by the configuration and reconfiguration of object networks being of a high enough complexity that it shouldn't and cannot be captured via only one salient feature. The necessary precondition for the verification of the variance of control was then an increased level of familiarity with the title on my part. This presents both a benefit to the analysis and a limitation generated by my own personal preferences that skew the corpus in a direction that does not account for possible situations encountered in games that I am unfamiliar with. I considered specific factors as relevant to variations in control, such as the possibility to play through procedurally generated environments, which led to the inclusion of *Downwell* (Fumoto, 2015) in the corpus. Other factors, such as the complexity of linear processes, which requires the inclusion of multiple disparate objects, lead to the inclusion of *Stardew Valley*. *Nier: Automata* was included due to its highly heterogeneous structure, which presents the player with diverse challenges which often transform the game from what would be called an action game to a chose your own adventure style game or a bullet hell. *Inside* (Playdead, 2016), *Nier: Automata* and *Brothers: A Tale of Two Sons* (Starbreeze Studios, 2013) were chosen due to the possibility of controlling multiple avatars in different configurations – in parallel, subsequently, or alternatively, and *The Missing* was chosen due to variations in attributes of the avatar. It is difficult to provide a unique reasoning or description of what the 'variations in the diffusion of control' means, before the analysis is performed. Certainly, there are important omissions in terms of control variation that this corpus does not account for. Titles such as *Fifa 21* (EA Vancouver & EA Romania, 2020) series where the locus of manipulation is distributed across multiple objects, or *Civilization VI* (Firaxis Games, 2016) series where the locus of manipulation is likewise not centralized, with many game objects functioning as relay hubs, would be interesting and rich examples to explore further. However, the open nature of the typology allows for additions to be made, and thus, over time, for the creation of a more comprehensive corpus.

These practical analytic requirements resulted in a corpus of 16 titles. While this core corpus serves as the basis for the development of the game situation typology, the results will also reference examples not included in the corpus as a means of comparison and expansion of the situation types. The titles making up the core corpus can be seen in Table 1. As seen in the table, the corpus presents the variation in terms of the number of objects and relationships between them as well as the distribution of the relations. The networks of the games analyzed can be found in the appendix.

Game	Nodes	Edges	AVG Degree
Bejeweled	4	5	1.25
Super Hexagon	4	3	0.7
Snake	5	6	1.2
Passage	6	7	1.1
Breakout	7	7	1
Tetris	8	11	1.3
Zuma	10	14	1.4
Super Hot	26	69	2.6
INSIDE	95	125	1.3
Downwell	108	892	8.2
Portal	321	670	2
Brothers: A Tale of two Sons	166	332	2
The Missing: JJ Macfield and the Island of Memories	278	460	1.6
Nier: Automata	1448	27738	19.1
Detroit: Become Human	1578	4463	2.8
Stardew Valley	2751	49157	17.8

Table 1. A list of the games in the analysis corpus and their corresponding nodes and edge count

Following the decisions regarding practical criteria and the game selection, Elverdam and Aarsheth's game classification typology (2007) was applied to the titles selected to ensure a measure of diversity across feature dimensions. The results of the application may be consulted in Table 2. While the corpus seems small, some of the more complex games, such as *Nier: Automata,* ensure that most of the features (barring features connected to multiplayer games) are covered. This is a consequence of the heterogeneous nature of games, wherein while external time, for example, may be generally mimetic, certain quests present the player with time-based challenges providing the opportunity of studying mimetic time features as well. This is also compliant with the low granularity of the analysis performed in this project, where the principal interest falls on the low-level relations between objects and only secondarily upon the game as a whole. The variation in titles across the dimensions proposed by Elverdam and

Aarseth provides further verification of the suitability of the games for the creation of a situation typology that would be comprehensive enough as groundwork.

Virtual Space	Perspective	Omnipresent	Bejeweled; SuperHexagon; Snake; Breakout; Tetris; Zuma
		Vagrant	Passage; SuperHot; Inside; Downwell; Portal; Brothers: A Tale of Two Sons; The Missing: JJ Macfield and The Island of Memories; Nier Automata; Detroit: Become Human; Stardew Valley
	Positioning	Absolute	Bejeweled; Zuma
		Relative	SuperHexagon; Snake; Breakout; Tetris; Passage; SuperHot; Inside; Downwell; Portal; Brothers: A Tale of Two Sons; The Missing: JJ Macfield and The Island of Memories; Nier Automata; Detroit: Become Human; Stardew Valley
	Environment Dynamics	None	Bejeweled; SuperHexagon; Snake; Zuma Nier Automata; Detroit: Become Human;
		Fixed	Portal; Breakout; Tetris; Downwekkm Brothers: A Tale of Two Sons, The Missing: JJ Macfield and The Island of Memories;
		Free	Stardew Valley
Physical Space	Perspective	Omnipresent	
		Vagrant	
	Positioning	Location Based	
		Proximity Based	
		Both	
External Time	Representation	Mimetic	Nier: Automata; Detroit: Become Human
		Arbitrary	Bejeweled; SuperHexagon; Snake; Breakout; Tetris; Zuma; Passage; SuperHot; Inside; Downwell; Portal; Brothers: A Tale of Two Sons; The Missing: JJ Macfield and The Island of Memories; Stardew Valley
	Teleology	Finite	Bejeweled; SuperHexagon; Snake; Breakout; Tetris; Zuma; Passage; SuperHot; Inside; Downwell; Portal; Brothers: A Tale of Two Sons;

			The Missing: JJ Macfield and The Island of Memories; Nier: Automata; Detroit: Become Human
		Infinite	Stardew Valley
Internal Time	Haste	Present	Super Hexagon, Snake, Passage; Tetris; Zuma; Super Hot; Inside; Downwell; Portal; Brothers; A Tale of Two Sons; The Missing: JJ Macfield and The Island of Memories; Nier: Automata; Detroit: Become Human; Stardew Valley
		Absent	Bejeweled; Breakout;
	Synchronicity	Present	Super Hexagon, Snake, Passage; Tetris; Zuma; Super Hot; Inside; Downwell; Portal; Brothers; A Tale of Two Sons; The Missing: JJ Macfield and The Island of Memories; Nier: Automata; Detroit: Become Human; Stardew Valley; Bejeweled; Breakout;
		Absent	
	Interval Control	Present	Bejeweled; SuperHexagon; Snake; Breakout; Tetris; Zuma; SuperHot; Inside; Downwell; Portal; Brothers: A Tale of Two Sons; The Missing: JJ Macfield and The Island of Memories; Nier: Automata; Detroit: Become Human; Stardew Valley
		Absent	Passage
Player composition	Composition	Single Player	
		Two Player	
		Single Team	
		Multi Team	
		Two Team	
		Multiplayer	
		Multiteam	
Player Relation	Bond	Dynamic	
		Static	Bejeweled; SuperHexagon; Snake; Breakout; Tetris; Zuma; SuperHot; Inside; Downwell; Portal; Brothers: A Tale of Two Sons; The Missing: JJ Macfield and The Island of Memories;

			Nier: Automata; Detroit: Become Human; Stardew Valley; Passage
	Evaluation	Individual	Bejeweled; SuperHexagon; Snake; Breakout; Tetris; Zuma; SuperHot; Inside; Downwell; Portal; Brothers: A Tale of Two Sons; The Missing: JJ Macfield and The Island of Memories; Nier: Automata; Detroit: Become Human; Stardew Valley; Passage
		Team	
		Both	
Struggle	Challenge	Predefined	Bejeweled; SuperHexagon; Snake; Breakout; Tetris; Zuma; SuperHot; Inside; Downwell; Portal; Brothers: A Tale of Two Sons; The Missing: JJ Macfield and The Island of Memories; Nier: Automata; Detroit: Become Human; Stardew Valley; Passage
		Instanced	Stardew Valley; Bejeweled; Tetris; Snake; Zuma; Downwell;
		Adversary	Nier: Automata
	Goals	Explicit	Bejeweled; SuperHexagon; Snake; Breakout; Tetris; Zuma; SuperHot; Inside; Downwell; Portal; Brothers: A Tale of Two Sons; The Missing: JJ Macfield and The Island of Memories
		Implicit	StarDew Valley; Nier Automata; Passage; Detroit: Become Human
Game State	Mutability	Temporal	Bejeweled; Snake; Breakout; Tetris; Zuma; SuperHot; Inside; Downwell; Portal; Brothers: A Tale of Two Sons; The Missing: JJ Macfield and The Island of Memories; Nier: Automata; Detroit: Become Human; Stardew Valley; Passage
		Finite	Snake; Tetris; SuperHot; Inside; Downwell; Portal; Brothers: A Tale of Two Sons; The Missing: JJ Macfield and The Island of Memories; Nier: Automata; Detroit: Become Human; Stardew Valley
		Infinite	Downwell
	Savability	None	Downwell; SuperHexagon; Snake; Passage; Breakout;

		Conditional	Tetris; Zuma; SuperHot; Nier Automata; Stardew Valley
		Unimited	Inside; Portal; Brothers: A Tale of Two Sons; The Missing: JJ Macfield and the Island of Memories; Detroit: Become Human

Table 2. Variation of game features across the game corpus.

5.5 Nodes and Relations – Identification

The functional definition attributed to a game object in the context of this project has been explored in depth in Chapter 4. In this section, the focus will lie not as much on what game objects are considered to be but on how they were identified. To that end, a brief reminder is considered sufficient. A game object is a conglomerate of observable affordances that exist in a stable relationship. The affordances of one object may be complementary with the affordances of another object, at which point a relationship is formed. In the current project, objects were identified via a multitude of sources, as enumerated above. However, the primary means of identifying the objects was through playing the games, while the other sources served a role of rectification and verification. To identify the existence of an object and for the object to be noted as a distinct entity in the game, the object should have an observable relation. It is possibly counterintuitive to identify a relation before an object. However, this is in line with the ANT idea that a stable object, which leaves no traces, is blackboxed, being removed from the role of mediator and placed in a role of intermediary, exerting no influences upon the network of relationships that surround it.

This strategy has certain consequences that need to be discussed in greater detail. One of the consequences is that identifying the game objects via the traces they leave results in appointing the status of object not only to something that we would intuitively consider a game object, like a sword or a rock, but also to forces or events that would not intuitively be considered objects, like darkness, time or gravity. While time, for example, is not a bounded, represented object, the fact that it is influenced and influences certain other objects is observable in the traces it receives or leaves on them. Sometimes, these non-represented objects were considered to have an effect directly on the player, transcending the bounds of the virtual world. An example of such an object is darkness. This object is considered to have a direct influence on the player by impairing their ability to visually engage with the world. The exclusion of such non-represented objects would provide a skewed overview of the control exerted by the player over specific objects. The non-represented objects are often outside the

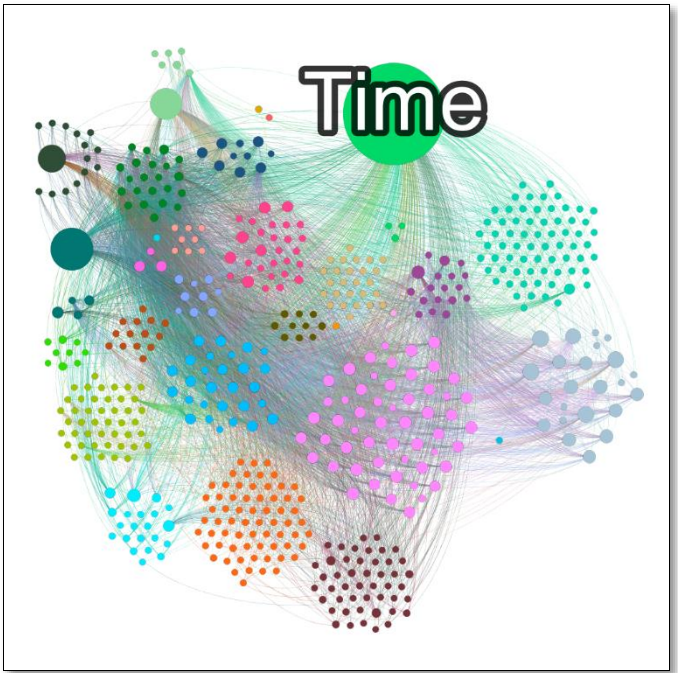


Figure 8. The Time object in *Stardew Valley* and its neighbor network. The colors are given by the type of objects and the scale is given by the out degree of the objects

control of the player or under indirect control. For example, time in *Stardew Valley* is controlled by the game system but can be manipulated by the player via specific objects, such as beds which allow the player to move forward in time one day automatically. The influence that time, as primarily controlled by the game system, however, highlights the diminished direct control that the player has over objects that are affected by time. Planting a seed and growing a vegetable, for example, includes the affordances of objects that can be used by that Locus of Manipulation directly. The inclusion of time in the network highlights the ways in which the growth of a vegetable is not only dependent on actions performed on and with objects under the control of the player but also controlled by the system. Excluding such an object from the analysis would not only have repercussions on the situations including it directly but also on situations that include its neighbors. In Figure 8, the variation of the types of objects that Time influences can be observed, along with the degree to which they themselves will go on to influence other objects.

Another type of object that is not represented but is identifiable by its traces are those objects created by an absence. An example of this is the gap left by two disconnected tetriminos in *Tetris*. It is, however, necessary to qualify this type of absence in more detail. The present work has thus far relied solely on the existent attributes of objects, choosing not to take into consideration the absence of potential interaction possibilities. In other words, if a playable character does not have the ability to jump from the beginning and throughout the entirety of the game, this is not considered an absence. This remains the case in instances in which the game environment presents challenges or opportunities for such an action to be performed. This stance was taken as a move away from the conceptualization of diminished player agency by virtue of the absence of desired interaction possibilities. Instead, in the current work, an absence is characterized by a negative complementarity to another object's dispositions. The negative aspect of the complementarity should not be confused, however, with a negative

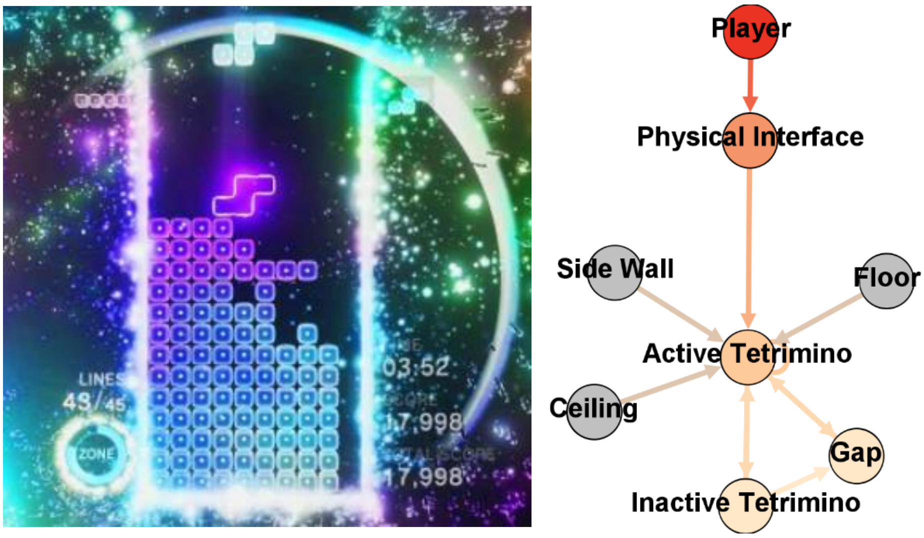


Figure 9. The full network of the game Tetris. The color is given by their distance to the player node.

effect. The playable character losing health when acted upon by an enemy is a positive complementarity, although having a negative result for the playable character. The disposition of the enemy to be harmful and that of the playable character of being harmable are situated in a relationship of complementarity. The proximity between the enemy and the playable character, however, intervenes in the attribute relationships as a conditional, becoming a negative complementarity to the enemy's attribute of being harmful. The enemy cannot harm the playable character when they are at a certain distance. In *Tetris*, this absence becomes concrete and persistent in the form of the gap between tetriminos. The properties of tetriminos to be matchable is conditioned on them touching. The gap thus negatively complements the tetriminos disposition of being matchable. Unlike proximity, the gap is not a permanently existing relationship. Gaps may be formed and eliminated, each time modifying the relationship between the existing observable objects. Proximity, however, due to its permanent latent nature, can be blackboxed. So, unlike the blackboxed proximity, the gap in *Tetris* has the status of object, despite its lack of representation, counterintuitively becoming an agent through absence. The non-represented objects included in the analysis were thus those objects that affect other objects leaving traces of their disponibilities, and whose complementarities with other objects' disponibilities are not in such a stable state as to be blackboxed. A further note to object identification is that objects that appeared multiple times with the same attributes were collated into a single node representation.

The identified objects were also provided with certain categorizing characteristics. The characteristics are not used in the principal analysis, which concerns itself chiefly with the topologies emerging from the node relations. However, they provide further context to the analysis and serve the role of guarding against impossible computed results. Attributes include, for example, the type of objects, denoted by face value attributes related to the narrative sequence in which they are encountered. Computing the topology of the game situation relies on the identification of the path between a source node and the target node, the specifics of which will be discussed in a further section. The resulting network of game objects and relations does not account for temporal sequences or for schedules of revealing specific objects and their attribute to the player but takes a global perspective that accounts for every possible relation that may exist during the entire course of the game. As such, searching for the path between two objects will disregard the possibility of the two objects being concurrently present or having an actually established relationship in the game. Thus, situations may be automatically identified without them existing in the game. Unfortunately, systematically identifying the potential for impossible situations increased the likelihood of discounting real ones as well. Inputting a condition of temporal concurrency is not desirable, as it would move away from the possibility of viewing every likely relationship and potential situation, becoming more akin to the depiction of a singular playthrough instead of the breadth of potential playthroughs. Due to that, identifying and eliminating impossible situations from the analysis was done on a case-by-case basis. Identifying node edges, or relations, was done, as mentioned by observing the traces that objects left on other objects. A relation between objects was determined to be the complementarity of object dispositions. Edges were considered to be directed, with the source node being the one that elicits the influence upon the target node.

5.6 Analysis

Following the playthroughs of the games and the consultation of the secondary sources, the object relations were noted in an excel document along with the object types. The graphs created were directed, often presenting cycles. An overview of the graphs obtained can be seen in Table 1. The edge tables were then imported into Gephi (Bastian et al., 2009) for preliminary analysis. Gephi is a popular open-source network analysis software that allows the examination of the overall network topology via different layout algorithms according to the analysis requirements, as well as the calculation of basic statistics regarding the network. Generally, the games presented a network topology that highlighted certain nodes as hubs, objects that connect to multiple other nodes, while the majority of other nodes present few connections.

5.6.1 Macro analysis

The preliminary analysis included the identification of objects with the highest in-degree and outdegree values. The analysis of these node types and their role in the control exercised by the player is the central topic of Chapter 6. The in-degree value of a node describes the

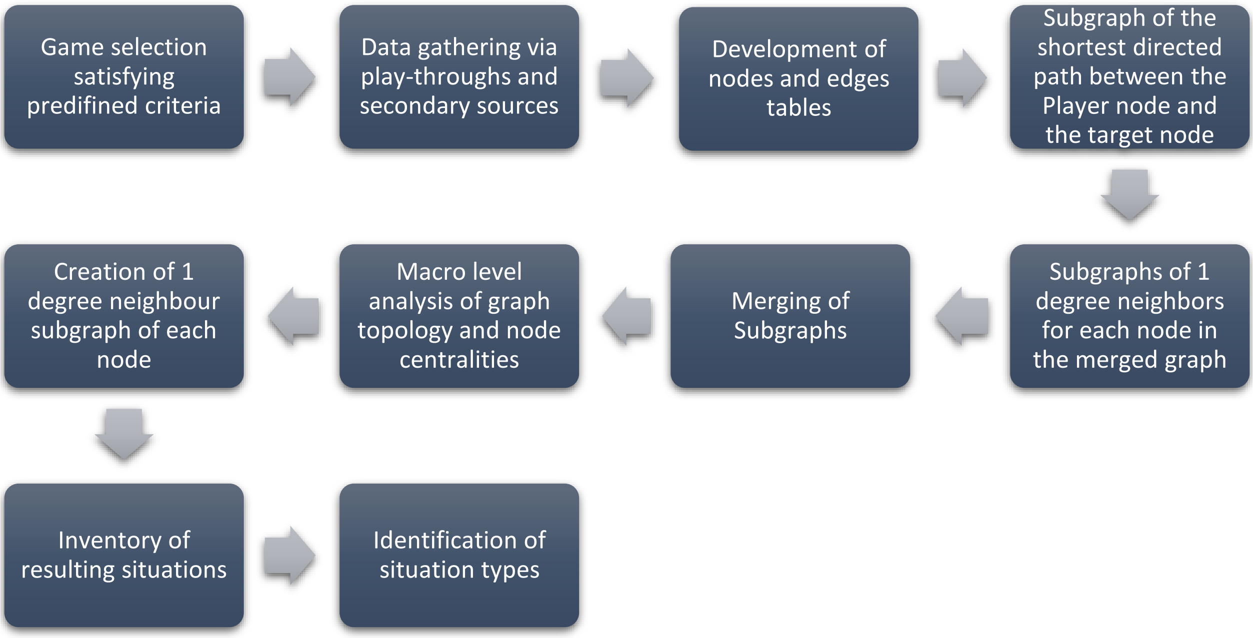


Figure 10. Method steps

number of objects that have an inbound connection with the node (Freeman, 1979). The out-degree value describes the number of objects that the node goes on to influence. This was an important step in establishing the distribution of control that the player and the game system exercise. Nodes with a high out-degree value indicate that their influence is exerted on a high number of objects. As such, they can be considered gatekeepers of a large part of the game, either by blocking the route to a great variety of objects or a large quantity of the same object type. Determining the objects with the highest out-degree, and the situation participant that controls them, allows the observation of the means through which that participant may exercise control throughout the game engagement or in a particular part of the engagement. This may lead to surprising observations. For instance, while the avatar exercises the highest degree of influence in the network of *Super Hot*, the second most influential node is represented by the enemy bullet. This occurs due to the fact that the enemy bullet may affect both enemies, and player-controlled objects, such as the weapons that the avatar can use. The degree of the enemy bullet points to its role as an advantageous, but not directly controllable, object.

Another reason for the examination of the degree of influence that nodes exercise is that due to their central position in the network, which designates how influential they are, they are important components in the study of potential unwanted changes between experimental conditions that should be maintained equivalent. If a manipulation includes changes to a node

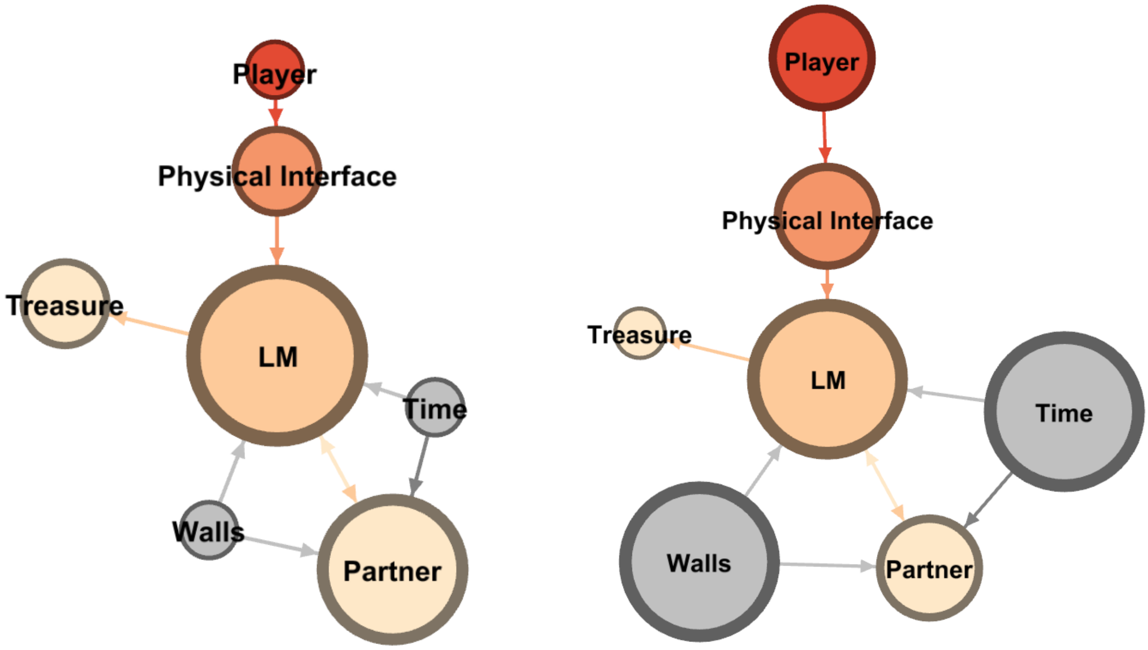


Figure 11. Illustration of the difference in influence of the nodes in the network of the game *Passage*. On the left, the nodes are sized according to their in-degree. on the left, the nodes are sized according to their out-degree.

with a high degree of influence, the changes applied to it will affect all the objects that they, in turn, influence. This becomes problematic in cases where the change is not part of the stimulus manipulation intended. To clarify, one of the nodes with the highest out-degree value in *Nier: Automata* is the games' currency, G. removing the currency as part of a manipulation that targets the presence and absence of rewards would not only impact the existence of a reward in the game but will impact the players' access to the stock of vendors. This includes weapons, upgrades, crafting materials, and others. Such branching, unforeseen changes are specifically one of the noted challenges to using video games in the role of stimulus. While this challenge appears in the context of all related objects in the game, they might be particularly damaging in the case of highly influential nodes.

Nodes with the highest in-degree values are, in contrast, the more influenced nodes. They receive the influence of a high number of both game-controlled and system-controlled objects. This puts them in a position of being somewhat of a focal nexus to the game. For example, the most influenceable nodes in *Detroit: Become Human* are the relationships that the players can build with the other game characters. Choices made along the way and success or failure to act in a specific direction all affect the relationships that the avatars build with specific characters. While these relationships may go on to affect the player's access to specific game options, this role is, quantitatively, disproportionally lower. Comparatively, in most other games used in the corpus, the role of the most influenceable node was held by the avatar. This points to the idea that objects in this role are the focal point of most engagements, the objects towards which most others gravitate. This can make itself visible in multiple ways, depending on the valence of the relationships. For example, if, as in *Super Hot*, the relationships that give the node its influenceable status are negative, mostly concerning the damage that can be inflicted by enemies, it points in the direction that the health of the avatar is one of the focal aspects of the engagement.

5.6.2 Micro-analysis

The micro-level analysis was performed in Tulip (Auber & Mary, 2021), another open-source graph analysis software. The change was made due to the increased levels of customizability that Tulip has in comparison to Gephi, as well as the higher level of clarity of software documentation. However, the visualizations and basic statistics calculated through Gephi were kept for the macro level of analysis due to the greater clarity and quality of the visualizations. The workflow in Tulip consisted of 5 steps. First, the neighbor network of degree 1 of every node was calculated. The network accounted for both outbound and inbound neighbors in order to have an overview of both the nodes that the object influences and those that it is influenced by. The neighbor network of the node created the first subgraph of the game network. The second step of the process was finding all shortest paths, considering edges as directed, between the player node and the target node. This was done so that the potential situations identified would take into account the influence of both situation participants. In cases where no such access exists, the opposite paths were taken, leading from the target node to the player node, or alternatively, to the Locus of Manipulation. Cases like these may be encountered in situations where the object is fully under the control of the system and cannot be influenced in any way by the player. This can be observed in Figure 11. While walls and time may influence the player, they cannot exert any influence on them. This removes the possibility of finding a path between the player node and the walls, for example, if the player is chosen as the source. The opposite relation is, however, possible. The two resulting subgraphs, the neighbor graph and the graph containing the shortest path, were then merged into a larger subgraph that encompassed all the situations that the target node may be involved in. Finally, the merged graph was split into subgraphs of 1-degree neighbors of all the nodes present in the graph. Through this step, individual subgraphs containing each neighbor of the target node were created, allowing the granular examination of individual situation topologies.

Following this step, the resulting situations were grouped according to the edge number and the node number. This grouping allowed for more clarity in the examination of their configurations. During the examination of the resulting networks, situation duplicates were removed, as well as impossible or invalid situations were removed from the analysis. The emergence of situation duplicates is fairly straightforward. If a switch connects with a door, they are 1-degree neighbors to each other. This means that, in the analysis of their situation networks, each of them will produce a neighbor network that includes the other. Situations considered invalid mainly included networks where relations exist between objects, but the configuration would never be encountered in practice. The principal reason for this is the necessity for temporal co-occurrence between objects. For example, *Nier: Automata* presents players with three different avatars that they control during different sections of the game. The control of the avatars is never simultaneous. However, every avatar may have access individually to the same object. This places them all at a 1-degree distance from the object. This means that a network that is composed of the 1-degree neighbors of the target node and has more than the necessary number of nodes for the players to access it can include the other avatars.

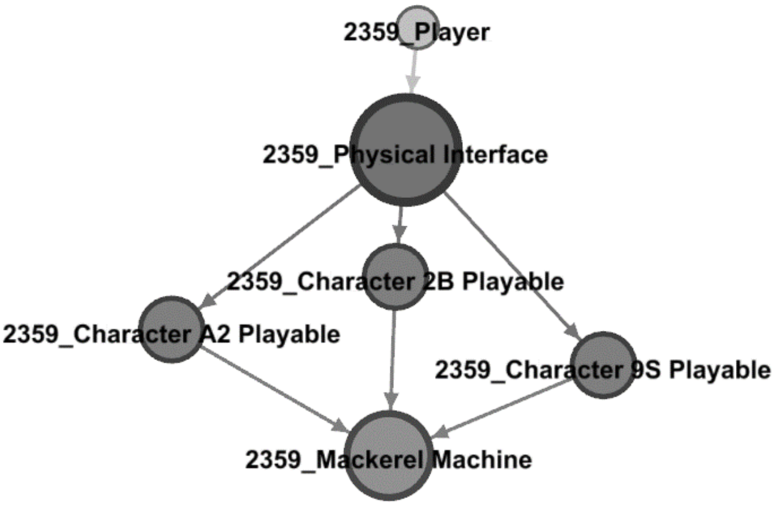


Figure 12. Example of an invalid situation.

Following the elimination of the invalid situations and the duplicates, the remaining situations were visually examined and grouped according to their object configurations. At this stage, the network analysis tools gave way to a more qualitative method of analysis. The principal guiding question as the situations were examined was 'what is happening when these objects relate to each other?'. Multiple descriptive notions such as 'conversation' or 'crafting' or 'location-dependent situation' emerged. Following the descriptive classification of the situations, their networks were examined with the aim of understanding the roles that the nodes play in the configuration. To do this, another set of questions was posed ‘who has control over the object in this situation?’ and ‘what does the object influence in turn?’. This resulted in the identification of objects that act as conditionals for access to other objects, objects that present a unilateral influence, either coming from the player or the game system, objects that both influenced and are influenced by the player. Following this step, situations that present nodes with the same roles and which had similar visual configurations were grouped, independent of their descriptive classifications.

The role of the objects and the visual configuration of the situations were the principal salient factors at this point, meaning that situations in which the activity performed was different or where the number of objects present was unequal were placed in the same category. The examination of different situations took place until a point of saturation was reached, and no further situation types emerged. Another factor that influenced the stopping point was the increased emergence of invalid situations as the number of nodes and edges present in the network increased. The more objects and relations present in the network examined, the higher the likelihood that one or more objects do not co-occur and are instead identified due to a distant relation in the network of the entire game.

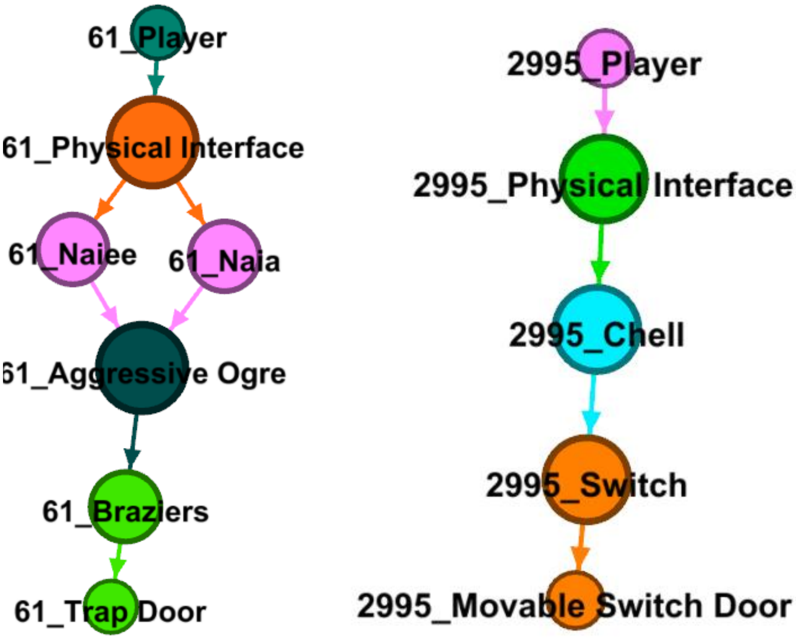


Figure 13. Example of two situations with a differing number of nodes, that were placed in the same category of sequential affordances.

Finally, the influence exercised by the situation participants, the player, and the game system was examined. This examination is related to the directionality of the object relations, and thus the source of the influence exerted on the objects. The result of the situation examination consists of a typology of 9 distinct situation configurations belonging to 3 types of control distribution. The situation typology is further explored in Chapter 7.

It bears noting that the situations inventoried are only the momentary situations in which the object appears. A game may present longer processes in which an object is embedded in multiple situations. The limitation of the 1-degree neighbor filtering has game-specific consequences that should be treated on a game-to-game basis. For example, in *Stardew Valley*, the situations involving a vegetable would include its 1-degree neighbors, that is, the locus of manipulation, who can eat it, characters who can receive it as a gift, and so on. Growing a vegetable from seed involves many such momentary situations related to every state in which the vegetable is, from the seeds and their source to their planting, the plant, and its endangering factors, the tools that work the soil in which the plant grows and so on. While these more extensive flows fall outside the scope of the momentary situation, they can still be examined in the full game network.

5.7 Verification and limitations

As a means of verifying that game networks constructed were sound and corresponded with the concepts described, another researcher was asked to analyze a selection of games from the same corpus by applying the same method. The games selected for verification were: *Bejeweled*, *Breakout*, *Passage*, *Portal*, *Snake*, *Super Hexagon*, *Tetris*, and *Zuma*. This list includes the games in the corpus with the smallest number of objects. This decision was made both due to time constraints and also because the examination of a network comprised of thousands of nodes, as would have been the case for *Nier: Automata*, would have been difficult to assess. The resulting comparisons between the networks produced by the two parallel applications of the network revealed both commonalities and differences, but most of all insights. As such, the discussion of the process of analysis verification will focus less on the discussion on the quantitative overlap between the results and more on the generative differences. The discussion is intended to not only present the process of verification but also highlight the parts of the concepts and method application where interpretation might vary and where clarifications are considered to be necessary. As such, the aim of the verification was not so much that of a standard coder inter-reliability check, as an occasion to ask why those disagreements occurred and what would be their analytic implications. As the method is highly reliant on the researchers' observation of the object relations, such disagreements are expected.

Generally, the analysis of the networks showed consistent agreement in terms of the objects and relations identified. The principal discrepancies between the analyses concerned two specific areas. The first is the identification of the objects on which the possibility that the player maintains their engagement with the game is predicated. That is, those objects that, if affected, will interrupt the play session. In the case of *Snake*, illustrated below, that is represented by the relationship pointing from the avatar (snake) to the player node. This was not a relationship that appeared in my network and not one that I had previously considered. I have identified other objects that have a close effect on the player, as will be discussed in Chapter 7. These generally include objects that affect the physical interface, such as visual effects that prevent the player from seeing the environment or affect the possibility of a button push to be recognized. I consider the inclusion of this relationship to signal the experiential foundation of the method. In an analytic framework founded on the concept of agency as the possibility of affecting the trajectory of another actor, it stands to reason that the effect that is felt more strongly is that generated by the objects that prompt the disruption of the engagement. I consider the inclusion of the relationship to be within the perimeter afforded to the identification of objects and their relationships. Reflecting on whether or not the inclusion of the relationship is necessary for analysis, however, I concluded that the central role in the network is sufficient. The role of exposing the relationship as it stands is that of making evident the potential point of failure in the engagement. Thus, if a harmful object, in this case, the walls, acts on the snake, the player is affected by the cessation of the game session. However, the location of the snake as the conditional object for the players' access to the other objects in the environment accomplishes a similar aim. To reformulate, in alignment with the previous statement, if a harmful object, in this case, the walls, acts on the snake, the player can no longer access the game network.

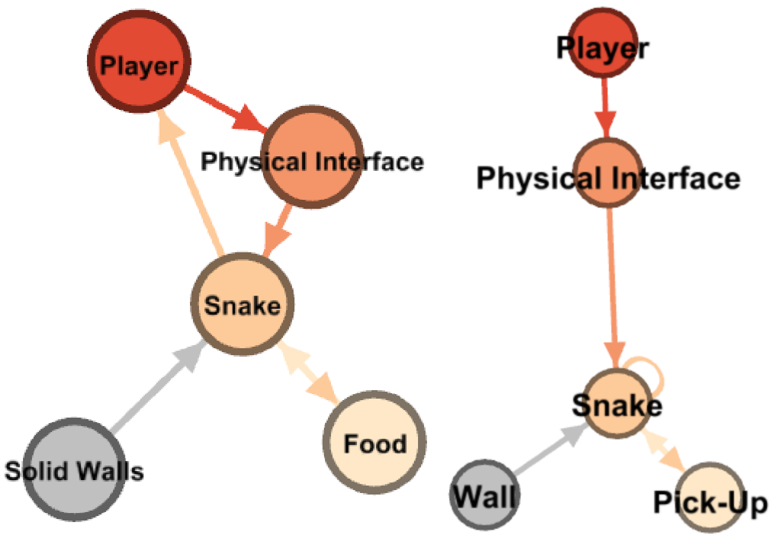


Figure 14. The two results of the analysis of the game *Snake*. On the left is the network created by the second researcher and on the right is the network created by me.

This difference, however, may appear differently in other games. As will be discussed, one of the limitations of this framework is the small number of games that were analyzed. While the interchangeability of these statements holds in cases where the player's access to the game network is contingent upon the point of failure, other titles might provide a better differentiation between the two. I can merely speculate at this point that a game like *Civilization VI*, where the locus of manipulation and the objects that can end the game session are fully separated, would make this differentiation more necessary. Likewise, multiplayer games like *Overwatch*, where the avatar's death is irrelevant to the end of the match, would most likely incentivize further inquiry into the matter.

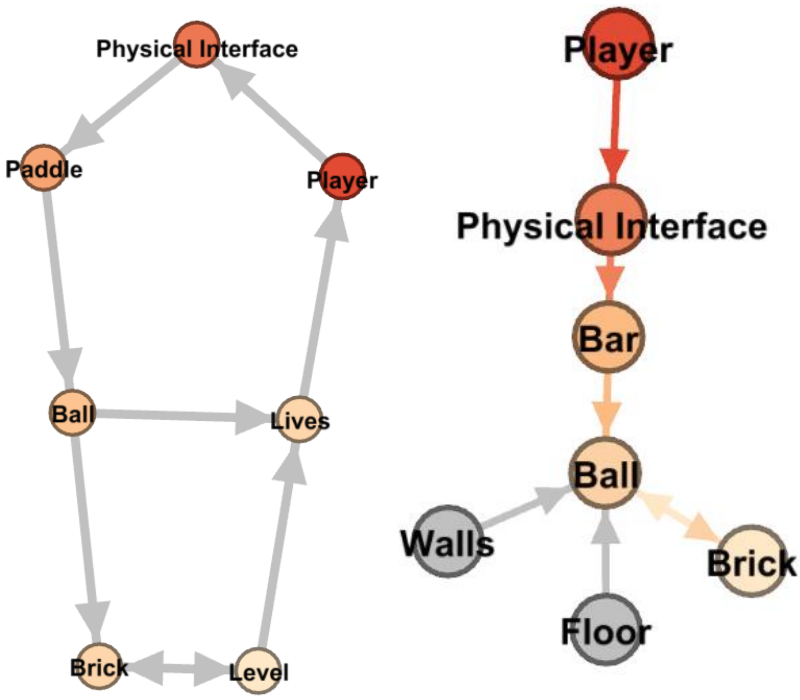


Figure 16. The two results of the analysis of the game *Breakout*. On the left is the network created by the second researcher and on the right is the network created by me.

Further differences between the two analyses were constrained to a case-by-case basis. This includes, in general, the identification of objects missing from the corresponding analysis or the consolidation of similar objects. The latter can be observed in the networks presented from the game *Snake*. While in my analysis, I differentiated between the walls acting on the snake and the snake acting on itself, the second researcher consolidated the effect produced by the collision under the object 'solid walls'. In this particular case, I disagreed with the consolidation, as the snake and the walls present different affordances that would prevent the conclusion that they are interchangeable. Other instances of consolidating objects that seem similar point to a necessity of clarifying the concept of affordances. One such instance was presented in the identification of the doors that lead in and out of test chambers in the game *Portal*.

As the analysis method was developed, I made the decision to consolidate all objects that have similar affordances and only differ in visual representation. The reasoning behind this decision was that the inventory of a multitude of objects with similar affordances would have little analytic advantage. For example, in *Super Hot*, the majority of items that the player can pick up, including coffee cups, fire extinguishers, and darts, can be used as projectiles. The relationships that these different items form are all the same. As such, it was considered valid to note one 'projectile' object, under which all the others were subsumed. The doors in *Portal*, however, are all embedded in different relationships. One door may be opened by pushing a button. Another door may only be opened by a high-energy pellet entering the receiver. The doors thus become embedded into different relations as a result of the complementary disponibilities they have with different objects. The second researcher that built the network of Portal consolidated all the door objects under one object called 'gates'. The reasoning for this is understandable. All the objects afford the player their exit (or entry) out of the level. This is concordant with Gibson's definition of affordances being all that the environment offers the perceiver. However, it moves away from the conceptualization of affordances as a disposition, which is situated in a relationship of complementarity with another objects' dispositions. The question emerges, if an affordance of an object is discernible by its relations, and the two similar objects present different relations in the network, and thus, different disponibilities, could they be considered the same object? Leaning towards answering yes furnishes the player, as the perceiver, with the primary role in the activation of affordances. The latter, however, decentralizes the position of the perceiver and highlights the possibilities of emerging object relations outside of their direct access. Taken further, this could result in a shift from the recognition of the agency of disparate objects in the momentary situation to specific affordance types that relate to each other. A small example of this can be observed in the conflation of the walls and the snake due to both being harmful to the avatar.

This leads to the final point of discussion. As can be observed in the networks of the game *Break-Out*, while I included walls and the floor of the game in the game network, the second researcher chose not to. The choice to not include them in the analysis was justified by the interpretation of the walls in *Break-out* as a limitation of the play space, and thus not an object that is integrated into the mechanical layer of the game. This gave me pause for two reasons. First, due to the fact that walls in *Snake* were noted in the network and thus considered to be a part of the mechanical layer. Second, due to the porous distinction between the mechanical layer of the game and the non-diegetic interface layer (Aarseth & Grabarczyk, 2018). The first issue has been primarily addressed in the previous paragraph, but the non-inclusion of the walls in break-out reinforces the assumption of the primacy of the player. The walls in *Snake* have a drastic effect – they kill the snake and interrupt the possibility of the player to continue playing. In comparison, the walls in *Breakout* have a less impactful effect. Their disponibilities connect with the ball and make it bounce. The effect is less pronounced, which precluded their recognition as objects. However, as noted, this is a misinterpretation of the conceptualization of affordances as used in this framework. Instead of conceptualizing affordances as a disponibility, they are conceptualized as inherent properties of the object. Thus, the ball does not bounce only upon collision with the walls; it has an inherent property of bouncing. This illustrates a challenge to the researcher in the application of this framework. While the source of the data gathered is their experience with the game, they must decenter their experience to gain an overview of the relationships between objects that they do not directly affect. Otherwise, the circularity issue (Rauthmann, 2015a) mentioned previously reemerges in the application of this method.

The second matter that this analytic discrepancy points to is, as mentioned, the distinction between the mechanical layer and the non-diegetic interface layer. As situated within the bounds of the mechanical layer, the framework is chiefly concerned with what Aarseth refers to as the ludic space (2012), or the arena of gameplay. But what are the boundaries of that space? Within the confines of this framework, the most facile answer would be that anything that has an effect on other objects as the game software is running would need to be integrated into the game network. That includes, for example, gameplay settings such as difficulty, which could link with the affordances of enemies, as well as visual or input settings, which affect the possibilities of the player to engage with the game. This inclusion would be very beneficial in the analysis of the game network, particularly in light of the multiple scientific inquiries into the effects of different controllers and levels of difficulty. The lack of inclusion of these factors is a limitation to my own application of the framework. However, in future applications, it is recommended that they are noted as relevant factors of the engagement, along with their respective relationships. A notable aspect is, however, that should these relationships be consistent throughout the course of the engagement, and they are not relevant to the specific manipulation of the independent variable, they can be blackboxed.

As observed in the discussion thus far, the principal limitation in the application of the method of analysis is the researchers' identification and interpretation of the object and relations present in the game. This is the result of the decision to provide a toolkit that allows researchers to analyze games without a need to access the code of the game. Requirements for accessing the game code would risk the imposition of an artificial limit on the games that can be used based on the developers' willingness to provide said access. It becomes then a matter of balanced advantages and disadvantages. Automated data gathering would provide results that would mitigate errors, at least in the sense of noting attributes that may not be easily perceivable, would emerge in rare and complex situations or would be so spread across the game that it would be hard to detect or keep track of by a player. However, the availability of the games that can be analyzed would remain problematic. Leaving data gathering solely in the hands of the researchers would ensure that the games that can be analyzed are not artificially limited. Likewise, being reflective regarding the object studied is difficult to be considered detrimental to the research process. If one of the issues raised at the beginning of this dissertation was the blackboxing of the stimulus game, the method would ensure the mitigation of this risk. However, with that comes the second limitation – the large time investment necessary for the construction of the object networks.

The largest game analyzed in this corpus was *Stardew Valley*, with 2755 nodes and 49163 relations. Its analysis, along with validation of relations via secondary sources and corrections to the network, required a time investment of more than a month. This challenge lies not only in the scale of the game. *Detroit: Become Human* posed challenges due to the dissimilarity between the objects present in the game, requiring that every object and relation be individually assessed and inventoried. The individuality of objects also increases the necessity of consulting and crosschecking with multiple secondary sources. However, while the time investment necessary to analyze the entire network of the game is large, the scale of the analysis can be left up to the judgment of the researchers. As a first application of the presented analytic toolkit, and due to the goals of the research of creating a typology of game situations, it was necessary that for the current research, that the games be analyzed in their entirety. In the event in which specific situations are required for analysis, the method may be applied to specific, isolated segments of the game that present the situations of interest, with the caveat that such a limitation will not allow for a full contextualization of the role of the object in the game, and thus limit the overview of its centrality attributes.

A further limitation is presented by the scope of the research, which was limited to only single-player video games and the relatively small number of games included in the corpus. As the initial application of the method and the demonstration of the analytic potential of the object relations framework, this work purposefully limited the potential for complexity by focusing on single-player games. Accommodating the presence of more than one player will invariably produce a different set of game situations. However, prior to this expansion, the viability of the framework needed to be established. For this reason, the typology emerging from the work is notably open and expandable. Future research should include a larger, more diverse corpus of games, as well as games with a varying configuration of players.

Chapter 6. Game analysis

6.1 Introduction

The objective of the current chapter is to provide an example application of the analytic framework using a corpus of 16 games. The focus of the example application is to observe, analyze and report the diffusion and modulation of control through the game network. The principal assumptions of the analysis are that the objects in the game environment present interlinking affordances that carry forward and modulate both the player, actions, and actions of the game system (c.f. Galloway, 2010, pg. 5). That is to say, a movable avatar will move after the player presses the appropriate, pressable button. The objects in the game environment and their interlinking affordances can then be conceptualized and visualized as a network. The network of the overall game environment then presents all of the possibilities that objects have of connecting and sending forward the actions of the emitter.

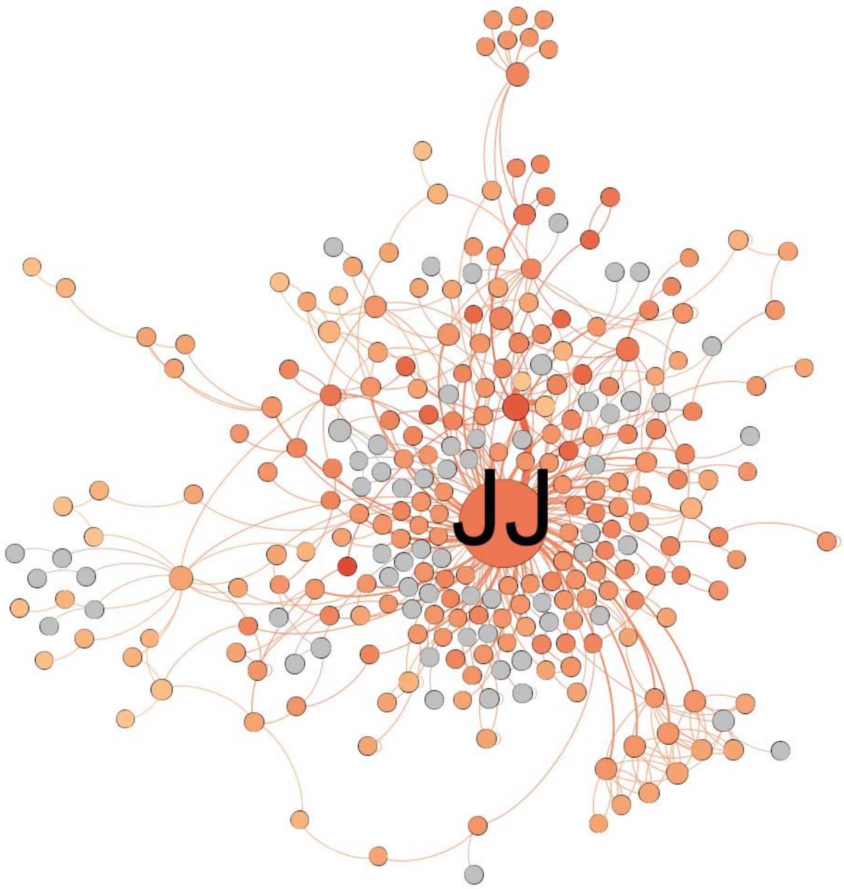


Figure 17. The network of the game *The Missing*. The colors of the nodes represent a heat map, depicting the extent of control of the player. The stronger the color, the closer the objects are to the players control. Grey nodes are objects the player can't access

The structures of the resulting networks are the principal points of examination. To provide a verifiable and common ground for the start of the study, I comparatively analyzed the most influential and most influenceable nodes of the games. I chose this course of action because the most influential nodes, in this case, the nodes with the highest out-degree, present junctions through which the majority of objects in the game environment can be accessed. As such, it can be inferred that they are hubs through which control is diffused through the network. Looking at Figure 17, we can see such nodes in the form of the JJ, the avatar found in the game *The Missing*. She is the node in close proximity to the player, who goes on to exert control over the majority of the objects in the game. Likewise, the most influenceable nodes, nodes with the highest in-degree, are considered an integral part of the analysis due to the assumption that accruing the influence of the majority of the objects in the game environment puts them in a position of guiding desirable endpoints, objects around which the engagement gravitates. Figure 18 illustrates the in-degree centrality of the active ball chain. The object receives influence from multiple objects, being the central focal point of the engagement.

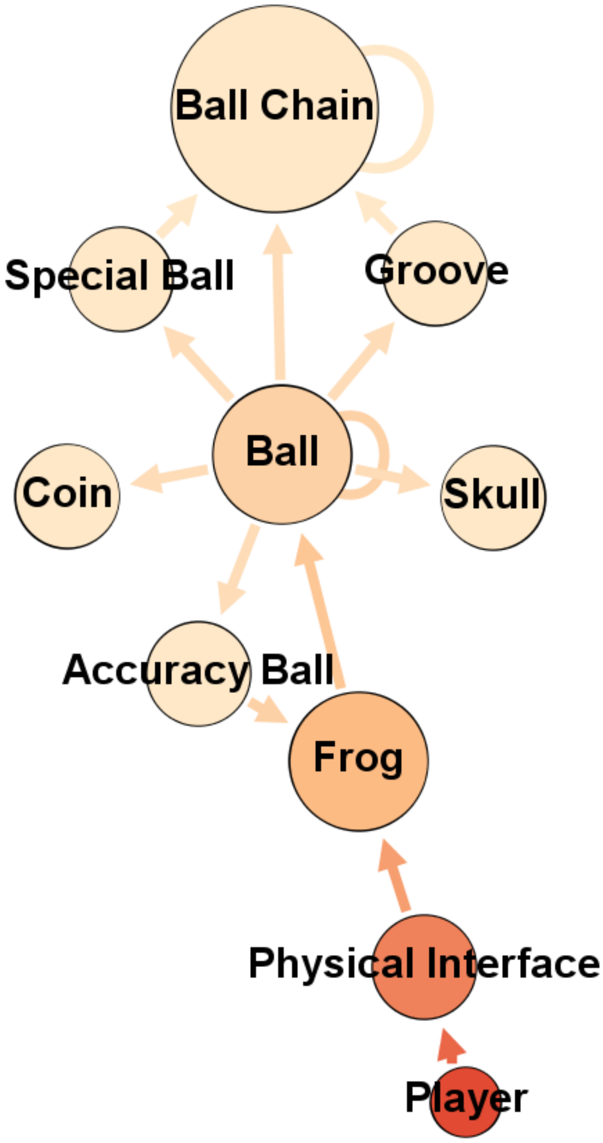


Figure 18. The Network of the game *Zuma*. The nodes are scaled according to how much influence they receive (their in-degree).

Graph analysis concerning matters such as the centrality and degree of nodes can be only the starting point of the analysis. More qualitative reflections are required for understanding the role of the nodes within the game network. Rothbaum et al.'s (1982) two-process model of perceived control will be used as a schematic to understand the types of control the player exercises in the engagement. The authors engage in a comprehensive review of literature on the practice of control, providing, as a result of it, a two-process model comprised of primary and secondary control. They describe primary control as the exercise of bringing the environment in alignment with one's wishes, while secondary control is an adaptation of the self to uncontrollable circumstances. The principal application of their model in the current analysis concerns primary control. While a case can be made regarding the player's understanding and acceptance of problems in a game engagement (for instance, taking a blow to your pride and changing the difficulty settings after one too many deaths), changes to the perception of the self fall outside the scope of this dissertation, and are not observable through the object network. However, that is just as well, as the possibility of accessing the affordances of objects denotes that, from a player agnostic perspective, the player does have control over objects in the surrounding game environment. The function of the analysis is not to provide a model of control exercised in games but to exemplify one of the necessary analytical steps and considerations discussed in Chapter 4. Thus, while Rothbaum et al.'s model will be applied, it will have a descriptive function, the intention not being one of adapting their model to games. The role of this macro analysis is to showcase the possibility and necessity of contextualizing game situations into the greater game network, in order to provide actionable and comprehensive insights. This requirement, or at least incentive, to rely on multiple levels of granularity in the analysis is enabled and supported by network-based analyses.

6.2 ANALYSIS

As presented in the methodology chapter, this first half of the analysis relies on centrality measures, particularly in- and out-degree centrality. The in-degree centrality of a node relates to how many other entities exercise their influence upon it. The out-degree centrality does the reverse and measures how many nodes the node influences. While the games examined present multiple differences, the examination of the most influential and the most influenced nodes in their network, together with their location, provides a generalizable way of characterizing control distribution, irrespective of the face value object category (e.g., resource, tools, weapons, etc.).

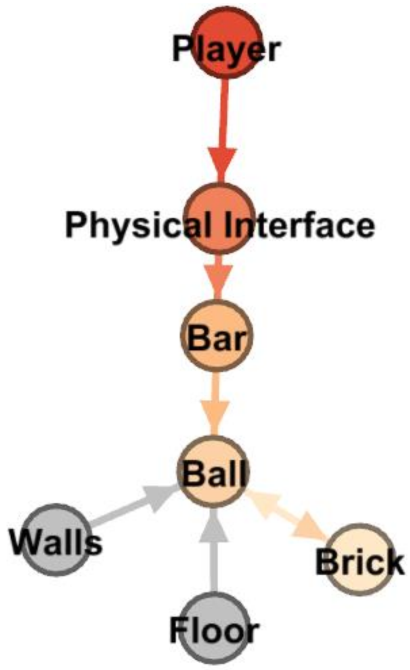


Figure 19. Network of the game *Breakout*. The Ball oubject can be observed to have an in-degree of 5 and an outdegree of 1. Comparatively, the Walls have an out-degree of 1 and an in-degree of 0.

The games were examined across two main factors: the location where control is primarily distributed (the central hub or hubs of the game environment), that is, the nodes with the highest out-degree, the locations where control is primarily exerted. This node where control is primarily distributed is discussed in order of distance from the player node. The three categories, from closest to furthest, are control distribution through the physical interface, control distribution through the avatar, and control distribution via tertiary objects. This differentiation, emerging from the structural distribution of object relations, allows the observation of different types of control at the player's disposition. The observations made across these factors were confronted with the general network structure of the game to understand the consequences of the specific influential and influenceable nodes, as well as their impact on the control exercised by the player and the game system within the game environment. While there is a degree of mutual exclusivity between categories (e.g., control cannot be primarily distributed via the avatar once it has been distributed through the physical interface), hybrids may appear between in- and out-degree categories.

The analysis is based primarily on the games that are part of the corpus of this dissertation, but the discussions may reference games outside of it. The networks of these games have not been fully mapped but are considered relevant to discussion due to similarities or differences that may enable valuable insights. In the following sections, the factors and their representative game structures will be discussed, along with the effects they are hypothesized to have on the control experience and the player game relationship.

6.3.1 The Physical Interface – Player Control

The first category of networks includes games where the physical interface presents the highest degree of influence. Before starting the analysis proper, a short clarification is necessary with regards to the physical interface object. While the majority of the game network objects are located in the virtual environment of the game, the physical interface seems to be an in-between object, straddling the physical and virtual environments. While that is true, a more precise description of what the physical interface object refers to in this work is necessary. Zagal et al. (2007) differentiate between what they call the input device, the thing that translates human action that is interpreted by the game, and the input method, the messages that are interpreted by the game software. The physical interface then, in this work, is a hybrid between the two, referring to the input that the game system considers valid so that action may be taken in the environment. Essentially, the physical interface is an object with two types of affordance disponibilities, one physical and one digital. What becomes observable and worthy of notation in the current work is not the standalone relationship between the player's affordances and the affordances of the physical interface (a player may push an invalid button or throw the controller away), but the affordances of the physical interface that link with other objects in the game environment. Designating a game to this category means that the player's action via the physical interface is required by most objects in the game, without their input being transformed or carried forward by the affordances of another object, like an avatar. This category was primarily observed in the game *Detroit: Become Human* (Quantic Dream, 2018) (henceforth *Detroit*). Developed by Quantic Dream, *Detroit* is an adventure game in which the target object often dictates possible actions. Whereas in a game like *Stardew Valley*, acting upon one door, for example, requires the same set of inputs and coopts largely the same object relations as any other door, every door in *Detroit* may require a different type of input on context. This creates a large amount of connectivity between the physical interface and the objects in the game environment, as seen in Figure 19. From this, it can be concluded that the

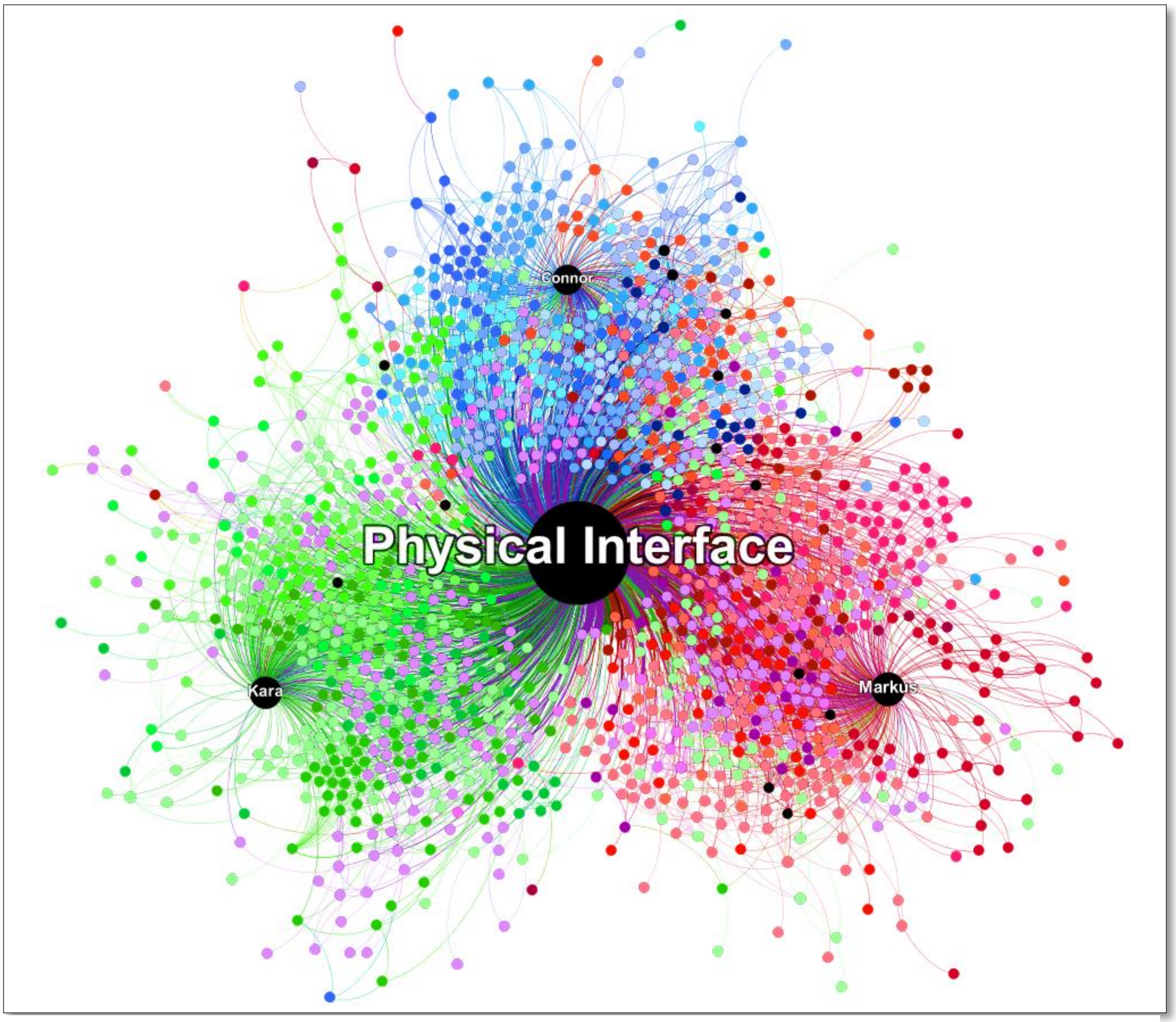


Figure 20, The full Network of the game *Detroit: Become Human*. The nodes are sized by out-degree and colored by the chapter in which they appear. Kara's chapters are green, Connor's are blu, Markus's are red and shared chapters are colored purple.

player is provided with a high degree of control over the game environment. However, the uniqueness of the object affordances must also be considered when reflecting on the player's type of control.

Due to the aforementioned distinctiveness of the objects and the fact that the player must await the game system's instructions before acting on an object, the player is forced to go through a process of relearning and readjusting with every object encountered. In games where the game attributes are stable, and a door has the same attributes as any other door, the objects can be delegated to a specific role (Latour, 1994a). However, the variation of the object attributes and their unforeseeability resists delegation and prevents the development of a stable relationship between the player and other game objects. This puts the player in a constant state of what Vahlo refers to as 'exploration' (Vahlo, 2017), meaning the state of evaluating the possibilities of acting. Constant reevaluation places the player in an exploration loop, being prevented from reaching a stage of coordination, and working with the other objects in the game. The control afforded to the player, given the location of the control distribution and the behavior of the objects receiving the physical interface's influence, is a reactive type of control, without the possibility of extending past the immediately accessible objects.

While not present in the current corpus, a similar structure may be observed in other games, such as the rail shooter *The Typing of the Dead: Overkill* (Sega, 1999). In *The Typing of the Dead: Overkill*, the player must type specific words or phrases instead of aiming at enemies to kill them. Being a rail shooter, the player does not manipulate an avatar directly but moves from enemy to enemy. Every time they encounter a new enemy, the player is prompted to type in a new word. The game deliberately resists learning, aiming to maintain a direct engagement and urgency, by requiring the player to provide complex and ever new inputs. The reactive control granted to the player, in this case, compensates in urgency for navigational movements and fast reactions that are not available in the game.

Figure 21. *The Typing of the Dead: Overkill* Screenshot

On a lower degree of similarity, we may find set up only games (c.f. Björk & Juul, 2012) such as *Game of Life* (Gardner 1970) or *Bad Rats* (Invent4, 2009), and idle games such as *Cookie Clicker* (Thienot, 2013) or *Cow Clicker* (Bogost, 2010). If placing all of these games in the same category seems misguided, it would be. They are only similar in terms of using the physical interface as the primary hub of control distribution. However, when compared to *Detroit*, their differences serve to better illustrate the reactive type of control attributed to the player. The crucial difference is the stability of the object attributes in these games. While the physical interface remains the primary control distribution hub, relationships between objects and the ways that their affordances connect beyond the physical interface are stable. This stability allows for the emergence of more complex relationships. While in a *Detroit* or *The Typing of the Dead*, objects do not often act on one other, playing *Cookie Clicker* is both reliant on and activated by contingencies between objects. Every upgrade enables the next one to open, adds passively to the store of resources, and increases the price of the next upgrade once it is purchased. It is thus necessary to consider not only one feature of the game structure when examining the control attributed to the player, but that feature in context. The increased complexity of relationships between objects in the example games and their stable affordances enables the player to exercise primary interpretive control in their engagement (Rothbaum et al.,1982). Exercising primary interpretive control requires the player to be aware of the contingencies in their environment, and their own capacity to change their environment. The player's awareness and learning of the attributes of the objects they may act on allows for that type of control to emerge. The absence of this stability in *Detroit* means that while the player controls their environment, that control is constantly in flux. With every action, the player must pause and wait for the subsequent request of the game system in order to react to it.

Given the constant state of exploration in which the player finds themselves, exerting varied but shallow levels of control, we can conclude that the role of the player is that of an operator, constantly acting and receiving a response from the game system, without establishing a relationship of coordination with the objects making up the game environment (Vahlo, 2017). In the following, the control of the player will be compared and contextualized with the control exercised by the game system. This is intended to provide an overarching perspective of the player-game relationship in *Detroit*.

6.3.2 The Physical Interface – Game System Control

The most influenced nodes in *Detroit* are the relationships that the player builds with specific game characters. The relationships are affected by the player's choices either in dialogue with characters or in critical actions taken. Relationships, in turn, can influence other decisional junctions by providing the player dialogue choices that would be otherwise locked. However, their influence is very low, only being relevant in 3-4 notable junction points. Still, given the player's lack of prior knowledge of where those points of influence will be, coupled with the lack of direct information of the status of a relationship, and the constant reminders that the relationship will be influenced, the game is able to exert a higher degree of influence through the relationships then they have in actuality.

Considering the actions that emerge as an influential link to these nodes, relationships could be considered the endpoint of imperative choice goals (Debus et al., 2020). The player chooses a specific course of action, and the system internally tracks their choices to have repercussions at a later date. The strong influence exercised upon these nodes speaks to the frequency with which the player is confronted with choices that lock out certain other node relationships or narrative beats in the specific case of Detroit. As mentioned in the previous section, the player exercises a type of broad, reactive control over the game. Objects often respond in unique ways that cannot be determined or learned prior to the player's prompt to act upon it. Coupling this reactive type of control with the end result of relationship influence via gatekeeping choices, it can be concluded that the game system exercises control within the engagement by maintaining a degree of obfuscation of the game environment. This control by obfuscation is maintained through the ever-changing affordances of objects and the constant pruning of pathways via choices made, as reflected in the relationships affected. This type of control is resonant with the category of controlled access posited by Aarseth (1997, p 63), with the adage that it is not only access to new scriptons that is being controlled but also the means of identifying the relevant ones. The player, via the physical interface, is provided with a broad level of control over the majority of the game

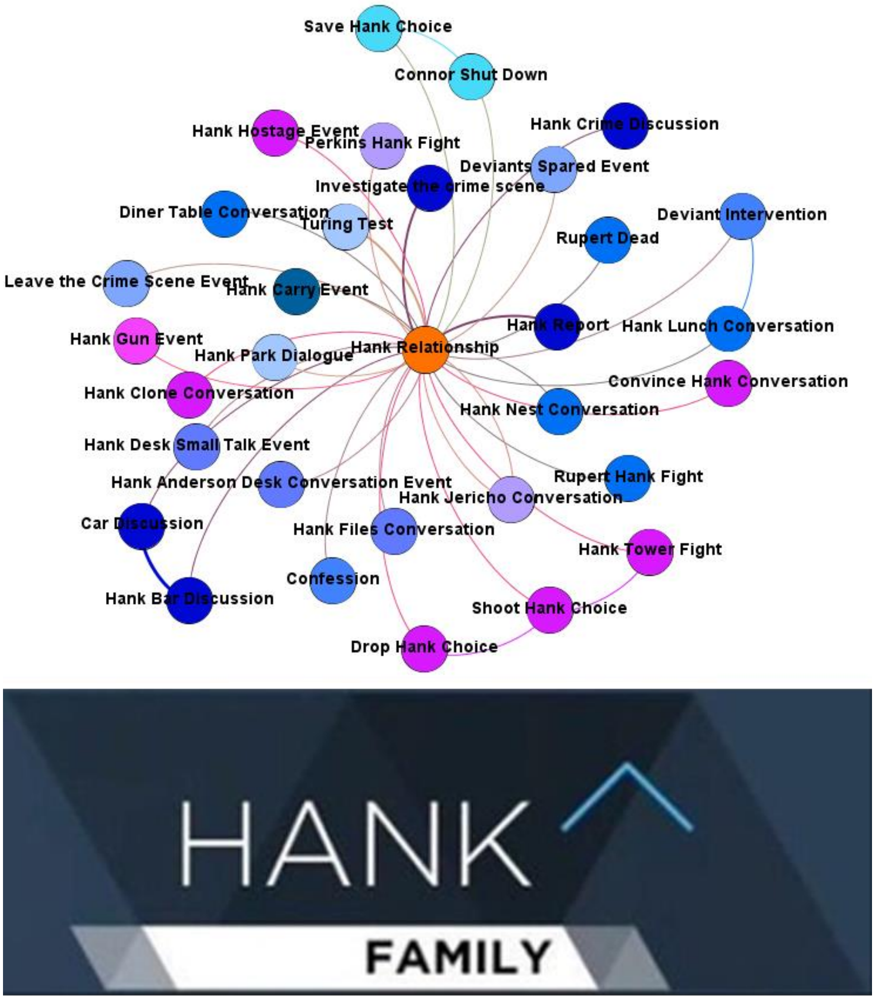


Figure 22. Ego Network of the relationship that can be built with the character Hank.

environment. However, it is only a few of the objects that are accessible that are relevant to progression or to the relationships discussed. The rest of the objects can be considered relational dead ends, and thus noise, obscuring the relevant objects. Would that make 'noise objects' deniable (c.f. Leino, 2010), or place them in the category of Intermediaries that carry on signals without changing their meaning (c.f. Latour, 2005)? I would say no. The characteristics of their affordances being similar to what would otherwise be called 'undeniable objects' is what provides the means for the game system to better exercise this control by obscurity. Through this, the game system can incentivize the player's exploratory behavior as they search the game environment for the relevant objects.

This analysis shows that the player and the game system's control can only be understood and identified relationally and within the game environment. Examining solely the objects via which control is being diffused is a valid starting point, but only in their relations can we understand the nuances of the player game relationship.

6.4.1 THE AVATAR – PLAYER CONTROL

The second network category moves one degree of distance from the player's control and concerns, most commonly, those games that present the player with the possibility of controlling an avatar. It is necessary to note that while most of the games in this category enable the use of an anthropomorphized avatar, this is not a requirement. Instead, this category also includes games like *Tetris* (Pajitnov, 1984) and *Bejeweled* (Popcap Games, 2001). Similarly, the games examined do not necessarily present only one main hub of control distribution. For example, *INSIDE* (Playedead, 2016) splits the game network into two subnetworks, each controlled by the corresponding avatar. During the first section of the game, the boy is the principal hub, while in the second section, the role is taken by the huddle. As the current framework looks at the game environment not sequenced by time or progression such dual

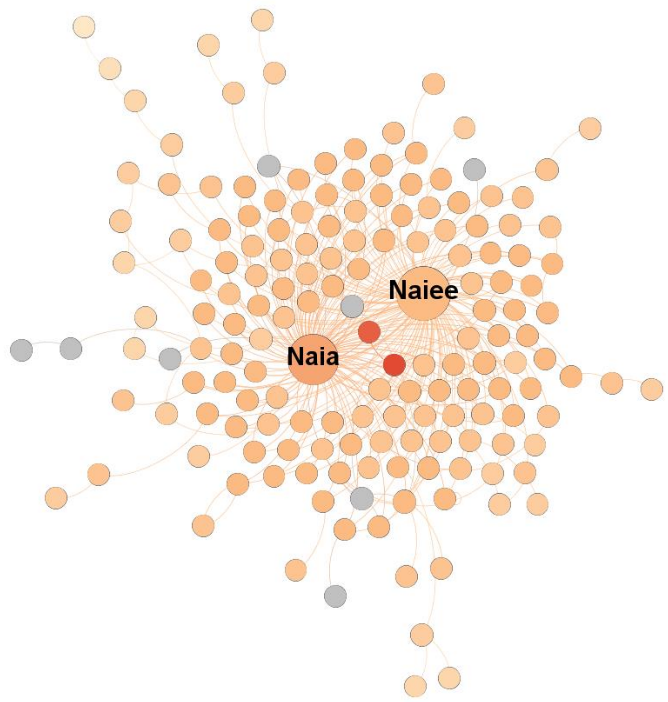


Figure 23. Network of the game *Brothers - A Tale of Two Sons* showing the two avatars as main hubs of the game

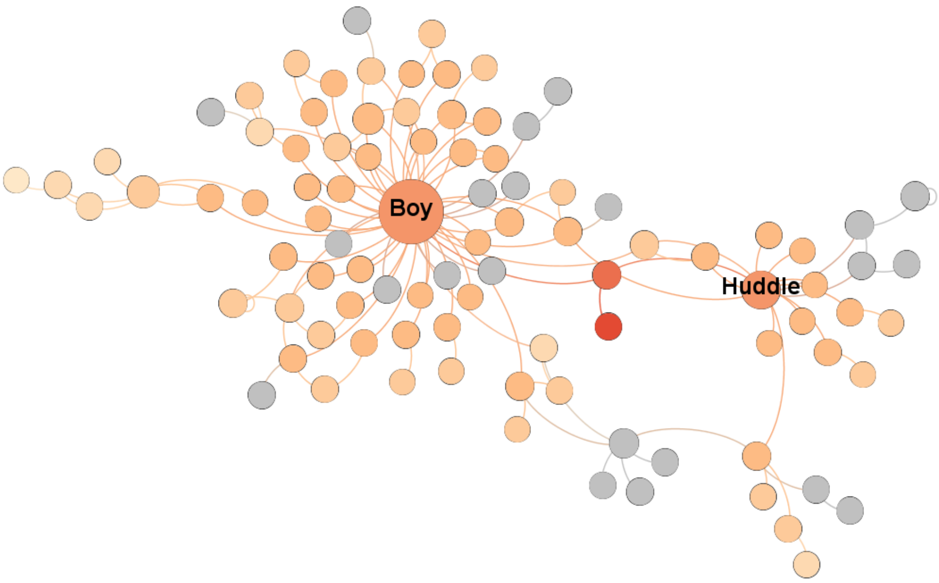


Figure 24. Network of the game *Inside* showing how each avatar is the central hub of their respective game section

hubs and the roles of the avatars in their respective sections are easy to spot. Similarly, *Nier Automata's* (Platinum Games, 2017) network is split between three avatars. The split does not necessarily occur based on progression but also other design decisions. *Brothers - A Tale of Two Sons* (Starbreeze Studios, 2013) also splits the network between two hub avatars, but the player is given concomitant control of them, each being controlled by one half of a game controller. The differences between the ways of splitting control between avatars can be observed in the network configurations. While the two brothers both occupy a central position, having similar affordances and connecting to similar objects, with few exeptions, *INSIDE* and *Nier: Automata* differentiate more drastically between the avatars, each having access to objects corresponding to their section of the game.

However split, and regardless of the anthropomorphic qualities of the objects, the overall structures of these games present in a hub and spoke configuration (c.f. Barabási, 2016), with the objects being the hubs of their respective game sections. As such, due to structural similarities, the term 'avatar' will be used as a shorthand for the role of hub located at the 2nd degree of distance from the player. While avatars have been studied primarily from the perspective of their dual characteristics of embodying both a tool of navigation and performance in the game world (Bayliss, 2007) and that of characters fitting into the game's heterocosm (Vella, 2015), the current framework is only interested in the position and role of the object in the game environment. Despite not targeting character-based games, such games naturally flock to this category due to the high proportion of attributes that connect with objects in the environment. Bayliss's statement that 'the world of *Tomb Raider* is made up of Lara units (2007, p2), and the configuration of objects in avatar-based go hand in hand. If the world of *Tomb Raider* (Eidos Interactive, 1996) is indeed made up of Lara units, made to accommodate her body, then the objects in the game environment will require her to be accessed. She thus receives the role of the principal of point control in the game environment hub.

As noted, avatars and characters have received a fair degree of attention, particularly linking them to the role of game environment gatekeepers. In her comprehensive analysis of avatar-based games, Willumsen even refers to this type of node as the 'player object', 'a concrete and integrated manifestation in the environment which allows the player to interact with other objects in the environment' (Willumsen, 2020, p. 5). Willumsen's and Bayliss's remarks, in conjuncture with the structure observed in the networks of these games, support this role of gatekeeper, bridge linking the player to the game environment. But why is this bridging quality highlighted so much in the context of the third node relative to the player compared to the physical interface? After all, access to the game environment would be impossible without support from the physical interface.

While both nodes can be considered bridges in graph analysis terms, the physical interface occupies a spot where its attributes and translation of the human inputs is desired to be seamless. The actual overt expression of the physical interface as a tool is undesirable, and accommodation to demands on this layer of interaction is considered cumbersome. The physical interface is thus put in a role of channel, which gives access but cannot itself, through its attributes, prohibit or modify actions (barring a technical failure). The physical interface thus resides in a dual place, receiving input physically, and translating it to the virtual world. A lack of recognition of input recognition is perceived as coming from the virtual objects it acts on, an unmapped button being pressed, or a command given in the absence of the required conditions. If the lack of recognition comes from the object itself, it is considered a malfunction outside of the possible affordance relationships. While remaining in the role of mediator (c.f. Latour, 2005), translating button pushes to recognizable inputs in the game environment, its perception is more desirable in the role of intermediary, a box counting for one, a direct translation of the player's gestures to the game environment. On the other hand, the status of mediator of avatar object is expected, accepted, and often even celebrated as a means of characterization (Willumsen, 2018). Avatars perform automatic actions for in the service of smoothing the actions that the players can take in the world, moving their focus on the mechanics of the game world and in the process providing strengthening the complexity of the avatar as a character. In the absence of a certain degree of automation and the collaboration of the avatar, every platformer would be *QWOP* (Foddy, 2008) elevated to impossible degrees.

This differentiation is further translated into the attributes of neighboring nodes. While in *Detroit*, the affordances of the adjacent nodes vary, forcing the player to respond anew to every encounter, in a game where the avatar is the central hub, the attributes of the objects that will be encountered can be inferred to a certain degree from the affordances of the avatar. Like the game world of *Tomb Raider* that is 'made out of Lara units,' an avatar's attribute of climbing denotes that climbable objects will be encountered, and their capability of jumping that the height of objects will play a role in the upcoming encounters (c.f. Fasterholdt et al., 2016). In this sense, then, the avatar acts as a point of access to interaction with the objects in the virtual world and a point of access to information about the performance that is expected. Sustained reliance on the capabilities of the avatar, repeated appeal to their affordances then allows the player to engage in the process of learning those capabilities and completing the cycle of exploration and coordination as described by Vahlo (2017).

Thus, avatars can be considered to occupy the role of gatekeepers. Freeman describes a gatekeeper as 'the keeper of the gate controlling communication to and from a particular person vis a vis the rest of the network' (Freeman, 1980). The 'to and from' part of the description is of particular interest. While, as discussed in previous literature, the role of the avatar as a tool to act within the game environment has been discussed, its role of communicating back to the player is key to the structure of the network. Via the stability of its inscribed affordances, the avatar acts as a constant point in the engagement. This has two repercussions: the possibility for the player to learn the means of engagement with the game environment, and subsequently, the possibility of creating longer, more complex relationships between the objects in the game environment. Once the player is secure in their knowledge that the avatar can, for example, grab and throw an object, the affordances of the target objects can come into the exploration and coordination process. The stability of affordances is just one side of the requirement, as discussed in one of the following sections. Their diversity, which enables the avatar to be both the effector and the receiver of exercised agency, influences their role in the game network.

However, the differences between the two hub types lie not only in the stability of the affordances of the objects in the game environment but also in the hubs' distance to the player. Examining instances where the role of the avatar changes temporarily can provide insight, by contrast, into their general role in games where they are the principal hub. While there may be instances in which the relationship between the avatar and the physical interface is brought into focus, their general correspondence allows them to remain blackboxed. However, sections where this relationship is disrupted, show the differences between the roles fulfilled by the two node types, like the avatar's role in sharing the responsibility for the player's actions. For instance, in *Spec Ops: The Line* (Yager Development, 2012), when the action of dropping white phosphorous upon civilians is required to progress, the player's control of the avatar is removed, and they are given access to the action directly via the physical interface. The developer's intention of underlining the player's accountability (Orland, 2012) for actions taken in a video game thus finds a channel through the chain of object mediation. Given the possibility that this disruption creates such an effect. Another example of such interruption is encountered in *The Missing* (White Owls, 2018). The game establishes from the outset that the avatar is harmable and can be dismembered by harmful objects. The avatar's attributes come heavily into play in the design of the puzzles. Her body and her body parts, obtained via dismemberment, are integral objects required for progression in the game. The player accesses the other objects solely through the avatar, placing her in a position of being crucial to progression and in a position where the autonomy of her body is overtly given to the player. The player moves her, other objects harm her, and, central to this example, the player may also heal her. The avatar possesses the affordance of being healed through the physical interface. Towards the end of the game, however, the possibility of healing the avatar is removed from the players' access and becomes a function that the avatar automatically performs when coming into contact with harmful objects. By taking ownership of the healing function from the player and interposing herself on the route of achieving the progression goal, the relationship between the player and the avatar as collaborators in the process of game progression is made overt.

To examine the two identified differences in unison, let us compare two instances in which the progression in the game requires a rapid response via a different control hub. In *Fruit Ninja* (Halfbrick Studios, 2010), the player is required to slice fruit by swiping the screen of their phone, trying not to touch the bombs intermingled with the fruit. There is no other object interposed in the relationship, just the player's gestures on the physical interface. Demands in reaction time in this situation fall squarely on the player's physical capabilities as there are no other objects upon which action may be delegated. Turning to the other example, we can look at one of the side quests in *Nier Automata*. To complete the side quest 'Speed Star,' the player must race an NPC and reach the designated finish line before they do. The race is undertaken via the avatar that the player controls. Whether or not the race is successfully completed depends not only on the player's inputs but also on the avatar's speed attributes, the height of their jumps, and the length of their dashes. Multiple other objects that affect the avatar's speed can be brought into the relationship, such as consumable speed salves or plug-in chips that have a more permanent effect on their movement. The player's gestures via the physical interface are, of course, also essential to completing the quest – standing still or failing to jump when necessary leads to failure. Nevertheless, the intrinsic speed property of the avatar is overtly brought into the relationship, mediating the inputs of the player. Reaction speed is thus partly delegated to the avatar and the other objects that may affect the attribute. The responsibility that falls on the player's physical capabilities is diffused through the multitude of objects that are part of the engagement. Thus, while both the avatar and the physical interface are, in actuality, mediators, translating the physical inputs of the player to actions within a game environment, the roles that they fill highlight or diminish that capacity.

While the previous section described the player as being appointed an operator role, exerting a shallow but extensive reactive control, games in the current section appoint them with a vicarious control within the game environment by, as Rothbaum et al. (1982) states 'allying themselves with a powerful other'. The vicarious control that avatars grant players to, together with their status as 'powerful other', given by their hub quality, justifies the research interest into parasocial relationships (Seung-A & Namkee, 2009), as well as attitudinal change (Behm-Morawitz & Mastro, 2009), behavioral change (Sah et al., 2016) and empathy (Gutierrez et al., 2014) engendered by playing alongside them. However, the research focuses only on the relationship between the player and the avatar, not on that relationship contextualized within the game environment. Given the stable and diverse range of affordances that avatars have, as mentioned, their influences are exercised broadly within the game environment and enable more complex relationships between objects. Their relationships require players to reflect on and understand the affordance couplings and how they can be used to reach the desired state in order to advance in the game. This enables the player to exercise what Rothbaum et al. (1982) call interpretative control, or the capability to understand the current state of the environment and ones' possibilities of changing them. When taking a perspective that contextualizes the avatar's role as powerful other within the broader game network, the general assumptions that the avatar inspires admiration and a desire for emulation (c.f. Sherry, 2006) leave room for focusing on topics outside of the player-avatar relationship. This refocalization from the relationship between the player and the avatar, to the relationship between player and avatar in the context of the game, has the secondary consequence of bringing into discussion games where the relationship between the player and the avatar does not involve an anthropomorphic avatar. Lara and the active tetrimino in *Tetris* may not have the same visual qualities, but they may enable a similar type of control for the player in the game, thus offering a stable point of comparative analysis.

6.4.2 The Avatar – Game System Control

As the previous game system control section, the current section will analyze the control exercised by the game system from the perspective of the most influenced nodes in the game.

The games entering into this category present, broadly, two types of nodes upon which control is exercised, and thus two types of control that the player must contend with.

The first type of node upon which influence is exercised the avatar itself. The avatar being affected, especially when that influence is exerted on the health pool of the avatar, points towards the avatar's survival as a prerequisite for maintaining the game engagement, or as Debus et al. (2020) state, the avoidance of removal. As mentioned in their discussion of removing the concept of survival from their typology, survival can be considered a prerequisite on top of which further imperative goals can be built. It is intuitive that an avatar must stay alive in order to reach the designated end position, for example. This strategy is understandable and similar to the decision made in constructing this framework to remove invariably stable relationships between affordances from the analysis, such as that between the health pool of an avatar and their mobility. However, at this point, the differentiation between the analysis of the game as a monolithic work, and the granular analysis of the engagement between the player and the game become apparent. It may be misleading, or at the very least incomplete, to describe *Super Mario Bros.* (Nintendo, 1985) as a game about survival. The imperative of the game system is that Mario reaches the castle. However, the entities that populate the game environment do not try to prevent the imperative goal 'reach' by erecting walls around Mario, moving the castle, or bugging out his navigation system. Reaching the castle becomes a challenge because the attempts at reaching it are contested by the armies of Goombas, Koopa Troopas, and Bullet Bills, who try to affect Mario's capability of staying alive. The necessity of highlighting this differentiation between the momentary imperative and the final imperative of the game is visible in cases where the two are interchanged.

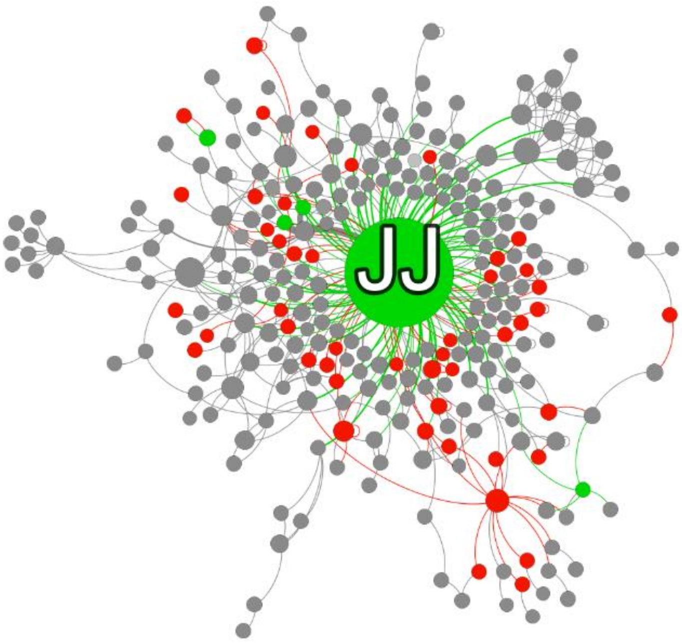


Figure 25. Full network of *The Missing*. Nodes are scaled by their influenciability. Harmful objects are colored in red.

The second type of nodes that are most affected in this type of game are nodes representing enemies. This is a variation on the control exercised on the player's possibility of maintaining the game engagement or surviving. The differentiation between the two types of games comes not from the types of nodes that are influenced but the network structure that enables them to be. A high degree of influence towards the avatar means that while it is acted upon in various ways, its means of acting on the enemies are limited. Take the example of Mario above. While Mario would, in the limited relationship network described above, have an in-degree of 3 (three different enemies are acting upon him), each of the enemies enumerated would have an in-degree of 1 (only Mario would act on each of them, by jumping on their heads). However, in cases where access to the enemies is varied, by providing the player with a choice between multiple types of weapons, the status of nodes would change regarding their degree of being influenced. Thus, while the control exercised by the game is the same, the control exercised by the player leans more towards an interpretative control, of being aware of their environment and their means of using the objects found therein. Examples of games found in this corpus that enter this category are *Super Hot* (Superhot Team, 2016) and *Downwell* (Fumoto, 2015). In *Super Hot*, almost every object in the game environment can be weaponized, thus being the quintessential example for a high degree of interpretative control. *Downwell*, however, presents a more interesting edge case. While the relationships are similar, with the enemies being affected by the majority of objects in the game environment, access to some of those objects is managed by the game system. *Downwell* has some characteristics generally associated with roguelikes, meaning that the game environment, including the weapons that the player may use, change according to specific parameters during every playthrough. Thus, while one playthrough may

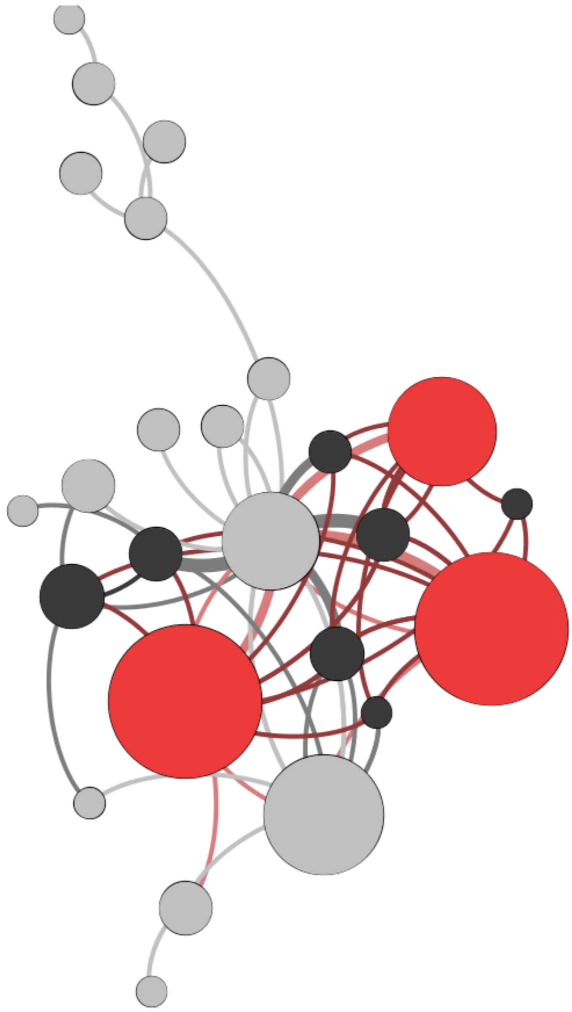


Figure 26. Network of the game *SuperHot* scaled by the most influenciable nodes. The enemy nodes are colored in red, while the weapon nodes are colored in black.

resemble the structure of *Super Hot*, the game system exercises a type of control over specific node types that the player must mitigate through further reflection and exercise of interpretative control.

Perhaps the most evident example of the difference between having the avatar or having tertiary objects as the most influenceable nodes are survival horrors of the kind of *Amnesia: The Dark Descent* (Frictional Games, 2010) (henceforth *Amnesia*). In *Amnesia*, the player roams the corridors of a mansion infested with dangerous monsters, but also helpful other objects, such as medicine, a lantern, and matches. The monsters can act on the avatar, but crucially, the player has no objects at their direct disposal with which to act back. Thus, the avatar takes its place as the most influenceable node, and the game system exercises control very clearly on the player's capacity of maintaining the game situation. The helpful objects also act on the avatar by helping manage his sanity. The avatar thus becomes the site of a tug of war between the game system's attempts to end the engagement and the player's resistance.

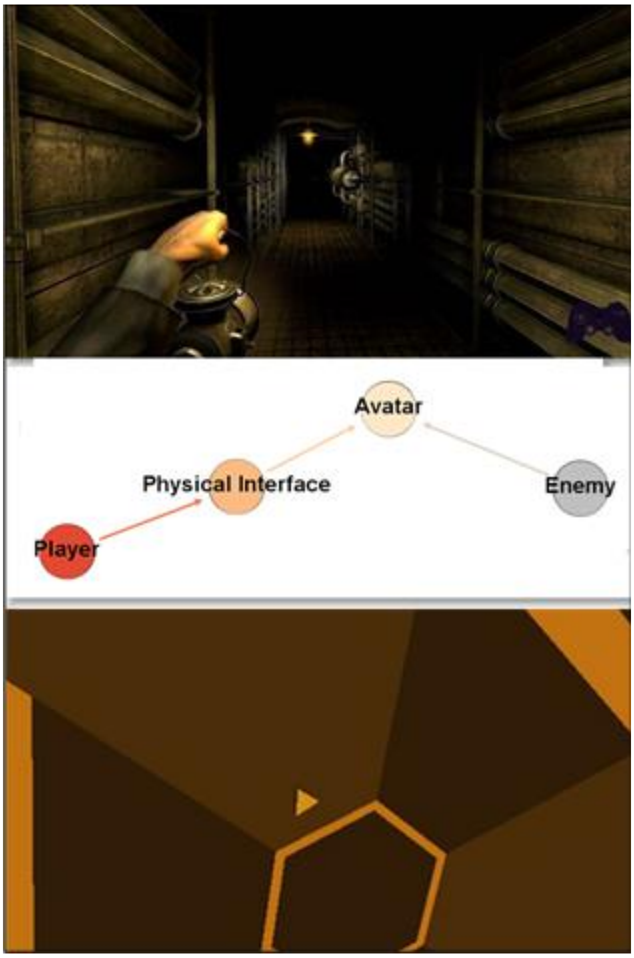


Figure 27. Screenshot from *Amnesia: A Machine for Pigs* and *Super Hexagon*, along with the full network of the game Super Hexagon

Perhaps horror games of this sort noted for their challenges of player agency (Krzywinska, 2002; Boonen & Mieritz, 2018) could be seen as a challenge to the vicarious control afforded to the player by their alignment with a powerful other. After all, these characters can be seen and are portrayed as anything but powerful. However, here, the position of this framework towards agency becomes visible. As agency is not considered quantifiable, increasing and decreasing, neither can the character in *Amnesia* be considered disempowered. The reconfiguration of the network and the roles that the player and the game system take in their negotiations over the avatar's body is the target of the framework, along with the capacity offering a common point of comparison between games. While Amnesia presents the avatar's body as a site for negotiation, its sequel, *Amnesia: a Machine For Pigs* (Frictional Games, 2013), removes the helpful items from the game while maintaining the presence of the menacing monsters. This change in the network of relations removes the player's possibility to act on the avatar's body, counteracting the game system's control through it. Instead, the network is reconfigured to a position where the sole means of maintaining the game engagement is via avoidance. This makes the network of *A Machine for Pigs* surprisingly more similar to the network of *SuperHexagon* (Cavanagh, 2012), a minimalistic puzzle game where the task of the player is to dodge incoming harmful walls than to its predecessor. The power of the 'powerful other' is thus not limited to general appraisals of power; it remains in the role of marker for a specific type of network structure, leaving room for more in-depth comparisons between unintuitively related games.

To conclude, the control that the game system exercises in these types of network configurations is the most general but also the most drastic type of control – control over the player's possibility of remaining in the engagement. The possibility of exercising this kind of control is not arbitrary but a consequence of the network structure. This structure corresponds to the hub and spokes network model (Barabási, 2016), wherein a singular hub can be considered a point of failure. Establishing one node as the principal hub that connects with the majority of the objects in the game environment and exists as a bridge between the player and said objects, opens the possibility for the easiest way of challenging the engagement with the game to be through that hub. Failures that occur outside of the route between the player and the hub node, and implicitly do not affect the hub, are inconsequential to the possibility of maintaining the game engagement but may have consequences over the experience of the engagement. However, changes that affect the hub node are more likely to have consequences on the possibilities of the player to maintain the game engagement and have access to an equivalent game experience. For example, a Goomba colliding with a Koopa Troopa will change each of their directions, possibly affecting the player's next move. However, it will not directly impact Mario's health.

6.5.1 3RD-DEGREE NODES – PLAYER CONTROL

The third and final category of network configurations observed contains games where the hubs are located in the 3rd degree of separation from the player. The principal example from the corpus that presents this feature is *Stardew Valley*. *Stardew Valley* (henceforth *SDV*) presents the player with the possibility of developing a farm, where they can grow fruit and vegetables, raise animals, build relations with the locals and occasionally venture into the Mines dungeons. *SDV* is the largest game examined in this corpus, and though in the sheer number of objects

Detroit comes close, the complexity of the object relations surpasses it. This is partly due to the type of objects that occupy the role of hubs in *SDV* – the tools. While the avatar maintains the role of primary hub, the tools exert control over specialized sections of the game's network. Unlike the previous game examples where the player's exercise of control was concentrated in one hub, *SDV* presents the players with a second junction in branching control. Fish can only be caught by using a fishing pole, ore may only be mined with a pickaxe, and trees can only be felled with an axe. While certain activities like removing furniture present an overlap in the tool that can be used, the activities that make up the life in the countryside presented by *SDV* are generally gatekept by a specific tool. The effect of this gatekeeping via tools in the game's network is the creation of modules of access to the game environment.

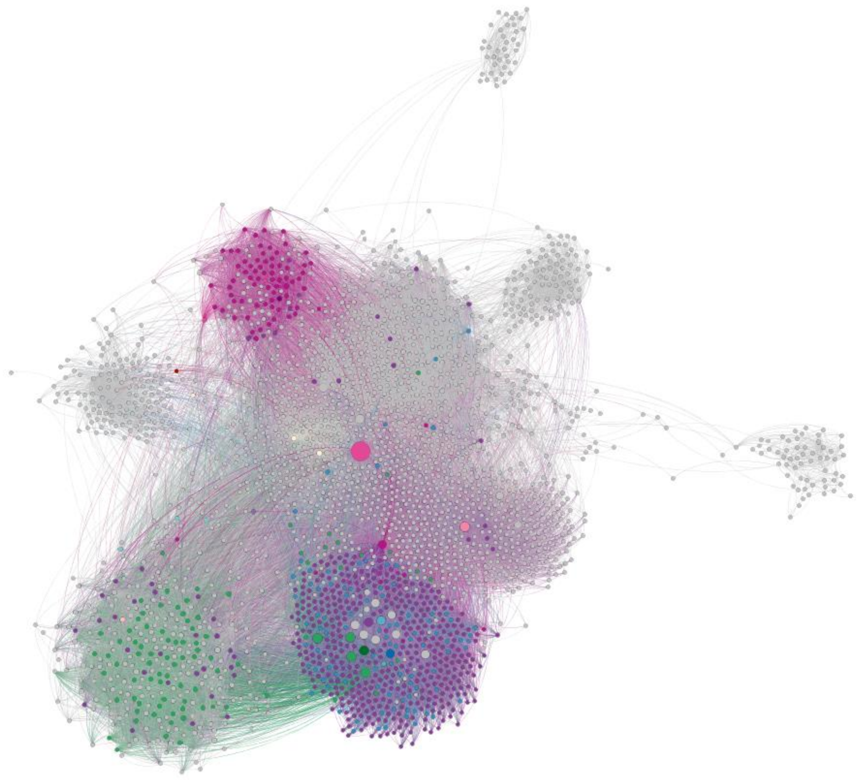


Figure 28. Network of the game *Stardew Valley*. The colored nodes represent the tools, and their neighbours. Each tool type is given a different color

The process of splitting up the game environment into modules at this degree of distance from the player has three distinct effects. The first one is that it more heavily requires and allows the player to exercise their interpretative control. The creation of hubs at the third degree of distance denotes the fact that the player's control is diffused via a greater number of nonhuman agents, who modulate the input of the player via their affordances. Thus, the player's awareness of and familiarity with the objects in their game environment is key to maintaining a relevant presence in the game. This is compounded by the second effect of modularization, that of enabling the creation of more complex relationships. Given that the hubs present here appear at a larger distance than the ones previously discussed, far more agents are coopted into each action.

Another structural effect that occurs is the establishment of cross-modular relationships. One sequence of cooking a recipe requires that the player dig the earth using a hoe, plant a seed, water it, wait for the appointed time, pick the vegetable and take it to the stove so that they may access the cooking interface and finally cook the vegetable. This sequence requires the cooption of 3 different hub tools – the hoe, watering can, and stove – and multiple other objects - seeds, vegetable recipe – that in themselves may be gatekept by smaller hubs such as currency and vendors. From such a small examination, it already becomes apparent that, while modules appear on a high level via the tools, the module pattern takes on fractal-like qualities, manifesting across more and more localized spheres of influence.

The third and final consequence of this modularity is the possibility that the player may engage in activities enabled via any of the hubs, according to their preferences. This structure presents more flexibility than the mono-hub structures presented in the previous sections, and thus, through flexibility, present a lower risk of failure. Failure here should be read as a failure to maintain the game engagement. More points of control distribution means that, should one be dismissed, the others can take its place. This should not be confused with a claim to a nonspecific type of player freedom and agency but to their capacity to choose the avenue of entangling themselves into the complex relationships created by the different hubs and their neighbors, along with the possibility of stopping said entanglement when a different avenue becomes viable. Quantifying agency in this manner would be undesirable. The complexity of the relationships enabled by this structure makes the computation of pathways that the player can take impossible. The strength and distinctiveness of this configuration lies instead in the players' possibilities of diffusing their control and allying themselves not with an all-powerful other but with many, more specialized others. The implications of this will be discussed further in the next section.

6.5.2 3RD-DEGREE NODES – GAME SYSTEM CONTROL

The discussion regarding the control of the game system will be different from the ones carried in the previous sections. Aside from the tools that the player can access, a second hub is noted, with a similar degree of influence, but which is outside the player's control. While discussing influence outside of the control of the player has not been the norm thus far, I consider that in this case, it is integral to the understanding of the control exercised over the player. The node I am referring to is time. In *SDV*, most of the objects populating the game environment are influenced in some way or another by time. Vegetables have a specific number of days that they need to grow, and a specific season during which they can be grown, NPCs can be found in different locations depending on the time of day and day of the week, and fish and items that can be foraged appear according to the current season. Time also influences the player, by having them pass out if they are not in bed by a certain hour. The player has a modicum of influence over time by being able to use the bed object and sleep, thus advancing time by one day. However, this limited influence does not override the amount and modes of control that time has over the other objects in the game. Via the examination of time then, we can observe one of the types of control that the game system exercises on the player – control over the pace of the engagement.

In-game time does have an equivalent in real-time, with one day lasting approximately 15 minutes. It may be inferred that the game exercises control over the player's engagement by dictating the natural exit points at the end of the in-game day or by incentivizing prolonged engagement by chunking their time into manageable sequences. But the focus of this analysis does not fall in that sphere but in the effects, that time has on the momentary engagement in the game environment. As noted in the previous sections, the range and nuances of the control exercised by the game system cannot be grasped in a vacuum but only if contextualized within the greater game structure. Modularity emerging from the implementation of multiple fractal hubs was concluded to allow the player to engage in deep, complex relationships, coopting multiple others. A choice to act on or through a hub object may lead to the gravity sphere of another and so on. Time is then inserted as a regulating factor in this traversal of hubs, injecting a soft, non-imperative choice into the matter. When deciding to engage in a specific path, the player is indirectly controlled by time via its influences on the objects on that path. Nowhere is that more apparent than in *Stardew Valley*'s winter season.

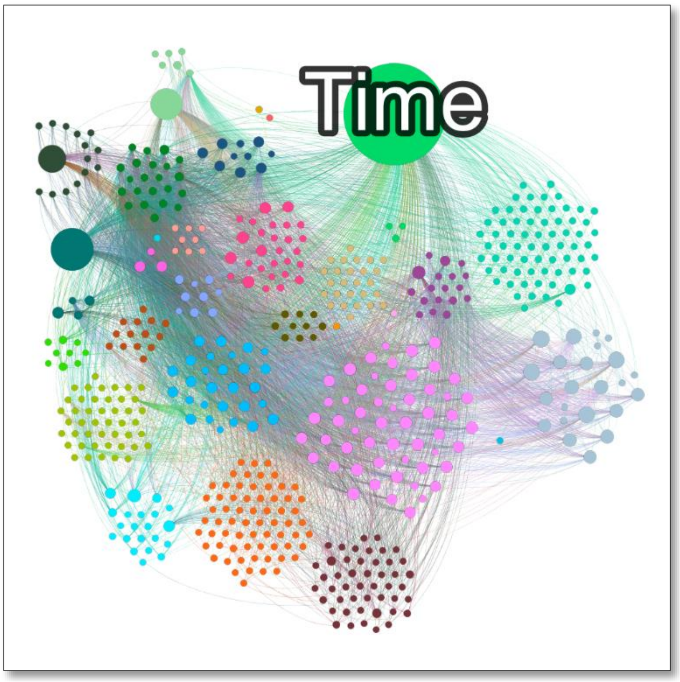


Figure 29. Ego network of the Time object in *SDV*. The nodes are colored by type - for example fish, characters, plants

During winter, the player can temporarily no longer plant vegetables in the ground. The vendors that sell the seeds do not have seeds in their inventory, and nothing, save specific foraged items grows then. The hub nodes connected to the growth of vegetables, along with their neighbors, are then temporarily disconnected from the possibilities of engagement. The player is left with specific other options, fishing, cutting trees, or venturing into the mines. Thus, the game system, via the time object, not only controls the pacing of the game by dictating the speed with which events unfold but exerts a type of localized interval control (c.f. Elverdam & Aarseth, 2007). Time grants access or denies it, not only to specific items but the entirety of their neighbor network, thus limiting the player's possibilities of acting in the game environment. It's not only that vendors are affected, for example, but the entire range of objects they sell. This type of pacing control is thus not a matter of control of the speed with which actions are being performed, but a filtering of the affordances that the players may access.

It is worth noting in this section that time-based constraints are counted among the three 'dark design' patterns presented by Zagal et al. (2013), being split up into two subtypes: grinding and playing by appointment. The authors define a dark design pattern as 'A dark game design is a pattern used intentionally by a game creator to cause negative experiences for players that are against their best interests and happen without their consent' (Zagal et al., 2013, p. 7). Does this kind of pattern and description match the type of time-based control that appears in *SDV*? Yes and no. Playing by appointment, for instance, appears in a transformed manner where the game time is the one that dictates the appointment and not its corresponding real time. The NPCs have a certain schedule that the players must respect if they want to interact with them, but that schedule will always loop within the 15 minutes of allotted real-time. Grinding likewise appears. The player can advance their relationships with the townspeople through repeated gift giving and can obtain more powerful tools and weapons by providing the appropriate vendors with the right, hard-earned resources.

Do temporal patterns then invariably result in a dark design? To attempt an answer to this question, we can compare *SDV* with *Farmville* (Zynga, 2009), likewise a farming simulator, and an example of dark design patterns provided by Zagal et al. (2013). Speculatively, *Farmville* can be said to have the same modular structure as *SDV*. Specific nodes are gatekeepers to smaller areas of the game. Water or the Feed Mill are the *Farmville* hub equivalents to the tools in *SDV*. Time acts on the level of both hubs of this game, and in both games, advancement helps mitigate the influence of time by opening up more and more of the network. However, *SDV* ensures that the hubs governing its modules are affected by time in alternative modes. For example, activities including fishing, farming, and crafting are affected by time. A vegetable takes a certain amount of time to grow, and certain vegetables can be planted only in specific seasons. Likewise, certain fish can only be caught at a specific time of the day and in specific seasons. Similarly, placing a piece of wood in a kiln will take a predetermined amount of time to turn into coal. The examples then present activities that are both time-locked and modulated by time. While crafting and farming are time-locked, fishing is only modulated, being influenced by time but not becoming unavailable. One can fish in any season, at any time of day, but will catch different fish. In *Farmville*, however, the time lock is the principal mechanism. Once a crop is planted, a certain amount of real-time must pass for it to be harvested. Once the water reserves are depleted, each charge will take a specific amount of real-time to replenish.

Thus, while time modulation dictates the game's pace by funneling the player to available avenues, time locking affects the disponibilities of the objects to be accessed by the player. Impeding the capacity of accessing the game objects, *Farmville* minimizes the possibilities of access to the game network. Thus, while not actively terminating the game engagement, it leaves it in a state similar to accessing a static web page more than accessing a game. Thus, while *SDV*'s time object exercises control over the pacing of engagement, *Farmville*'s time exercises control over the engagement itself. Based solely on this, it is difficult to make a case for the 'darkness' of the design pattern. However, this comparison opens up the possibilities of finding variation in such patterns and more clearly understand the possibilities of their misapplication.

So, how would changing aspects of *SDV* percolate through the network? As observed in the previous section, altering certain game features may radiate unpredictably and unwantedly through the network, affecting aspects of the engagement that are not targeted for change. This effect is compounded by the hub status of the avatar, which acts as a gatekeeper to the player's access in the game environment, and aside from exerting the most significant amount of influence, it is also the most influenceable object. This structure is quite different from the modular structure of *SDV*. While the avatar maintains a high degree of influence here as well, their influence is parallel to the influence of other hubs, mainly the tools. For example, once a tree is chopped off using an axe, the avatar picks up the resulting wood. The avatar may also shake the tree to obtain fruit, but it may not chop it off by itself. Their influence thus exists in parallel to the influence of all of the smaller hubs, being thus quantitatively large but not all-encompassing. The existence of multiple hubs has thus the effect of localizing the effects of eventual changes to the game. If an element is eliminated, such as the players' rewards from killing enemies, the percolating effects will be more localized. While the player may not be able to complete certain quests or construct certain buildings, their possibility of engaging in the parts of the game dominated by other hub structures will not be affected. This would provide a less disruptive intervention into the game structures and help ensure that the player's experience is affected only in the areas in which the change is desired. However, the sprawling structure of such modular games also makes observations of engagement following such changes more difficult. Playing through such a complex game with all of the access modules can take a long time and lead players down different paths. The next chapter, which will look at the typology of momentary game situations, intends to address the issue of feasibility of changes in a short engagement.

6.6 Discussion

The current chapter has provided an example of the possibilities of macro analysis of games using the object-network framework. The analysis focused on the control exercised by the player and the game during the engagement, by looking at the most influential and influenceable objects in the game, and their interplay, in the greater structure of the game. The games in the corpus were found to fall in three categories with regards to the control afforded to the player, depending on the location of the influential object. This localization of control points within the network, coupled with their contextualization within the network structure, was then mapped onto the types of primary control described by Rothbaum et al. (1982).

In the first case where the control is funneled via the physical interface, the player is found to have a reactive type of control. This occurs when the game system continuously changes its means of acting in the virtual world. In its turn, the game system exercises control by obfuscating the consequential objects with noise objects. The second type of networks examined contained games that diffuse control via the avatar. Being the principal hub of control and the gatekeeper to the player's engagement with other objects in the game environment, the player's control in the game is through alignment with a powerful other. The stability of the avatar's attributes allows the extension of the relationships with more distanced objects in the network. It thus allows the player to exercise interpretative control in the game, understanding the problems presented and coopting the agencies of the relevant objects to solve them. The status of the avatar as both the most influential and most influenceable object in the game enables the observation of the control exercised by the game as being related to the very possibility of maintaining engagement with the game. The hub and spokes structure of the game network makes any changes that relate to the avatar to impact the player's capacity to maintain engagement with the game, and due to its centrality, it's very possible that they will. The final category includes networks where control is exercised through objects with a 3rd degree of separation from the player. This diffusion of control via a multitude of objects leads to the formation of fractal hub formations, allowing the player a higher degree of interpretative control. The player is allowed to choose their route and rely on the assistance of multiple specialized others. In its turn, the control exercised by the game is observable not via the most influenceable node, but via a node with a similar degree of influence that is outside of the player's control – time. By controlling the time element, making time a scarce, uncontrollable resource, the game system constrains the pacing of the engagement, asking for the player's commitment when commencing engagement with one of the routes dictated by the hubs.

The analysis provided in this chapter is intended to be only a demonstration of the possibilities of analysis enabled by the method, and as such, it is incomplete and expandable. One possibility of expansion is by including other games in the analytic corpus. While the analysis performed presents networks that fall in discrete categories, hybrid game examples can be found. An instance of this is *House Flipper* (Frozen District, 2018), a game where the player can buy and redecorate houses, selling them for a profit afterward. The player's access to the game environment is through an avatar, matching thus the configuration of networks found in the second category. The configuration of the rest of the game may be speculatively likened to that of *Detroit*. The game presents a series of buyers interested in the house, each with specific requirements for the living space. The avatar, however, can access a multitude of decorative objects, each of which may or may not appeal to the interest of the buyers. In this sense, *House Flipper* presents similarities with Detroit regarding the game system's exercise of control by obfuscation. *House Flipper* then may take on a hybrid quality when confronted with the network categories discussed in this chapter. One of the core pillars of the current work is that games are heterogenous artifacts, so hybrid configurations are accepted and welcome, and will provide more insights into the control distribution between the player and the game system.

Hybridity may also emerge within layers of granularity. As will be explored in the following chapter, multiple configurations of relations, eliciting different types of control, may emerge within a single game. Some of those situations, or even configurations appearing at an intermediary level of granularity, may espouse traits observed as being dominant in other network types. Take Fizek's (2017) description of *Fallout 4* (Bethesda Game Studios, 2015) as an example:

> 'Automation of play manifests itself also in the autonomous nonhuman agents traversing the game worlds. One of the most recent Fallout 4 (2015) mods, Sim Settlements (2017), provides a very illustrative example of this. The mod makes non-player characters build their own housing, plant their own crops, even work in shops they themselves construct. The human player is welcome to the city building algorithmic spectacle as a bystander or a

delegating agent rather than an active performer. The non-player characters no longer wait for the player to micromanage them; instead, they metaphorically and literally take matters in their own hands, in a similar way to the delegated gameplay model known from god-simulation genres.'

Thus, *Fallout 4*, in the settlement part of the game but not necessarily others, becomes a hybrid of an avatar-based game and the *Game of Life*, wherein objects relate to each other without the player's control. However, relevant to the moving levels of granularity enabled by this framework is the localization of this occurrence within the area of the game concerned with settlements. The possibility of extracting insights on a medium level of granularity in the analysis is also a practically helpful feature. Mapping the objects relations of a complex game such as *Fallout 4* will be a very time-intensive task. Thus, the granularity of the analysis can be left up to the interest of the researcher, with the caveat that conclusions drawn a lower level of granularity benefit from contextualization within the game network as a whole.

The following chapter will move from the macro to a micro-analysis of the player-game engagement and provide an expandable typology of momentary game situations. As the game situation emerges from and is located in the greater game network, the two types of analysis are meant to be taken together and applied in concert. While the current chapter provides the context for the emergence of situations, the following one is meant to provide a functional unit for segmenting the player's engagement with the game.

Chapter 7. Situation Typology

7.1 Introduction

The current chapter moves from the macro perspective to a micro-level of analysis. Following the examination of the entire game networks, we can now have a closer look at their component parts, or what has been termed throughout this work, 'the game situation.' As discussed in Chapter 4, game situations are momentary configurations of objects linked by their attributes. By examining the neighbor networks, that is, the immediate connections, of the objects present in each game network, it is possible to observe the configurations in which they are present, and thus how the player may use them, how they modify the player's actions and what kind of control they enable on the part of the game system. All the situations include the player and the physical interface, as they are necessary components of the formation of the situation. In their absence, the player would have no means of actually engaging with the game, and thus a situation would not be formed due to the absence of a participant. Examining the resultant small networks allowed for the bottom-up construction of the situation typology.

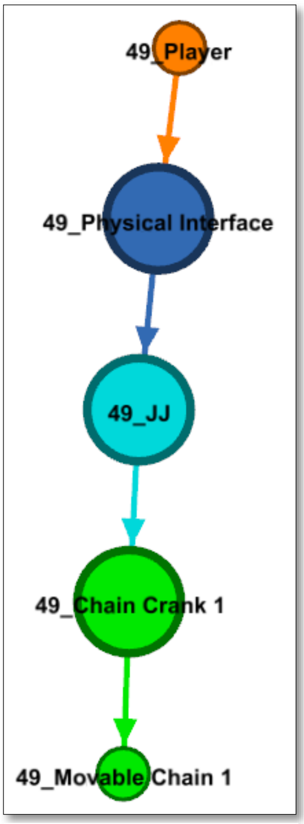


Figure 30. Situation network obtained from the game network of *The Missing: JJ Macfield and the island of memories*.

As they were obtained from the entire game networks, the analyzed neighbor networks consist of observed interactions between game-specific objects, as illustrated in Figure 30. The neighbor networks were then analyzed and grouped according to the directionality of their influence. In the example illustrated, we can see that the player exerts influence, via the physical interface, on the avatar, the playable character JJ. The avatar, in turn, acts on the chain crank, which moves the chain. The player is thus considered to have an active influence exercised at first on the avatar, which then translates that influence and transmits it further through the complementary affordances they have with the crank – they grab it and move it in place. The same process repeats itself with concern to the crank and the chain. There are no observable relationships directed towards the avatar or other objects under the player's control; thus, the game system is considered, in this situation configuration, not to have an active influence in the situation. However, the requirements surrounding the order of use of the objects, dictated by their linking affordances, points towards a passive type of control, one that guides and molds the player's behavior. The player is unable to act at will, first on the chain and then on the crank, but are expected to incorporate the affordances of the objects into their own behavior.

The first step in constructing the typology was thus identifying the directionality of influence elicited by the game objects. This allows the observation of the type of control that the participants exert in the situation – passive or active. If a player-controlled object, such as an avatar, was observed to transmit control further in the network, it was considered that the player has an active type of control. If the inverse was true, and a game object was observed to elicit control over a player-controlled object, the game system was considered to elicit an active type of control. If no directional relationship was observed between a player-controlled object and another object, or vice-versa, the participant was considered to elicit a passive type of control. These categories naturally result in four combinations of situation categories:

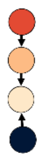
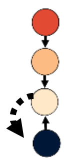
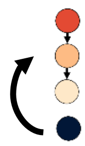
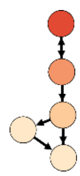
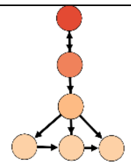
- Game Active / Player Active
- Game Active / Player Passive
- Game Passive / Player Active
- Game Passive / Player Passive

However, the final combination was not encountered, and it is not difficult to see why. If neither participant exerts an active influence, then an observable link is not formed between game objects and is not present in the game network. This may include cases in which the game is not engaged with actively, and the entities may enter an idle state. While this is frequently encountered in games, with avatars often being provided with idle animations to fill the engagement gap, they are not considered to create game situations, as the two participants would be effectively missing.

As this step concerned only the directionality of the influence exerted, a further categorization was necessary with concerns to configuration. The objects involved in the situation were analyzed in terms of their role and the means through which they allow each participant to exercise the corresponding type of control. By role here, I am specifically referring to their role in transmitting the actions acted upon them. This included asking questions such as:

- What is the object's influence over its neighbors?
- Is the object required for access to its neighbors?
- Does the object depend on any conditions to be accessible?
- What is the closest participant to the object, the player, or the game system?

The questions asked intended to elucidate them the extent to which the object exerts influence in the relationship, along with the direction of that influence. Situations were categorized then according to their object configuration, irrespective of the exact number of objects appearing. That means that if one sequence-based situation consisted of 5 nodes, like the one in Figure 1, and another sequence-based situation consisted of more nodes, including two avatars as situations in *Brothers: A Tale of two sons* generally have, they were placed in the same category. The number of nodes present in the situation is not considered to be irrelevant. The more actors are coopted in the situation, the more agencies are exercised, and the more complex the situation may become. However, it could be a more analytically productive idea for an analysis of that type to be conducted on a type-by-type basis. That would allow an understanding of the effects of scale when the types of control and the node roles are maintained constant. For now, however, my analysis stops at the development of the situation typology illustrated in Table 3.

Control Distribution	General Characteristics	Type	Configuration	Cases
G. Active / P. Passive	Objects act unilaterally in an autonomous scripted manner on the player-controlled object	**Autonomous objects**		• harmful, inaccessible enemies • obstacles
		Passive player influence		• influence from persistent structures constructed by the player
		Influence on engagement		• visual effects • denying access to an ability
G. Passive / P. Active	The game system elicits control via gatekeeper objects	**Conditional**		• quest items • crafting • stat check
		Sequence (temporal)		• control of the order in which objects become available

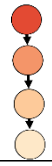
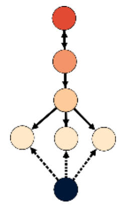
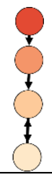
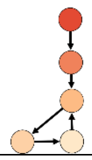
		Sequence (Affordances)		• puzzle
		Passive Background Control		• areas • quests
G. Active / P. active	Game system controlled objects and player-controlled objects act on each other mutually	**Mutual active influence**		• combat • persistent harmful entities
		Mutual acting through a tertiary object		• ranged combat • fighting with a companion

Table 3. Situation Typology

As apparent in the examples corresponding to each situation type, the same configuration may appear in the same title or across different titles in different forms. For instance, a game may present the player with enemies that are harmful towards the avatar but which they can fight back and eliminate. Another game may present the player with harmful entities that cannot be harmed or eliminated but which they may lure away or manipulate in some other form. In terms of control distribution and object configuration, both situations belong to the **Mutual active influence** category; even though, on the face of it, they present the player with different mechanics. This allows a cross-game and intra-game comparison of the player's engagement with the game, abstracted from title-specific factors, and provides the researcher with the possibility of using control distribution as a constant variable across situations.

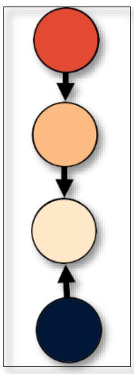
As noted in Chapter 4 and the previous section of this chapter, situations occur on the foundation of the greater game network. They are high granularity, interdependent game segments, and are experienced sequentially. Due to their sequentiality and the possibility of an individual object to take part in multiple, different situations, it is likely that in practice, the situations are experienced as composites, or nested within each other. For example, a situation where the game exercises control passively by assigning different areas as object containers, may be attached to a situation where the player is tasked with finding a specific object without which they cannot progress. In its turn, that key object may be possessed by an enemy who must be eliminated in order to obtain the essential items. This describes three different situations in terms of control structures. However, experientially, all three are felt and engaged in simultaneously. Even though the situations become composites, their constituent parts corresponding to the types described persist.

The current situation types can thus be considered to be ideal types (c.f. Bailey, 1994, pp. 17-33) abstracted from their empirical versions to illustrate the most relevant features with clarity. In practice, a variation in the number of objects or the relationships present may exist. However, the roles of objects as formed through the directional influence they receive and transmit, and the source of the action impulse, remain the central criteria of identification. In the following, each situation type will be discussed in turn, together with illustrative examples from the games that were analyzed. The diversity of examples is intended to illustrate the possibilities of cross-game and intra-game comparisons that the typology enables.

7.2 Control Distribution: Game Active/Player Passive

The following situations present different configurations of the game active/player passive control distribution. This means that their unifying factor is the active influence of autonomous, scripted entities on player-controlled objects – either avatars, the physical interface, or more distant objects that have received the influence of the player. The player, in turn, does not have the possibility of mitigating or responding to the influence exercised. Their passive role is observed, experienced, and visualized in the lack of complementary affordances between the objects they control and the influencing objects. This section includes situations where the game exercises control through an **autonomous object** without the player being able to act upon it, situations in which the player has a degree of **passive influence** over the object, and situations where the game elicits **control on the possibility of the player to maintain the engagement** with the game.

7.2.1 Autonomous objects



The first configuration entering into this category consists of situations involving autonomous, scripted objects. One of the ways this configuration may be instantiated in games is the presence of harmful inaccessible objects. In these situations, the player cannot access the harmful object directly and thus cannot influence it in any way. An example of this may be found in *INSIDE*. In one section of the game, the player is confronted with a harmful, automatic, intermittent shockwave that they cannot suppress, but instead must dodge by hiding behind cover objects. This type of situation incentivizes evasive actions and familiarization with objects in the environment in order to identify and understand the use of objects that may act on the inaccessible, harmful agent.

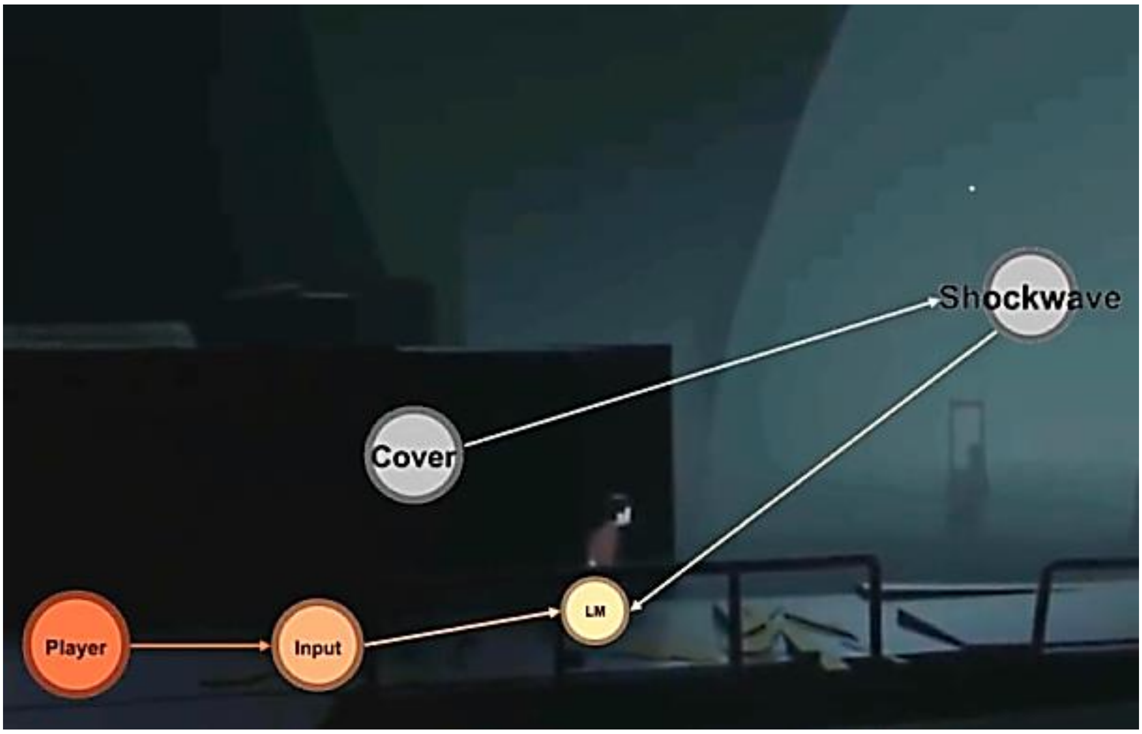


Figure 32. Situation in *INSIDE* where the player is confronted with an inaccessible harmful object, but can hide under a cover

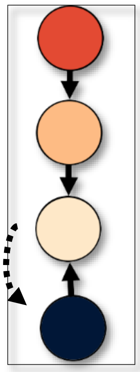
The influence of the harmful object is not limited to the objects that the player controls or the avatar. In the introduction of the shockwave challenge, the player's progression is blocked by a movable box, which, when acted on by the shockwave, is shattered. The player is thus confronted with the challenge of evading a harmful, inaccessible object whose affordances are showcased via their effects on the movable box. This is not a procedure isolated to *INSIDE*. In *The Missing*, the player's first glimpse of The Shrieker, a creature that intermittently chases the player in the game, is shown standing over a projection of the body of the avatar. Thus, the affordances of the harmful objects are telegraphed visually and not via direct access to the harmful object. This can act as a demonstration of the harmful object's affordances. As the inaccessible object does not connect with the affordances of the player-controlled object (generally the avatar), except for the health points, their affordances cannot be extrapolated from the affordances of the player-controlled object. Their influence can also be neither tried out nor experienced without risking the cessation of the game engagement. Instead, the harmful object's affordances must be demonstrated through the traces they leave when acting on other objects. This frequent design choice highlights the capacity of learning object behavior by observing the traces objects leave when affordances are linked.

Referring to the objects present in the examples above as harmful does not mean that all the situations in which harmful objects are present enter into this category. The unilateral influence of objects is the operative factor here and not what affordances they influence. Some harmful objects, like a spike trap, for example, even if harmful, require the player's input for a collision to take effect, thus eliciting their influence on the player-controlled object. Thus, this type of object and the configurations they create are part of the mutual action situation type. This differentiation illustrates that the existence and direction of relationships takes precedence over the face value attributed to objects as being harmful. This difference can be observed in the behaviors incentivized by survival horror games like *Amnesia*, discussed in the previous chapter, where the player has no means of directly acting upon the enemies, and horror shooters like *Resident Evil: Village* (Capcom, 2021), where the player may act directly on the enemies, shooting them.

While thus far, the situation examples included only harmful objects, this is not a requirement. A similar configuration may appear in non-harmful instances where an object may act on affordances of the player object other than their health, such as their mobility. Such a case may be encountered in *INSIDE*, where objects that are part of the topology of the environment, such as slopes, act on the avatar's mobility and transport them without the player's input to a different location. A similar occurrence can be encountered in *The Missing*, where the avatar uncontrollably sliding down a slope results in their mutilation. This subsequently allows for the demonstration of the avatar's ability to regenerate. Aside from being an example of the game system actively influencing the player-controlled object, this instance is also a small showcase of the passive acknowledgment of the relational nature of affordances and actions in games. That aside, in cases where multiple game-controlled objects, visually discernible as distinct, act in such a manner upon the player-controlled object, it is possible to black-box them under one automatically acting entity. Their individual discrimination is unlikely, as the resulting traces left upon the avatar can only be observed at the end of the sequence. This makes black-boxing a viable and analytically economical alternative.

To conclude, the current situation type consists of instances in which the player-controlled object is acted on without a possibility of acting back. This control distribution incentivizes evasive behavior and more familiarity with the environment in order for evasive maneuvers to be taken, or for the cooption of other objects that act on the inaccessible ones.

7.2.2 Passive influence from player objects



Unlike the previous situation type, this kind of situation provides the player with a modicum of influence in the situation, although indirectly. This is primarily achieved through modifications to the environment carried on by the player, which brings into existence objects that influence the autonomous entities. In this sense, the situation is structured similarly to the previously discussed one, wherein a tertiary object is used as cover. However, the player's contribution in creating this cover object confers it a different variation in levels of control.

This situation may be exemplified with a case from *SDV*. In *SDV*, certain phenomena like seasons or lighting affect the crops that grow on the player's farm. Certain plants grow only in specific seasons, and if struck by lightning, they will be destroyed. Neither seasons nor lighting can be directly influenced by the player. However, the player may build a structure on their property, a greenhouse. Plants that are planted in the greenhouse will not be affected by lighting or seasons and can grow there undisturbed by them. The player does then indirectly influence the effects of the phenomena on the plants. However, once the greenhouse is built, its effects on them are permanent and autonomous, requiring no further intervention on the part of the player. The player's influence in the momentary situation of lighting striking is passive.

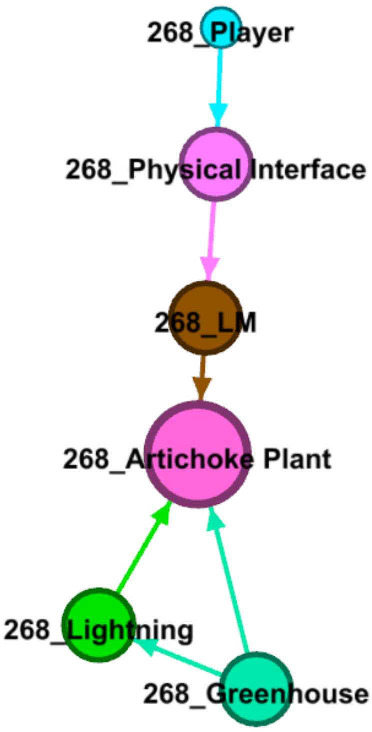
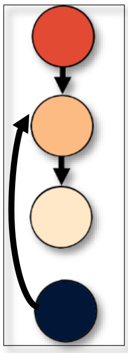


Figure 33. Situation illustrating the influence of a player constructed object (the greenhouse) on an otherwise inaccessible object (lightning)

This situation illustrates a behavioral requirement similar to the previous type, wherein familiarity with the environment and the relationships between external objects to those that the player directly controls is necessary. However, this requirement becomes more pronounced in this setting, as the player must not only react but has the possibility of being proactive, guarding against the inaccessible object ahead of time. This illustrates a differentiation in control attributed to the player, even in the context of passivity, demonstrating the possibility of further, more granular analyses when this variable is maintained constant.

7.2.3 Influence on engagement



The distinguishing factor of this situation is the possibility of objects controlled by the game system to directly influence the player's means of engaging with the game. This is achieved by affecting the means through which the player physically engages with the game, including their possibilities of visually perceiving the game environment or accessing the affordances of the player-controlled objects via the physical interface.

An example of such a situation can be encountered in *SDV*, where there is no light in some areas of The Mines, one of the zones in the game. The player is thus unable to see the environment, the enemies that populate the dungeon, or the ladder objects that may allow them to escape the level. The possibilities of the player acting in the game environment are thus impaired visually by the absence of light. Another situation, this time targeting the physical input through which the players can access the avatars' abilities and thus act in the environment, can be encountered in one of the battle arenas of *Nier Automata*'s [DLC 3C3C1D119440927 (Platinum Games, 2017). When engaging in the trials presented by the arena, the player is sometimes challenged to not use specific mechanics, on a per challenge basis, abilities that have been in common use in the game thus far, such as dodging or ranged missiles. In the case of dodging prevention, the constraint imposed by the game system addresses the control that players have on the physical interface. The dodge button performs the same action; the attribute links are not broken, and dodging can still occur if the attributes are activated. However, dodging is punished if it occurs.

Situations in which the player's inactivity results in a failure state may also be interpreted as entering into this category. In *Detroit: Become Human*, during a scripted event, the inflatable boat which the avatar is using to cross a river is shot at. The shots pierce the inflatable boat, and it begins to sink. The player is given a set amount of time to react and reach the other side of the river before the boat sinks. Not acting within that time interval results in a fail state, the avatar permanently dying, and the player being unable to continue that particular storyline. Thus, an automated event controlled by the game system may result in the lack of possibility of continuing the engagement with the game.

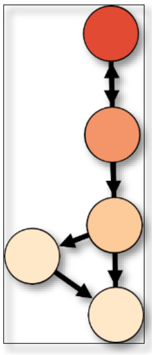
It is worth noting that all the example situations mentioned here are reversible or avoidable in one way or another. The player may use torches to abate darkness in *SDV*, the constraints placed upon the physical interface in *Nier Automata* are temporary, and the player may attempt to reach the other side of the river in *Detroit: Become Human*, and thus not go down with the boat. The player does have control over the situation in which they are put; however, that requires they coopt other objects in the engagement. In the momentary situation in which they are confronted with the active game object, however, the game system is the principal acting participant, while the player takes on a passive role.

Due to the proximity of the physical interface to the player and the influence that the game exerts over their possibility of engaging with the game, this type of situation can be considered one of the strongest exercises of control on the part of the game system. As the physical interface is outside of the game environment, being directly controlled by the player in the case of the input method, influences elicited upon it will be experienced more directly. This can be observed in cases where influence exercised upon it is used in a fourth-wall-breaking scenario, such as the Psychomantis boss fight in *Metal Gear Solid* (Konami, 1998). During it, the enemy asks the player directly to lay their controller on the ground so that the enemy may move it with the power of their mind. The controller's rumbler then vibrates, moving it in the direction of the enemies' gestures. The memorable nature of the encounter, along with other fourth wall breaking events, signal what has been referred to as expansions of the 'magic circle' surrounding games (Conway, 2010). While it is not necessary that control over the physical interface occur in the setting of a narrative fourth-wall-breaking moment, their cooccurrence signals the strength of these situations due to the proximity of the physical interface to the player.

7.3 Control Distribution: Game Passive/Player Active

The control elicited by the game in this category is usually achieved via a gatekeeper type of object. This can be a gatekeeper in the classic sense of the term, where an object bars access to subsequent objects (Freeman, 1980), as is the case for the **Temporal Sequence, Affordance Sequence,** and **Conditional** situation types. Another type of gatekeeping may occur in cases where a container or global influencer object controls most of the objects present in the situation. This occurs in the case of the **Background Control** situation type. In these situations, the player elicits active control by being able to directly influence all the objects present in the situation, while the game system controls where and when they may exercise said direct control.

7.3.1 Conditional



The conditional situation is one of the two standard configurations of this type of control distribution. Further variations and sub-variations explored below are different types of structural configurations out of which the conditional situation may emerge. The variations generally imply the contribution of multiple other objects in the situation or different means in which the game exerts its passive control over the situation components. In this category, situations where a specific object bars access to one or multiple other objects may be encountered. This includes cases such as quest items, crafting, resources, and currency, and, in a more deferred manner, stat checks. While the list may seem to contain diverse, and on the face of it, unrelated settings, the shared commonality is the presence of an object which, while not exerting a direct influence on the player or their possibilities of engagement, interposes themselves on the path between the player and another object. For instance, chopping down a tree in *SDV* and obtaining wood requires the use of an axe. The player may still interact with the tree without it, but the wood cannot be obtained. Likewise, fulfilling a specific quest, such as one that needs wood, would not be possible without wood, and thus the rewards provided by that quest could not be accessed. The two situations described differ both in the player's actions and the goal type that they provide. While the quest situation involves an imperative goal (Debus et al., 2020), the action of chopping wood can occur for a variety of player-driven reasons. Nevertheless, their common denominator is the gatekeeping action of a specific object.

Access to the key object is not necessarily direct. In cases such as stat checks, we can see a similar configuration to the examples above but no direct way for the player to access them. For instance, access to specific areas like the NPCs rooms in *SDV* is conditioned by a certain level of Friendship with them. The player cannot directly access the stat like they may an item like the axe, but the stat can be increased by providing the NPC with well-liked gifts, for example. Thus, while the configuration remains similar, more objects need to be coopted in the situation for the gatekeeper objects to be accessible. A similar case is encountered when quest items are in possession of a specific

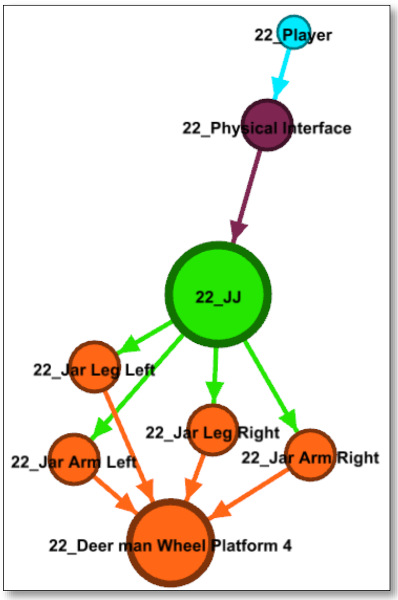


Figure 34. Multi-object conditional situation encountered in *The Missing*

enemy. Then, we can identify a nested type of conditional situation wherein the enemy is the gatekeeping object to the quest item, while the quest item is the gatekeeper of the quest rewards. This illustrates the intermingling of situations and the variations in the control distribution that occur throughout the game.

As mentioned at the beginning of this section, game situations in practice are sequential and thus may merge and become hybrid instances of nested situation types. The conditional situation type may emerge in more complex versions where multiple objects are required for access to the desired objects. This is a frequent occurrence in crafting, where a recipe may demand the use of multiple ingredients, but it is not necessarily limited to it. Quests and puzzle solutions often require that the player obtain or act on multiple objects in order to proceed. However, a difference that should be noted here, in comparison to the sequence-based situation types, which will be discussed in the following, is that the conditional objects are independent from each other, situating themselves on a similar level of availability in relation to one another. Figure 31 illustrates such a situation, where the player must manipulate and place a series of blocks in their required positions in order to progress. The blocks are all accessible at the outset, and the player is not required to access them in a particular order, placing them on the same conditional level.

Another version of this multi-object conditional situation, like the one illustrated above, can be found in the case of vendors. Vendors control the stock and thus bar access and provide the player with a wide array of objects. Thus, while the previous example illustrated a case where multiple conditional objects were required to access a subsequent object, vendors invert that relationship, to provide access to multiple objects, once one conditional object is accessed. The commonality between the two situations is the sequencing between the conditional objects and the result.

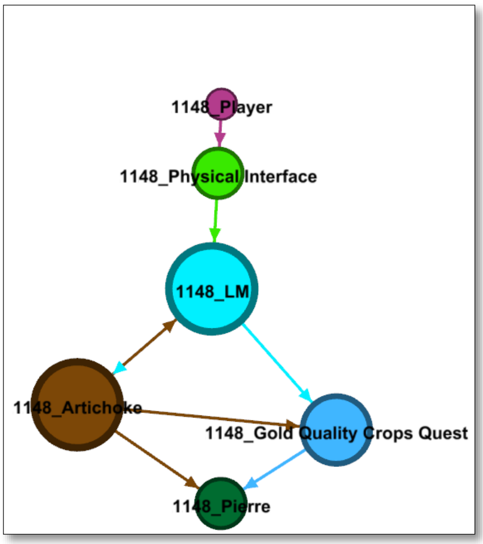
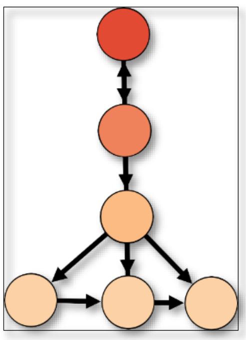


Figure 35. Multi-Object situation in *Stardew Valley*

This type of multi-object conditional situation may also appear in hybrid forms. As previously discussed, *Detroit* often engages in a global type of control via obfuscation, wherein the player is granted access to multiple objects that may not actually be relevant to their progression. In that case, although the player is presented with an array of available objects which they can access, their resulting links are hidden, and not all the objects will lead to progression. On the other side of the spectrum, such a situation may also present itself with diverging results based on the object the player chooses to access. For example, when accessing a food item in *SDV*, the player has the option to eat it, which will act on their health and stamina points, give it as a gift to an NPC, which may increase their Friendship stat, or use it in a quest, which will provide them with the quest rewards.

The conditional situation is the cornerstone for this type of control distribution, where the game elicits a passive control over the player's active control. It is possibly the most frequent situation type, following a request-response pattern often attributed to the concept of gameplay loops (Cook, 2012; Sicart, 2015). However, the alterations it can undergo and the configurational changes that will be explored in the following sections speak to the diverse agency that objects embed in the request-response pattern. Although similar, the behavior they elicit varies enough for them to be considered different situation types.

7.3.2 Sequence (temporal)



In this situation type, control exercised by the game system is related to the temporal order in which the events are experienced. The player has little to no choice in deviating from this sequence. This was often encountered in *Detroit*, where the affordances of different objects become available as the player interacts with the preceding, required objects. However, the player does have access in turn to all of the emerging objects in the sequence, differentiating the structure of this situation type from the affordance situation type. In the example provided in the conditional situation section, the inflatable boat being shot opens the player's possibility to choose the way they will react. They can hide in the boat, they can jump overboard, or they can do nothing. Jumping overboard will open the option for them to climb back on board once the enemies have departed. Once they have climbed back on board, they may interact with the objects in

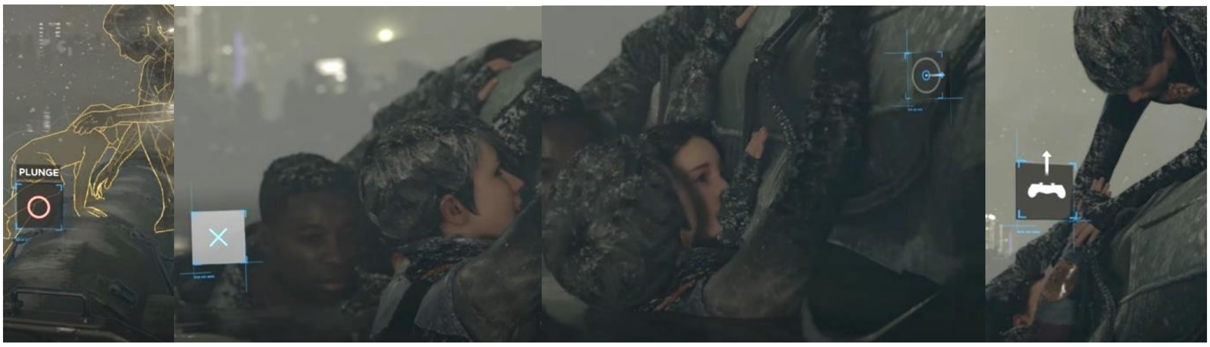


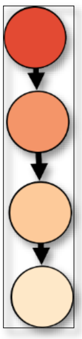
Figure 36. Temporal Sequence situation in Detroit become human. The screenshots show the emergence of the different requirements for input on the part of the player.

the boat and examine the damage. The order in which the player takes action is thus passively constrained by the game system, while the player takes ownership of actually enacting them. This constraint is not dictated by the affordances of the objects. One does not require the other to be accessed. As discussed in the next section, their affordances are not available and accessible before the game system makes them available, barring the player's interaction with the preceding object.

The repeated requirement for the player to act on the emerging objects has the effect of maintaining the player in a state where their input is constantly required but where their familiarity with the game environment is not strictly necessary. Whereas in the previous situation type, the desired object has the potential to be known before the conditional (e.g., items required for a quest), or their links to be known perpetually throughout the game (e.g., using an axe to obtain wood), this type often presents the conditional object in the absence of the player's knowledge of the result of their action. Thus, the player's response behavior is tied more closely to the possibility of simply accessing an object than to a goal-directed action with a specific purpose.

This situation type is challenging to the method of identifying the start and end of the situation via a change in the network of objects. Due to the game system controlling the availability of the interactable objects, this situation type can also be interpreted as short and frequently changing affordance sequences, which will be explored below. However, the game systems' control over the availability of the objects, and the strength of that influence in the situation, was considered a viable factor in separating the types.

7.3.3 Sequence (affordances)



The principal differences between the temporal and affordance-based sequences are the transmission and modification of input via the game objects. While in the case of the former type, interaction with each object triggered the availability of the next object in the situation, in the case of affordance-based sequences, the objects transmit actions in a modified manner, according to their capacities. Objects in this situation type are thus the clearest illustration of Latour's mediators (2007, pp. 37-42). Intrinsic to both this, and the temporal sequence situation is that all the objects participating in it take on the roles of conditionals, barring access to the following type of objects. Both sequence types of situations and the conditional situation type present the same means via which the game system exercises its influence. The principal difference between them, and this sequence-based situation is that the control that the game elicits in this situation type staggers the interaction in a more granular manner. While the conditional situation may rely on one gatekeeper node to provide access to a more extensive array of objects, the sequence situations apply the same structure on an object-by-object basis.

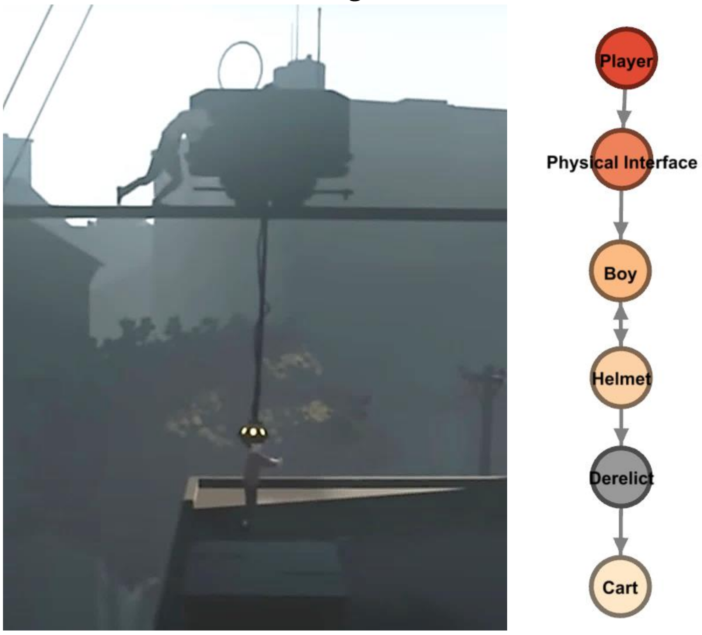


Figure 37. Sequence Situation in *INSIDE*

An example from the game *INSIDE* may illustrate the situation type more clearly, as well as the differences between it, and the temporal sequence. One of the key objects encountered in *INSIDE* are the so-called mind control helmets. The avatar may access a mind-control helmet attached to a cart. Accessing the mind control helmet allows the player to control one of the previously inert NPCs called Derelicts. Accessing the derelict allows the player to push a cart that would have been otherwise inaccessible. Moving the cart moves the avatar's body, which remains attached to the mind control helmet, allowing the avatar to reach a previously inaccessible area. As seen in the situation network appearing in Figure 6, a situation of mutual influence is nested within the sequence situation. The boy acts on the helmet and remains immobile in it while their inputs are transmitted to the derelict. This relationship between the boy and the helmet remains stable throughout the course of this situation, illustrating a possibility of blackboxing the two linked objects and considering the 'boy-with-helmet'[9] a new actor in the situation. In the absence of the ,boy with helmet' relationship being fulfilled and stable, the rest of the situation would not be possible. The new, composite actor then is in itself a conditional for the engagement in the situation.

From the example, we can also understand that the differences between the temporal sequence and the affordance-based sequence lie in interactive objects' availability. The relationship chains formed are reliant on the coupling of affordances – the derelict can't be accessed in the absence of the mind control helmet, and the cart can't be accessed in the absence of the derelict – and not by the availability of the interactable objects, which in the temporal

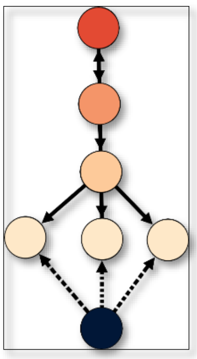
[9] This process draws on Latour's example of 'man with gun' in his discussion of the translation process that takes place in technical mediation.

sequence is controlled by the game system. A more in-depth differentiation between the two situation types may be visible in games like *SDV*, where their modular structure, discussed in the previous section, allows the player to disengage from one affordance sequence when necessary. Temporal sequences, such as the one explored in *Detroit*, generally do not allow for this lateral disengagement, as the game system controls the availability of objects.

A variant of sequencing can be encountered in situations where the avatar is augmented with a permanent or temporary upgrade. In these instances, a new object is brought into the situation, exercising its control constantly but silently. For example, in *SDV*, an expansion of the inventory size may be purchased from a vendor, which is a permanent upgrade to the number of items that the avatar can carry. Suppose the modifications are as permanent as the inventory expansion. In that case, they can potentially be blackboxed and exit the analysis or treated as a new actor, such as the above case of ‘boy-with-helmet’. However, if their influence is impermanent, or their traces undeniable (Leino, 2010), such as in the case of a damage or defense buff, their presence in the relationship network becomes visible.

The affordance-based sequence can thus be considered an extension of the conditional situation. The most notable difference between them, however, is the staggered effect elicited by the multiple objects coopted, which bring their own affordances and agency in the situation. In the above example, concerning the situation in *INSIDE*, it would be difficult to make a case for a singular entity acting as a master over the situation. The player does not move the boy, and neither does the derelict push the cart, but all the objects find their place in a chain to act in concert in the situation. Such lengthy chains of complementary affordances require that the player obtain a great degree of familiarity with their environment beyond the complementary affordances of their most closely controlled objects.

7.3.4 Passive Background Control



While the previous situation types encountered in this category of control distribution centered around constraining the player's focus to particular key objects, this situation type moves away from that form. The focus will be on what will be referred to as container objects or global influencers. Global influencers and containers refer to two different types of objects. However, the control they elicit is similar in the sense that it is persistent throughout the course of the game. Thus, the player can learn the relationships in which they are embedded. An example of a global influencer is the time object in *SDV*. As explored at greater length in the previous section, time influences the majority of objects in the game, from the types of fish that the players can catch to the speed of growing vegetables to the schedule of NPCs. Another type of global influencer may be encountered in the case of topological features of the environment. Buildings in *Nier Automata*, which impede movement for both player-controlled and game-controlled entities, can be considered examples of such. These objects act on the movement possibilities of the entities but are rarely relegated to a central role in the situation. Both time and the topological features mentioned are a persistent influence on the majority of objects in the object network. The player must thus integrate the complementary affordances they form with all the objects they influence to navigate the game environment successfully. Knowing when an NPC can be found in a particular location or blocking the enemy's path with a topological feature can thus become an indirect tool that the player can use. They are thus objects upon which the player cannot exercise any direct control but whose relationships are transparent and persistent enough to be learned and integrated into the player's repertoire.

Container objects include a wide range of objects from the more abstract, such as areas, to the more concrete, such as enemies that provide a specific array of objects when eliminated. Like global influencers, container objects elicit an indirect control over the player's behavior through the persistence of their relationships. Unlike global influencers, though, their control is more localized. Suppose a specific object of interest can be found in a specific area for example. In that case, the player's behavior will be indirectly impacted by the area's control over the object of interest. Again, like the global influencers, their relationships are persistent and thus can be integrated into the player's knowledge and used to navigate the environment. Unlike them, however, their influence is also localized, incentivizing a seeking behavior, and granting them a high degree of value within the environment.

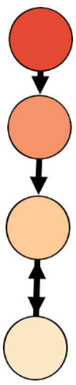
Another example of more abstract container objects are quests. Some items present in the environment may be inconsequential and even noninteractive until the player starts that specific quest chain. For instance, in *Nier: Automata*, the player may see specific white flowers in the environment, which they cannot act upon until they start a specific quest. The quest objective is to find and interact with all the flowers in the environment. At that moment, the flowers cross the state of deniable, to undeniable objects (Leino, 2010), by virtue of being a quest objective controlled by the active quest. A similar but more dramatic occurrence may be encountered in another *Nier: Automata* quest. After starting the quest 'Parade Escort,' the player is tasked with protecting a set of friendly NPCs from an onslaught of enemies that target both them and the avatar. Neither the friendly machines nor the enemies are present in the game environment prior to the player starting the quest. Thus, like the aforementioned flowers, the objects required for the completion of the quest are controlled by it. However, unlike the flowers, their very existence in the environment is predicated on the 'Parade Escort' quest, thus making the status of the quest as a container apparent.

While different in terms of configuration from the previously discussed situations in this category, container and global influencer objects are in themselves gatekeepers. However, their influence is not isolated to a particular situation. Instead, being exercised on a wide array of objects, it becomes more diffuse and more indirectly felt. In this sense, it opens up the possibility of them being integrated by the player in their behavior in multiple, unrelated situations. For example, time in SDV may exercise its influence in the choice of activities that the player takes on on a particular day, thus contributing to their task prioritization. However, being in the same control distribution category, the differentiation between container objects and conditionals may become porous. Does a vendor offering a wide array of objects enter into the conditional or the container category? In the current text, it has been assigned to the conditional role, but an argument may be made for both. Whichever category they fall into, however, the control distribution will remain the same.

7.4 Control Distribution: Game Active/Player Active

The situations that appear in this category are characterized by the mutual active control exercised by both the player and the game system. In the case of the game system, as in the first category, this primarily includes autonomous scripted objects, but also, unlike the first category, objects that merely respond to the player's actions. It is not required that the mutual action target the same affordances, meaning that these situation types are not limited to combat situations. Instead, the situations are centered around any affordances that may elicit a **mutual active influence**, or a **mutual influence via a tertiary object**.

7.4.1 Mutual active influence



This situation type includes all cases in which a player-controlled object may act on a game-controlled object that autonomously reacts in some way and elicits an influence on the player-controlled object. This may include both negative influences, such as the case of combat, or positive influences, such as obtaining and eating a piece of food in *SDV*, which will restore the avatar's health and stamina points. While this situation may be extended to multiple acting objects, the general characteristic of the situation is the mutual influence between the player-controlled and game-controlled objects.

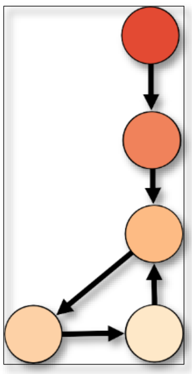
This situation allows the player to directly influence the game objects and respond in an appropriate manner, according to their available affordances. An illustrative example of this is the player acting on persistent harmful objects. Harmful objects were discussed previously as part of the **Autonomous objects** situation type. Objects that appear in situations of that type are, however, inaccessible to the player. In contrast, persistent harmful objects can indeed be accessed but not eliminated. For instance, in *Brothers: A Tale of Two Sons*, players are confronted with a situation in which they have to cross a field of hay bales. A harmful dog, who will eliminate the avatars if they reach them, guards the field. The dog does not have the

Figure 38. Brothers: A Tale of Two Sons. Mutual acting situation

affordance of being eliminated, but it can be lured by one of the avatars, allowing the other to cross the field. Thus, while the danger cannot be eliminated, the player can actively manage it. This allows a comparative assessment of inaccessible, persistent, and eliminable harmful objects. While the first category incentivizes an evasive behavior, and the last one, an explicit, directed action of elimination, the persistent harmful objects take on a role more akin to a puzzle piece. They are mediators, translating the player's influence according to their own affordances of action. This places them in general in situations where they must be purposefully manipulated as a more distant and semi-autonomous puzzle piece or a high pressure tool that can be used in concert with the surrounding environment. An example of the latter instance can be encountered in *The Missing*. There, the player may encounter a specific enemy, the so-called Scissor Kids. They are hidden in the decorative foliage and only appear when triggered by the avatar's proximity. Once triggered, they will attack the avatar and damage her to a certain extent, modifying her body to the point where they are only a mobile head. The player cannot fight back; the only action they can take is luring the Scissor Kid to attack. However, in a particular case, the player must traverse a narrow passageway that would be inaccessible if the avatar's body were whole. The harmful action of the scissor kids then, damaging the avatar to the point where they are one step from complete elimination, is integral to the successful traversal of the game, placing the persistent harmful objects in the role of useful and usable tools.

However, naturally, persistent harmful objects are not the only ones that may enter this category. Combat in which no other objects are present, and situations in which the avatar may eliminate a harmful object enter into the same category. As does interacting with objects that may beneficially enhance the player's attributes, such as healing items, buffs, or upgrades. This wide array of cases that this situation type may include may appear at first glance to make the category too general as an analytic tool. However, the framework does not prevent but incentivizes the more granular analysis of situations once the distribution of control has been established. Thus, even though seemingly too open, the purpose of this situation category is not to differentiate between harmful or beneficial influences, but rather, how different configurations of, say, two harmful situations may provide the player with different types of control and elicit different behaviors on their part.

7.4.2 Mutual acting through a tertiary object



Mutual actions can also occur with the aid of a tertiary object. In this case, the situation configuration changes to one that more closely resembles a loop. In this case, one of the participants of the situation acts on the other via a tertiary object. This is most evident in cases of ranged combat. In those instances, the avatar's affordances do not directly link with the affordances of the enemy. However, the avatar can fire a projectile that is able to harm it. The situation maintains the same configuration in a reverse case, where the game object is the one firing the projectile, the loop being inverted. However, it is not necessary for the combat to be ranged and projectiles to be used for this situation to emerge. The same loop-like configuration appears in cases where the player-controlled objects may passively influence environmental objects or companion NPCs to act on their behalf. The first two sections of *Nier Automata* always present the player with a companion, who will engage enemies in a manner that is manageable by the player. They can be tasked with having an aggressive, balanced, or passive behavior, which they enact autonomously. In such a case, the companion NPC may take the place of the tertiary object acting on the harmful enemies. Likewise, *Downwell* presents the player with the possibility of equipping an upgrade that transforms the gems that can be found in the game environment into bullets, harmful to enemies. Thus, the player may coopt environmental objects to act as a tertiary object through which they can affect the enemies.

This situation thus differs from the type previously described through the cooption of a tertiary object. The affordances of the object then, as the link between the player-controlled and the game-controlled object, will be the ones most influencing the behavior the player can employ. If, as in the above example, the tertiary object is a projectile, constantly requiring action from the player to be fired, they will require an active engagement that is dictated by its affordances. These can include range, rate of fire, damage output, and others. The player is thus asked to distribute their attention and possibilities of actions across both objects, the one they can most closely control, and the projectile, integrating both of their affordances in their decision-making process and actions. On the other side of the coin, we can find companion NPCs. They are generally autonomous entities that follow the avatar and act upon enemies as requested. This opens the possibility of a type of play that is more akin to guidance than active engagement. The player can, via the avatar, guide the companion to a combat engagement and allow them to freely carry on the combat on their own, adopting a direct control but a passive approach. The two extreme examples illustrate the disproportional influence of the tertiary object in the situation. Being an extension of the avatar's control, they dramatically influence the player's behavior.

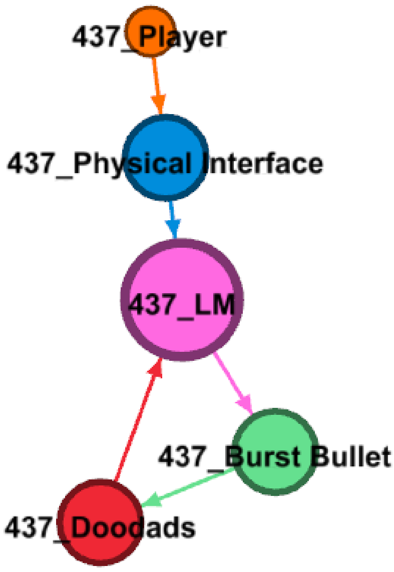


Figure 39. Example of a situation from the game *Downwell*, where the player acts on the enemy via a ranged weapon.

A similar change may occur in cases where the loop is inverted, and the tertiary object belongs to the game-controlled object. This is the case of ranged combat, where the enemy is in possession of the harmful projectiles. In such a case, in comparison to melee combat, the behaviors elicited by one object – the enemy – become separated. If previously, the enemy required both evasive and aggressive actions, grouping the range of affordances under one representation, now the player's attention must be distributed towards evading one object while approaching the other. This behavioral switch, corresponding to the tertiary object, illustrates the differences between this situation type and the previous type and highlights the importance of influence directionality.

7.5 Discussion

As previously stated, this typology was constructed in a bottom-up fashion, and it is open, meaning that it can be expanded in multiple directions. An examination of a more comprehensive array of games may provide the possibility of distinguishing more situation types along with the same types of control distribution. Likewise, an analysis of the effects of scale, the number of objects implicated in the situation may provide more sub-types of situations within the same configuration type. Within the scope of this work, the typology limits itself to examining the configurations appearing in the different distributions of control and discussing the behavioral changes that the different configurations may elicit. The typology aims to provide a framework that can aid in maintaining constant the object configuration that forms the situation and thus provide a stable grounding upon which the stimulus manipulation may be examined, and cross-game comparisons may be performed.

To understand what this aim means in the context of experimental research, we can have a more in-depth look at two studies. The first study discussed, conducted by Kasumovic et al. (2021), used six different games to understand the effects of violent video game play on self-perceived mate value and mate preferences. The second study discussed was conducted by Carnagey and Anderson (2005) and used *Carmageddon II: Carpocalypse Now* (Stainless Games, 1998) with the aim of observing the effects of reward structures on aggressive affect. The principal reasoning for choosing the two studies was their difference in stimulus selection. The first study used six games, three of which were considered violent and three considered non-violent. The diversity in stimulus games is a good measure to ensure that the results observed were not related to the specific individual title but to the common manipulations of the independent variable (Wells & Windschitl, 1999). In contrast, the second study utilized only one game and formed the different experimental conditions by modifying the game to suit the variations in the independent variable. The conditions were receiving a reward following a violent act, receiving a punishment following a violent act, or not having the possibility to receive rewards. The two studies thus differ with respect to their use of games as a means of variable manipulation. In the following, the studies will be briefly reviewed, and the object networks representing the research conditions will be presented. The variations between conditions will then be discussed, with reference to the object networks and the situations encountered by the players.

The first study, as stated, utilized six games in their research design. Three of those games, *More mindless violence* (DX Interactive, 2006), *Deanimator* (bumbarian, 2005), and *Gunblood*

(Wolf Games), were considered to be violent. The other three, *Bubble Shooter* (Absolutist, 2001), *Pongnop* (kchamp, 2008), and *Perfect Balance* (ttursas, 2009), were considered to be non-violent. The study was chosen due to its use of stimulus games, its recency, and its use of small games, which allowed a more facile inventory of their object networks. The researchers did not provide a reasoning for the choice of the specific titles, so an assumption could be made that they were chosen due to their face validity. I played all the games three times for the same amount of time allotted to the participants, which was five minutes. Following that, I created the object networks based on that limited engagement. It is possible that the complete game networks are larger and more complex. However, as the time I spent playing each game was the same time allotted to the study participants, I consider the networks as shown to be sufficiently representative of the experience of the study participants.

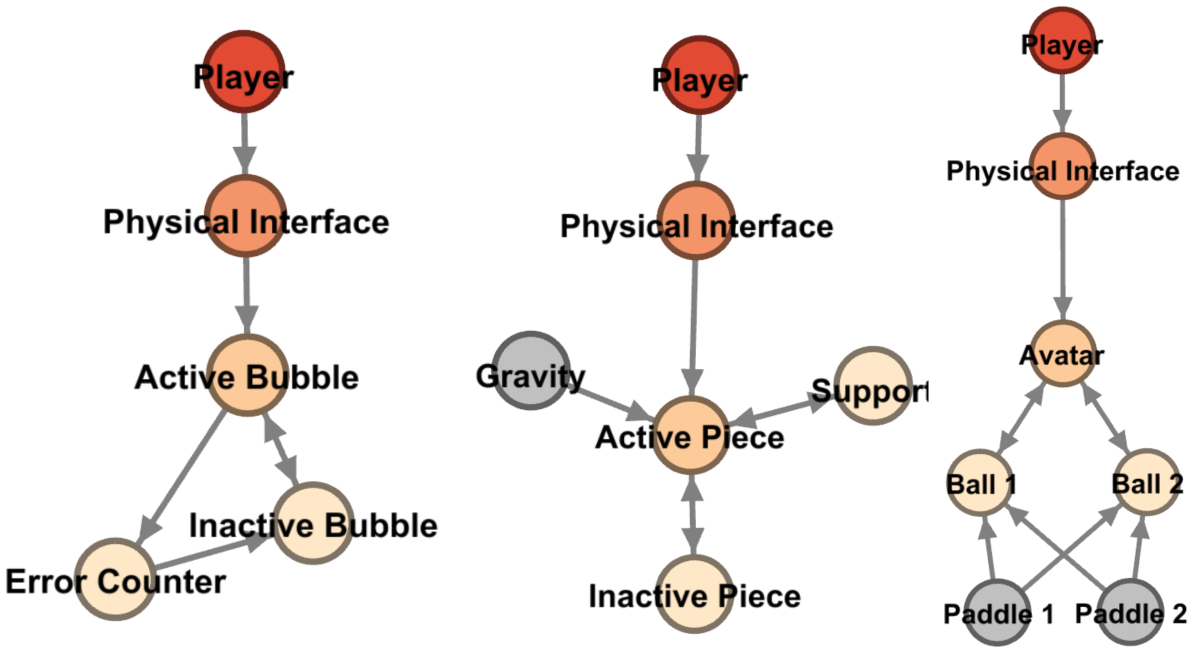


Figure 40. Networks of the games in the non-violent condition. From left to right: *Bubble Shooter, Perfect Balance and Pognog.* The objects are assigned colors in a heatmap fashin, starting with the player node. The nodes that the player has no control over are grey.

The games in the non-violent condition included *Bubble Shooter*, a small game in which the player shoots colored bubbles that disappear when the bubble shot matches the color of the neighboring bubbles. If a bubble does not match, the error counter is affected. Once a specific number of errors are made, the rows of inactive bubbles descend. If the player is no longer able to shoot an active bubble, the game is lost. If the player succeeds in eliminating all the bubbles on the screen, the game is won. The second non-violent game included is *Perfect balance*. *Perfect Balance* provides players with a series of shapes, which must be held in balance on a support object. Once a piece is placed, it can become the support for subsequent pieces. If the structure is unstable, the pieces will collapse, and the level will be lost. The player will successfully complete the level when all available pieces are placed in balance. Finally, the last game used was *Pongnop*. A remix of *Pong*, *Pongnop* provides the player with one controllable paddle, which can be used on two balls that travel in a mirrored manner. On each side of the screen, there is a paddle that will bounce the ball back. The balls can cross to the other side and can be acted on by any of the two peripheral paddles that are outside of the players' control. The speed gradually increases, and there is no win condition. The game session ends when one of the balls is not caught by the side paddles.

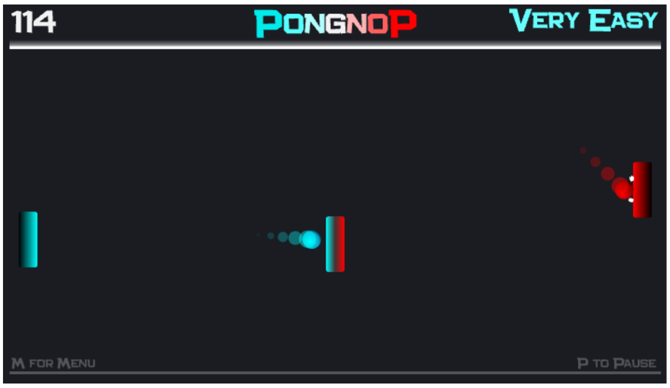


Figure 41. Screenshot of *Pongnop.*

The study also uses three games in its violent condition. The first game pictured, *Gunblood* presents the player with a duel-like setting, where they are tasked with shooting an enemy before they themselves are shot. To emulate the duel conditions, at the start of the encounter, the player is required to hover their mouse on their ammunition counter to prevent them from targeting the enemy before time. In this sense, then, the game exercises its influence upon the player. Once the duel starts, the avatar has a set number of shots with which to eliminate their opponent before they are eliminated. In bonus levels, an NPC appears, which should not, but can, be shot. The NPC is not dangerous to the player but throws several bottles that can harm the avatar, and that the player can shoot. The second game, *More Mindless Violence*, presents players with waves of enemies that they must eliminate. If the enemies reach the player, they reduce their health points. Unlike *Gunblood*, the player can choose to reload at any point, a necessary activity, as without ammunition, the enemies cannot be shot, eventually overwhelming the player. More enemy types appear as levels progress. During my limited playthrough, aside from the enemies that simply advance and damage the player when they reach them, I also encountered enemies with an intermittently raised shield that blocks the players' shots. The final game, *Deanimator*, like the previous one, presents the player with waves of enemies that are harmful when they reach them. The principal difference between this game and the previous one is the players' control of the ammunition. While in the previous game, the player controlled the times when they chose to reload, in *Deanimator*, the act of reloading is controlled by the game, taking place only when the barrel of the gun is fully depleted.

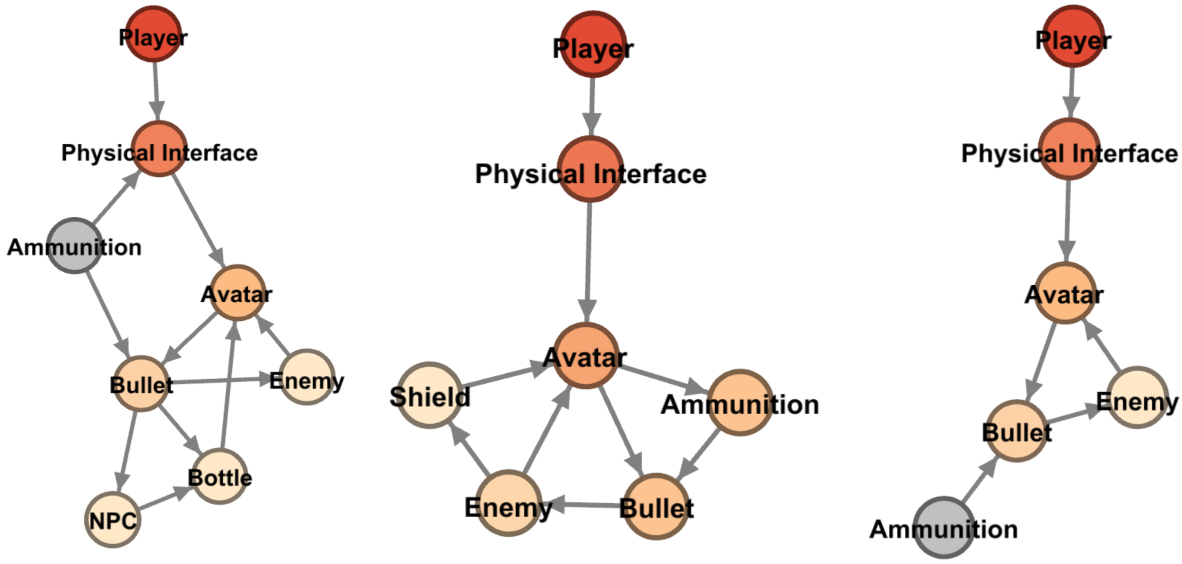


Figure 42. Networks of the games in the violent condition. From left to right *Gunblood*, *More Mindless Violence* and *Deanimator*. The objects are assigned colors in a heatmap fashin, starting with the player node. The nodes that the player has no control over.

As visible from the object networks, the distribution of control is quite variable across the six games. Examining the networks with the aim of identifying the situation types that may emerge, we can encounter both similarities and differences. The most visible one can be found in the non-violent group of games. As all three games present the player with the possibility of shooting their enemies, they all present situations of **mutual acting through a tertiary object**. However, this is not the only situation present. The influence elicited on the player's physical interface in *Gunblood* results in an **influence on engagement** situation type, that is not present in the other titles. This can be particularly notable since, as discussed, this type of situation signals a close and, therefore, strong type of control exercise. *More mindless violence* also presents a secondary situation, this time a mirrored **mutual acting through a tertiary object** situation, due to the shielded enemies present. Even if the shielded enemies would be eliminated from the network, as they are dependent on progression and it is possible that not all participants may encounter them, the game's network shows a more extensive amount of influence granted to the player. Their control of reload times, unlike in the other games, ensures that the player can, at a greater or smaller distance, influence all the objects in the game network. Finally, *Deanimator*, unlike the previous game, prevents the player's control of reloading. Instead, when the barrel is depleted, the reload animation plays automatically. Thus, a situation where an autonomous object exerts control on the player is created. Notably, the avatar is vulnerable in this time, and the enemies keep advancing. This small change then becomes, in actuality, the central source of failure in the game.

The games in the non-violent condition are no less varied than the violent ones. While the central common situation to the violent games was the **mutual action through a tertiary object**, the common situation found in the non-violent games is the **affordance sequence situation**. However, alongside this central commonality, the games also present variations in the influence exercised by the player. The game that allows the player the most comprehensive degree of influence is *Bubble Shooter*. Here, even the most distanced object, the error counter is still under the player's distanced control, given the player's decisions of the location in which they would like to place the bubble. One factor that exercises a large influence in the situation and which the framework does not account for is the random color of the bubble. This creates a parallel relationship of influence between the active bubble and the player. As the player influences the placement of the bubble, the game system influences the color of the bubble. In the second game, *Perfect Balance*, the players' influence seems to be in perfect balance with that of the game system. The configuration presents the player with an action loop, where their control of the active piece is automatically evaluated by the game through its influence on the same game object. The player places the active piece, and if it is not placed correctly, it will fall to the ground, and the level will be lost. The game thus presents, aside from the common **affordance sequence situation**, a secondary situation of **influence of an autonomous object**. Thus, unlike *Bubble Shooter*, where the player's influence extends over all the objects in the game, the second game presents a more standard dyadic relationship between the player and the game system. Finally, *Pongnop* presents the player with the least degree of control over the game objects present. As the two side paddles are not controllable by the player, two mirrored situations of **influence of autonomous objects** emerge.

The variations of control across the games placed in the same category are beneficial to the assurance that the results observed are not attributable solely to the individual title but may be tied to the common instantiation of the independent variable. However, the variations in control between the two conditions are also significant, a factor that may impact the interpretation of the results presented. The common situation emerging in games in the violent condition is that of **mutual influence via a tertiary object**, whereas the common situation present across the games in the violent condition presents **affordance sequences** as the common situation. While control varies and influence is exercised on the player in the non-violent condition as well, there is an overall general imbalance of control between the games present in the two conditions. This becomes relevant in conjunction with the dependent variable of interest, perceived performance. As Rothbaum et al. (1982) state, a lowered degree of primary control may enable participants to exercise secondary control, sometimes manifested in the inhibition of unfulfillable expectations. Thus, while the variation is desirable, in this particular case, there might be a specific unwanted effect emerging due to the inequivalence between games in the two conditions.

The second study that will be reviewed was conducted by Carnegey and Anderson (2005) with the aim of understanding the effects of reward structures on violent behavior, cognition, and affect. *Carmageddon II: Carpocalypse Now* places the player in control of a car and tasks them with finishing a race. The race is timed, so the player must finish within the allotted period. The role of pedestrians and other vehicles in the environment is the factor of interest in the research. Running over pedestrians is a violent act, but in this case, it also takes the role of resource gathering, as each pedestrian killed increases the number of credits and the time that the player has to finish the race. The same is true for other race drivers. Colliding with other cars and taking them out of the race will also grant more time, alongside the elimination of competition. However, the car that the player controls can also be damaged in a collision with other cars or with solid objects in the environment. If the player does not repair it by using credits, the car will not function properly. Other objects present in the environment are power-ups. Colliding with power-ups grants the avatar new abilities or modifies other objects. The power-ups include changes to pedestrians, such as making them smaller or larger, changes to the car, such as receiving a lightning bolt ability that electrocutes pedestrians, provides invulnerability, or allows wall climbing. *Carmageddon II* generally adopts an image of absurdist violence. Cars are fitted with guillotines, pedestrians can explode on impact and let out screams when seeing the cars approach, and even the difficulty modes have colorful names, such as 'as easy as stomping kittens' for the easiest difficulty.

The research focused on the effects of rewards structures on violent behavior and used *Carmageddon II* as a stimulus game. The study was comprised of three conditions. In one condition, the participants were presented with the standard game described above. In the second condition, the game was altered so that collisions with the cars and pedestrians would subtract credits and time[10]. The present example focuses only on the first intervention. The first condition was an unaltered form of the base game where credits and time were rewarded for pedestrian and opponent eliminations. In the second version, eliminating pedestrians and opponents was punished by subtracting points. Finally, in the third version, the pedestrians

[10] The research article only refers to the award and subtraction of 'points', making no specific reference to time and credits. However, the description of the first condition mentions that 'The first version was an unaltered form of the original game' (p. 884). As the aim of the research was the study of reward structures on behavior, I consider it to be a grounded assumption that the term 'points' here subsumes the two resource types.

were removed, and the opponent cars were reprogrammed to be passive. Participants played the game for 20 minutes. The researchers monitored the number of points obtained and the number of pedestrians killed and asked participants to rate the video game across a series of dimensions, including difficulty, frustration, level of violence, how addicting, and how fun they considered the game to be.

Formulating the conditions as situations, even if, in this case, abstracted from the greater context of the game, offers some insight into their equivalence and their fit to the intended variable manipulation. Unlike the first study reviewed, which used multiple games, the current study purposefully only utilized one. Thus, we can see two approaches to stimulus control. While the first study attempted to ensure that the variations observed in the dependent variable were not solely attributable to the characteristics of one title, this study chose to use a modified version of the same game in a bid to ensure the control of unwanted variations. Their efforts are observable in the similarity between the first and second conditions.

While the two conditions presented significant modifications, the distinction in the influence exercised by the objects is not observable in the object network as enabled by the current framework. This is a consequence of the framework not accounting for the valence of the relationship. Thus, in the first condition, the avatar may collide with and kill a pedestrian, which grants them more time to finish the race. In the second condition, following the same action, time is subtracted from the time allotted to the player. The conditions thus do not vary in terms of the influence allocated to the participants. This does not mean that the experiences are similar. Without the possibility of increasing the resource tied to the successful completion of the race, the player is incentivized to approach the task with more urgency, and, as to not reduce the time provided, they must treat the pedestrians as harmful objects, adopting an evasive behavior towards them. Thus, while the possibility of acting on the pedestrians persist, the risks at stake transform their role. It can be argued then that the informal prohibition of acting upon the pedestrians transforms them into 'inaccessible' harmful

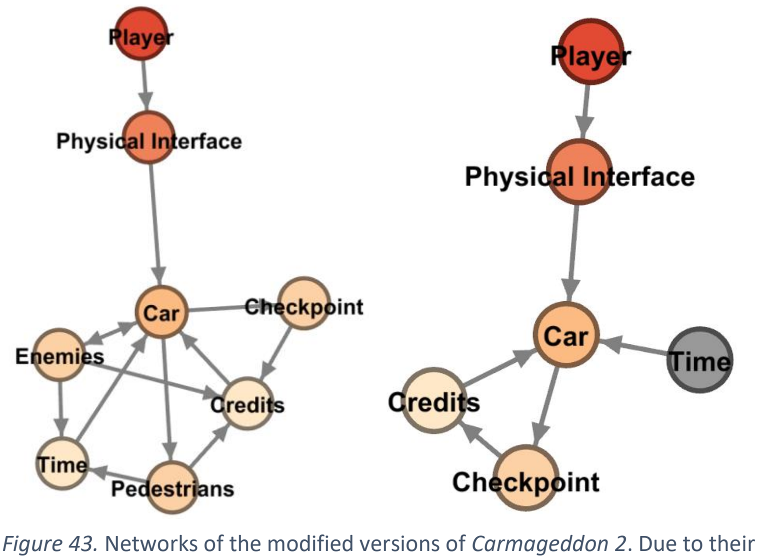


Figure 43. Networks of the modified versions of *Carmageddon 2*. Due to their similarity, the first network represents the first and second condition. The second network represents the third condition.

objects. Of course, they maintain their accessibility, as it is indeed the actions performed upon them which are punished. However, as this is an experiential factor, it will not appear visibly in the situation network, being a matter that could be approached through self-report measures.

The third condition, however, differs considerably. While the first two conditions present similar distributions of control, with changes in the relevant dependent variable, the third condition eliminates the sources gaining time, only maintaining credits in the position of rewards. By virtue of eliminating the other sources of gaining rewards, the frequency with which they can be obtained is also greatly diminished. The first map[11] available in *Carmageddon II* presents four checkpoints. This scarcity of reward choices results in the most frequently encountered situation being one of **autonomous object influence**, where time exerts its influence without the player being able to react to it. This shows the inequivalence between the conditions with respect to the independent variable. It is then unclear how the condition is comparable with the previous two, as both the violence and the rewards are removed in the greater part of the engagement. The researchers state:

> 'Furthermore, Experiment 1 showed that playing a violent video game, regardless of whether the game rewards of punishes violence, increases aggressive affect relative to playing a nonviolent video game. However, Experiments 2 and 3 showed that playing a game in which violent actions are punished, does not produce significantly more (or less) aggressive thought or behavior than playing a nonviolent version of the same game' (Carnagey and Anderson, 2005, p. 887)

Comparisons drawn against a 'nonviolent version of the same game' do not consider the branching changes that make the nonviolent version a different experience across the variables that the study sought to manipulate – the rewards provided to the player. This matter becomes more problematic as the effects of engagement with a violent game are made by comparing the first two conditions against the third one.

The third condition is also included as a control for the competition embedded in the game. However, the relationships between the players' car and the other competitors denote an inequivalence in the manner in which competition is handled. The players' direct access to the enemy cars, forming a situation of **Mutual active influence**, allows them a lot more control over the competition, both with concerns to the elimination of opponents and in terms of the rewards that their elimination yields. In the non-violent condition, however, they act in parallel,

[11] The article does not state what map was used in the study, the use of the first map is just an assumption. However, the maximum number of checkpoints that can be encountered in the game, across all maps is 8, while the minimum number of pedestrians is 168.

without a direct or indirect relationship existing between them. In the first and second conditions, the existence of the opponents is not subsumed to competitive racers, but they take on the role of danger to the players' possibility of maintaining the engagement, as well as sources for the resources necessary to win. The second condition, however, by removing these roles, changes the relationship the players have with their opponents and thus makes the equivalence in terms of competition difficult to pinpoint.

The application of this framework to the two studies illustrates the means through which it can be employed in the analysis of the experimental conditions. The small scale of the scope is appropriate for distinguishing minute, but relevant, changes that may inadvertently occur between conditions. Further, the focus afforded to the means of control that the player and the game exercise in the engagement ensures that the analysis will center on changes that concern the player's role in the game, their possible experiences, abilities to influence the status quo, and ways in which they are influenced by it. As was observed in the previous example, due to small changes occurring on the level of object relationships, it cannot be concluded that the situations enabled comparable conditions in the cases of competition and reward. An application of the framework would then enable researchers to have an overview of the conditions via which the observed effects, if any, are elicited comparatively, analyze if other factors may be responsible for their occurrence, and replicate the study with different games that present similar conditions.

7.6 Conclusion

The chapter presented the situation typology, constituted of three control distribution types that instantiate nine different situation configurations. They are presented as abstracted object relations, which means that the same configuration may appear in different contexts. For example, acting upon a harmful entity and using a beneficial consumable would appear in the same configuration. This occurs partly due to the fact that the framework does not illustrate the valence of the relationship but only their existence and direction. This is both an advantage and a limitation of the framework. The abstraction allows for comparisons between apparently dissimilar games to occur across the common variable of influence. At the same time, following the application of the framework, more examination of the game may be necessary if the positive or negative valence of the relationship is of interest. While the situations are presented as independent configurations, in practice, it is possible for them to become composites. This is due to the object relations that may extend across more than one situation.

Finally, the chapter closes with an examination of two studies that used video games as a method of stimulus manipulations. The framework is applied as a means of examining the equivalence between the experimental conditions. The application of the framework illustrates that in the absence of an overview of the object relations that form and surround the players' position in the game, inadvertent changes may occur that may affect the control of the independent variables. The framework is then shown to enable the observation of these experiential changes and thus provide researchers with the means of selecting and using comparable game segments, which would help in the elimination of potential confounds, as well as enable the replication of studies using different, but analogous games.

Chapter 8. Discussion and Conclusion

8.1 Introduction

The principal aim of this dissertation has been to unpack and examine the role of the video game stimulus in the experimental design. Researchers' interest in the study of games in this research setting has persisted and changed while dealing with both moral panics and challenges presented by the complexity of the game artifact. Debates concerning effects center around the existence and magnitude of those effects (Ferguson, 2019; Kowert & Quandt, 2015, Johannes et al., 2022). As a response to this, critics within the field often examine the procedures through which effects are assessed and the analytical procedures employed to assess those effects (Ferguson & Kilburn, 2010; Bushman et al., 2010; Sherry, 2006). This dissertation chose not to add to that specific discussion. Instead, it centered around my curiosity to uncover what exactly it is that would be considered to have an effect. The standard response would be, of course, video games, but a video game played in a private setting is not the same as a video game played in a laboratory. Researchers have noted the effects of different social settings on the play experience, but what of the virtual environment?

The social setting in which the game is played does not only alter the state of the player but the virtual environment as well. In a private setting, one may enjoy the video game as a complete experience. At a game expo or a conference, one may play a vertical slice of the game, selected in such a way as to serve the purposes of the developers. It might be the most polished or even the only playable part of the game if the developer is looking for audience engagement and promotion. In other cases, it might be an experimental, new section of the game that the developers want to test in a low-stakes setting. During a laboratory experiment, the game takes on the role of the stimulus, and the section that the players engage with provides the means for manipulating the independent variable. It must become the vehicle through which the behavioral determining material must be delivered. Understanding the means through which this stimulus is delivered, the operational experimental definition attributed to the game in the experimental setting was, ultimately, the motivation for this dissertation.

Following the examination of these procedures, an understanding of their roles and repercussions in the experimental design, I proposed an alternative method for analyzing single-player video games in this experimental setting. The development of the framework followed, at least in my judgment, a similar thought pattern as the initial question. Before looking at the results, look at what produces them. Following the works of ecological psychology, that was concluded to be the game objects and their relations. This decision is at the center of the granularity and resolution levels of the framework and determines both its application possibilities and its analytical potential. As such, before the closing of this dissertation, the following section will provide a summary of the contributions of this work. This will be followed by an examination of analytical frameworks of similar scope, with the aim of encouraging a joint application that would mitigate existent blind spots. Finally, the limitations of this work will be examined, along with speculations regarding future research

8.2 SUMMARY OF CONTRIBUTIONS

The first objective of this dissertation was to unpack and bring into focus the role that the stimulus game plays in experimental research designs. To this end, the first chapter reviewed a series of theoretical frameworks employed in the area of game effects studies. The theoretical frameworks were also confronted with a series of challenges that video games bring to experimental research, including the potential for variable, uncontrolled experiences, and the risk of including confounding variables in the manipulation due to the systemic complexity of games (Gundry & Deterding, 2019; Järvelä et al., 2015). This review was intended to provide an understanding as to how the theoretical frameworks address said challenges, or, perhaps, how they make them more prominent. It was concluded that the practices most influenced by the particularities of using a video game as a stimulus were the process of selecting the game to use in the study, and the practice of delivering the stimulus, or, in the context of this type of research, having participants play the game. The stimulus selection procedure presents an integral step in the research design. Stimulus sampling (Wells & Windschitl, 1999) reflects the necessity of qualifying the presence of the variable of interest within the selected stimulus representative and the qualification of the individual within the population, among which the results can be generalized. Not abiding by these rigors can result in a lack of generalizability of the results, a criticism often brought to the field of game effects studies (Sherry, 2006). Likewise, the process of having participants engage with the game is noted to be challenging due to the active participation of players in the virtual environment. This is only problematic in so far as the stimulus that the game is intended to deliver is not contextualized within the surrounding game environment. As a solution to this issue, a process of reframing the role of the game from that of a singular, unitary stimulus, to that of a situation is proposed. However, with this proposition, a new question emerges 'what is a game situation?'. To start answering that question, it was decided that a review of the current practices that researchers employ in the experimental study of games is necessary. This decision was made on the grounds that proposing an alternative method would be inappropriate without the analysis of the needs of the field.

A sample of 133 studies was thus employed with the purpose of exploring the procedures employed in selecting the stimulus game, and having the participants play it. The most frequently encountered procedures and their limitations were discussed at length. The procedures most often used for selecting a stimulus game were: selecting the games according to the face validity of the title (e.g., Krcmar et al., 2014), selecting the games according to the built-in possibility of manipulating the Independent Variable (e.g., Schmierbach et al. 2014), the selection of titles according to the results of an exploratory pilot study (e.g., Anderson & Dill, 2000), and finally, choosing titles according to the commercially appointed rating (e.g., Hummer et al., 2010). Unfortunately, the majority of the studies sampled did not report such a procedure. With regards to the procedures of segmenting the game engagement, and delivering the stimulus to the participants, the most frequently encountered were time-based segmentation, that is, having participants play for a predetermined amount of time, and structural segmentation, meaning that participants play a specific level or round of a game. The article review results can be summarized as a need for a game analysis framework that can be used to compare brief segments of the game and contextualize the targeted stimulus within the surrounding structures. Thus, a separate evaluation of the person and the structure could be provided, eliminating the risk for a circular assessment (Rauthmann et al., 2015a).

These conclusions were the foundational guidelines for the development of the game analysis framework. While other schools of thought, such as symbolic interactionism, were reviewed, its focus on the definition of the situation via the individual's appraisal was considered not to be fitting to the aim of this work. Instead, as a necessity for the analysis of the stimulus game to be separate from the participant's assessment, ecological psychology was considered the most fitting avenue of approach. However, the concepts proposed by ecological psychology still required translation to the domain of video games. Specifically, Turvey's (1992) conceptualization of affordances as disponibilities for action and manifest properties was adopted, and translated for a more fitting application. The necessity for such translation was evidenced by the overt, and necessary reliance on the affordances of both real and virtual objects in interactions related to video games. As such, the distinctions made by Turvey in terms of the actions of organisms and the properties of objects was considered to not be as analytically productive as an acknowledgment of the multitude of agencies functioning in concert within the virtual environment. On this foundation, the game objects, conceptualized as conglomerates of affordances, were proposed as the building block of the game situation.

The roles attributed to the player and the game system in the context of this work are those of operators who provide activation impulses to the game objects, resulting in the juxtaposition of their complementarities. The role of operator, attributed to the player, was chosen both as a consequence of the need to maintain the analytic focus on the stimulus, and not the person, and a desire to acknowledge their active participation and not just the passive reception of content. The directional relationships formed between the game objects form thus the wireframe of the game situation, which is provided the functional definition of a momentary configuration of game objects, linked by their dispositions. The defining factor of the situation is the stable topology formed by the observable objects. Once the object configuration changes, the situation is correspondingly considered to have changed. Also notable is the emergence of the situation on the foundation of the greater game environment. The objects that appear as part of the momentary situation are themselves part of the overall game network. This dictates two separate layers of analysis between which the researcher must move, in order to obtain a comprehensive overview of the object relationships in which the player can enter. These two distinct layers are the focus of Chapters 6 and 7, respectively.

A consequence of this conceptualization is the emergence of a single, unifying factor across which the games utilized can be comparatively analyzed, and upon which the equivalence of the conditions may be examined. That is the unifying, universal variable of control. To understand the relevance of this contribution, the limitations of the current game selection and segmentation procedures must be reviewed, along with the noted challenges that stimulus games bring to research designs. The global limitation observed in the procedures of game selection was the decontextualization of the stimulus from the supporting structures of the game. Choosing a game based on the outward appearance of the independent variable or the built-in possibility of manipulating said variable does not consider the context in which the variable emerges. This has two significant consequences. The first is that the game stimulus cannot be qualified as a representative of a particular group. Thus, it becomes unclear across what population of games the results can be generalized (Wells & Windschitl, 1999). The second consequence is the lack of procedures that would ensure the equivalence of the conditions. As many studies utilized different games in their experimental and control conditions, the lack of contextualization of the independent variable within the supporting structures results in uncertainty that the manipulation concerns solely the independent variable. Studies using commercial ratings rely on them to vary the presence and absence of the variable between conditions, for example, by using a game rated M for mature in a violent condition and a game rated E for everyone in a control condition. However, the difference in scope does not guarantee that equivalence is achieved. Likewise, using pilot studies to ensure equivalence presents the risk of creating a circular assessment, wherein it is uncertain if what is being assessed are the features of the game or the characteristics of the person doing the assessment (Rauthmann et al., 2015a). In terms of the game segmentation procedures, either time-based or structural, the global uncertainty rested in the unverified variability of experiences. In a 15 minute segment, for example, the experience encountered by one participant will vary depending on a multitude of factors, from their experience playing the game, to their preference for specific actions, to the motivation they have to explore certain game structures. In short, the procedures highlight the need for a better overview of the context in which the independent variables emerge, and within that context, a need for a method of verifying the equivalence of possible experiences that participants may have, both within and across experimental conditions.

The solution presented by the current framework rests on two pillars – the object relationships and the unifying variable of control. Acknowledging the role of objects, and the relationships they form via their affordances as the building blocks of the game situation, addresses the issue of contextualizing the independent variable. As one of the challenges brought by stimulus games is their systemic complexity which may result in the intrusion of confounding variables in the manipulation, choosing this small scale, universal unit of analysis is intended to provide the possibility of gaining an overview of the context in which the player acts, and how their actions may be supported, modified and constrained by other agencies in the game environment. Thus, the systemic complexity of the game is set at the center of the examination. The role of the player within this object-based system is also acknowledged as one of active agent, operating within the bounds of a complex system and not simply enacting a script. The action possibilities players have are thus made apparent. Thus, even though the possibility of experience variability may persist, the parameters of that variation are recognized, making its observation and accountability more facile.

Adopting control as a unifying variable relates to the challenge of equivalence between conditions. As discussed, object relations signify the presence of complementary affordances, whose juxtaposition may result in what Turvey (1992) refers to as effectivities, or manifest properties. Turvey does not input a directionality to the relationship, stating that the emergence of an effectivity as a result of affordance juxtaposition is symmetrical. However, due to the necessity of acknowledging the source of the action impulse, within the current framework, the relationships are granted a direction. This allows for the acknowledgment of the player as an active agent, acting on and with other objects in the game. This directionality also allows the observation of agency exerted on the player, coming from the second situation participant, the game system. The engagement with the game is thus conceptualized as a continuous negotiation of control between the two participants, visible via the objects they are able to influence actively. The directed relationships between objects in the game thus become descriptors of the distribution and diffusion of control.

The manner in which this singular variable of control becomes a beneficial factor to the necessity of maintaining equivalence is simply by providing a unique descriptor of the game engagement. Differentiating between stimulus game types has taken multiple forms, the most frequently observed being the use of genres or ratings. They, however, fall short in several aspects. Both rating descriptors and genre descriptors are abstracted to encompass the entirety of the game, and thus are not scalable to the short play time utilized in experimental studies. Likewise, their scale implies that the effects observed should be generalized across the game type they designate. However, the heterogeneity of games makes this possibility often untenable. Is *The Legend of Zelda: Ocarina of Time* a violent game? A puzzle game? Can the results observed following a study that used another violent game, such as *Doom*, be applied to it? How about the results of a study using a puzzle game, such as *Myst* (Cyan, 1993)? Adopting control as a unifying variable eliminates the need for these descriptors that relate to the entirety of the game, and instead, offers the possibility to scale down, and appraise the small segments of the game used by researchers during the experiment. Further, the current characteristic, that of the diffusion of influence of the situation participants, makes another step towards acknowledging the active role of the player, who is not simply passively presented with an object that presents a specific feature. Observing how their control is diffused through the network of objects not only allows researchers to recognize the active role, but their role contextualized within the network of agents present in the environment. The role of the player is thus no longer a passive one, and their actions are to be viewed in the context of game engagement. As seen in the previous chapter, this allows a more contextualized perspective, where the result of a violent act may not be just a reward, but in the context of the other objects of the network, resource gathering.

There are thus two large areas in which the current framework addresses the necessities of experimental research using games as stimuli. That is by making overt the complexities of the game system and offering a single characteristic across which comparisons can be drawn between game segments of an appropriate scale. These two large areas can be mapped, more or less, to the two types of analysis presented in this work – the macro analysis of complete game networks and the microanalysis of game situations. The macro analysis explored in

Chapter 6 discusses the different network configurations observed in the corpus of games analyzed and the general ways in which the game and the player exert control in the game, as observed in the examination of the most influential and the most influenceable nodes in the games. Chapter 7 adopts a micro perspective and examines the most common object configuration types encountered in the game. The game situations are categorized according to the type of influence that the player and the game system exercise, as well as the object configurations that constitute them. This small unit of analysis is more compatible with the short engagement between the player and the game during the curse of an experimental study. Taken together, these two analyses exemplify both the challenging areas that the framework addresses, as well as the analytic loop that researchers are advised to adopt when selecting the stimulus game, and the segment that they wish the participants to play.

As discussed in Chapter 4, where the concept of the game situation is first provided a foundation, the small engagements occur on the foundation of the greater game network. Objects involved in the momentary situation, may have different standings within the network as a whole. Further, an examination of the entirety of the game network can provide information with respect to the different possible situations that the player might be embedded in, as seen in the examination of the six violent and non-violent games utilized by Kasumovic et al. (2021), discussed at the end of Chapter 7. The analytic loop then consists of an examination of the game network, which elucidates the potential situations that may emerge in the engagement and then returning to the greater game network to contextualize the objects present in the situation. This strategy reinforces the necessity of acknowledging the systemic complexity of the game while maintaining in focus the brief playtime afforded to a study participant.

To summarize, the contribution brought by this dissertation does not necessarily make the work of researchers easier. Contrarily, in some senses, it makes it harder, advising more reflection and time investment be made in the utilization of games in research designs. However, however, the principal intention is for the research procedures to respect both the demands of the object of study, and the demands of the research design. In short, it provides an analysis method that brings into focus the context in which the experimental variables of interest may be located, and limits that focus to the segments used in the experiment, providing a more viable means for replicating studies and generalizing results, not across entire game types, but across small scale game segments.

8.3 Framework Contextualization

As a means of analyzing brief segments of gameplay, extracted from the greater game engagement, game situations count themselves among a series of other, similar analysis tools. Among these, we can count loops, states, and design patterns. In the following, the game situation will be compared with the aforementioned analysis tools, with the aim of identifying its strengths and weaknesses. By doing so, the intention is to provide an understanding of how these different tools can work together, to address each others strengths and weaknesses, and in the process, provide a firmer analytic grounding.

Zagal et al. (2008) present a comprehensive analysis of types of gameplay segmentation utilized in early arcade games. Among the types of segmentation described, they count temporal segmentation, spatial segmentation, and challenge-based segmentation. These types of segmentation are instantiated in the games through specific design elements, such as levels, rounds, and waves. The types of segmentation are noted to not be discrete. Instead, they may blend in different manners. A level may, for example, present a timed combat challenge of increasing degrees of difficulty. While heuristically very useful, the framework would present a series of shortcomings in the context of experimental game effects research, for reasons more broadly explored in Chapter 3. The segmentation employed through levels can occur within and across many of the layers[12] of the game (visual, mechanical, spatial) and vary both between games and within the same game. This description of segmentation thus takes a higher level of granularity in comparison to the situation framework, and as such, if used on its own, would not provide the necessary means of controlling for confounding variables or ensuring equivalence between experimental conditions. It is, however, possible for the frameworks to be applied concurrently. One of the shortcomings of the situation framework is the amount of time required for the identification of the full set of objects and relations existent in a large-scale game. This would make its application prohibitive due to the practicalities of research. However, selecting a specific type of segmentation – a level, a bonus stage, a series of rounds – and identifying the specific objects, object relations, and emerging situations can prove to be a more feasible practice.

The gameplay loop is a frequently encountered concept in game design discussions. Its popularity can perhaps be attributed to the intuitiveness of application for the analysis of the most prominent activities in which a player is involved when engaging with a game of any

[12] Here, the term ‘layers’ is used in accordance its conceptualization in Aarseth and Grabarczyk’s ontological metamodel (2018)

kind. In a 2012 blog post, Daniel Cook describes gameplay loops as repeated, fractal structures. The formal structure of the loop is described as,

‘The player starts with a mental model that prompts them to...

Apply an action to…

The game system and in return..

Receives feedback that...

Updates the mental model and starts the loop all over again.’ (Cook, 2012)

This model thus looks at the player as the rational actor who forms and employs cognitive schemas based on information that is presented to him by and through the game system, with the help of the multiple information channels present in the game. As loops are described to be fractal, branching, and regrouping through the course of the game, the mental model stage includes information regarding both the macro elements of the game as well as the microelements, relevant to the particular current state. The concept of the mental model is widely used in cognitive science, reflecting the representations of external reality that people develop based on their personal experiences and perceptions (Craik, 1943; Johnson-Laird, 1989; Jones et al., 2011). From this perspective, then, Cook’s model can be considered a cognitivist model of player-game interaction, moving away from the necessity of examining the game environment in its depth and centering instead on the players’ appraisal of their position in it. In Sicart’s presentation of game loops and metagames (2015), the concept of the loop is built upon a grounding much similar to the one adopted by this framework. Specifically, Sicart states that ‘Interacting with a game is a constant dialectical challenge of submission and rebellion, of getting what we want through what we can do [5]. The ludic experience exists at the tension between play and designed structures.’ (p. 3). On this foundation then, he defines the game loop as ‘a composite of game mechanics, computing operations, and feedback mechanisms that is repeated until a break condition is reached, either in the game mechanics or in the computing operations.’ (p. 3). The repetition and end conditions of the game loop separate it from the conceptualization of game situations. While the loop starts and ends with the player’s mental model, or when a break condition is encountered, a situation ends when the network of objects in the perceivable environment changes. The differentiation comes from the diverging focal points between the two concepts. While the gameplay loop is interested in understanding the experience of the player, and their sense-making of the virtual environment, the game situation wants to highlight the components of that virtual environment and their potential relationships. While recognizing the existence of an individual player present in the situation, their sense-making of said situation is not accounted for. This is a conscious decision made as a means of separating the game as a stimulus from the players' appraisal of it. A second difference between the loop and the situation is the former's repeating nature, which results in it representing the most prevalent ways in which the player can act in the game. Situations can, but don't have to repeat, and their prevalence in a game is not the analytic focus of this dissertation. However, the prevalence of specific object configurations in different games can be a future avenue of research. Are specific game network types conducive to a specific type of situation appearing more frequently? As discussed in the previous chapter, the temporal sequence situation type is frequently encountered in *Detroit: Become Human* by virtue of the game system's exertion of control via obfuscation. This situation type was not encountered in other games, such as *Tetris*, *Zuma,* or *Snake*. The reasoning behind this lack may be due to the necessity of constant access to information regarding the environment that the games must provide. Future research could examine the prevalence of specific situation types in the context of different games, along with their absence in others, thus providing more context for the different types of control emerging across different genres. Such an endeavor could prove productive for the practice of stimulus selection.

Cook's game loop model also presents similarities to Juul's (2004) game-state based model of game time. The grounding of both models is the sequential exchange between the player and the game. The player takes action upon an existing milieu. Their action takes effect and produces a new state. Juul's model enables differences between games to occur across the length of the sequences sanctioned by the game, the rate at which the action of the player is registered and effected. A new state emerges with every action. Juul's model of game time is proposed as a separation of external, play time, as well as temporal units utilized by the game. From this perspective, the notion of game states and their parallel existence with play time and temporal units is similar to Gibson's notion of events (2014/1979). Gibson describes events as primary realities due to the fact that events are perceived directly, while time is not. Much like Juul's distinction of game time and play time, Gibson describes events as 'The stream of events is heterogeneous and differentiated into parts, whereas the passage of time is supposed to be homogeneous and linear' (p.92). The discussion of events is a byproduct of Gibson's expansion of the theory of perception to include the dynamicity of the environment. As he states, 'The environment has been described as shaped and textured and colored, as well as illuminated by a moving sun, but as if frozen. Let us now bring the environment to life.' (p. 85) The equivalence of the event and the affordance remains at a point of uncertainty, Gibson both stating that an event can include, but is not in itself, an affordance. For example, in the event of a fire breaking out, both warmth and burning are afforded. Events constituting affordances lead to the observation that they could be considered interchangeable (Stoffregen, 2000a). The game state, as Juul describes it, can be considered an integral component of the game situation and a precursor of it. The state can be considered a static configuration of objects whose relationships are not traced. As such, the game situation is built on the game state, with a further acknowledgment of object dispositions. Much like Gibson's desire to bring the environment to life, the game situation aims at examining the player game relationship during the engagement with the game and thus requires that dynamicity be maintained in its construction. Thus game situation relates to loops, events, and states in its sequential nature. A situation relates to the previous one and to the next via the object dispositions present. As Gibson describes affordances as capable of creating further affordances, so can dispositions of objects be used to generate the next situation.

Finally, Game Design patterns, as defined by Björk and Holopainen (2006), are 'semiformal interdependent descriptions of commonly reoccurring parts of the design of a game that concern gameplay.' (p. 34). The principal difference between game design patterns and game situations emerges from one central point: the notion of game objects. The game design patterns framework presents a series of component elements, among which rules, goals, events, actions, and game elements. The description of game elements is the following:

> 'Game elements are the physical and logical components that contain the game state and are manipulated by players to achieve their goals. Players influence the game state through actions performed on the game elements, which they can control.
>
> Game elements usually contain attributes that define their abilities and are used as input to determine the effect of actions. Typical attributes are those that define the types of game elements, signify what actions it provides, define who controls the game element, and represent numerical attributes that are used in algorithms for determining the outcome of actions.'
>
> (p. 26)

The definition of game elements used by Björk and Holopainen and the notion of game objects used in the current framework are similar to a degree. Therefore, the point of divergence emerges in the desire to separate components such as rules and actions from the game elements themselves. While the current framework functions according to the same notions, that games are designed, constructed objects and behaviors that may occur within their bounds are dictated by the programmed rules, the idea that game objects are instantiations of those rules and mechanics is taken more literally. Game elements, too, as seen above, 'contain attributes that define their abilities and are used as input to determine the effect of actions,' functioning along the same parameters. The game situation framework then uses objects and their relationships as the unique and unifying constitutive element of situations. This has the consequence of moving the focus to the directionality and distribution of control among the objects, providing a common baseline of comparison. At the same time, however, this process results in a loss of resolution in the framework. While situations describe the distribution of control, they do not provide descriptive accounts of the experience.

The game design patterns framework, however, maintains a high resolution in the construction of patterns, but their scope varies widely. While the conceptualization of game elements is similar to the conceptualization of game objects, they do not hold the same role in the frameworks' construction, being just one among the many constitutive elements. This points to the fundamental difference between the two frameworks. While game design patterns were created as a means for enabling a common language in discussions about gameplay, particularly in the design of games, the aim of the game situation is to enable comparison among equivalent conditions. As a result, patterns are highly descriptive of gameplay but also highly grounded in the source material. For instance, one of the game design patterns the framework discusses is combat. They define the combat pattern as 'Actions where the intent is to kill or otherwise overcome opponents.' (p. 145). From the description of the framework, we can identify concepts that have a higher resolution than the ones used in the game situation framework, such as qualifying the actions performed as killing and the objects upon which these actions are performed as enemies. By virtue of only distinguishing object relationships and their directionality, the game situation framework does not provide this kind of resolution. Instead, what the game design patterns framework understands as combat can be found in multiple situation types, including the **mutual active influence situation**, **mutual acting through tertiary objects**, and **affordance sequence** and **autonomous objects**.

There is thus the possibility for the patterns to be applied together, reinforcing each other and providing a more comprehensive means to select and control the game stimulus. The game situation framework is a method for operationally defining the game engagement. However, as discussed in the first chapter, humans don't generally think and experience their environment in an abstract, operational frame. Operationalization thus allows the movement between the construct of interest and the usable, standardized stimulus. In cases where, for example, a violent act is sought as a stimulus, a game design pattern can be the first step in its selection. Following its first selection, the specific instantiation of combat can be analyzed from the perspective of control distribution, and the situation or situations in which players find themselves can be identified. Conversely, the design patterns can be applied to provide a more in-depth account of the situations identified, mitigating the limitations produced by the lack of accounting for the valence of relationships.

8.4 LIMITATIONS AND FUTURE RESEARCH

The aim of any dissertation is to make a meaningful contribution. However, meaningful does not necessarily mean flawless. As stated in the introductory chapter, the principal personal motivation of this work was to ask questions. Some of those questions were answered in the development of the framework, but not all. The application of the resulting framework will, likewise, answer some questions, but not all.

The first limitation I was confronted with when applying the framework was the lengthy amount of time necessary for identifying all the objects present in the games and their relations. The framework requires very minute attention to detail in its first application, and that translates to a large time investment. This may be a requirement difficult to fulfill for many researchers. However, the application of the experimental method inherently calls for a high degree of control and awareness of the stimuli used. While a large time investment, it does not fall in the category of being unreasonable in the context of researching the effects of engaging with an object that is part of such an extensive network of stakeholders as video games are. The time investment necessary has the possibility of also decreasing over time if a corpus of games is analyzed and published as open data. This would allow the research field to grow in a collaborative fashion. Another solution is the analysis of isolated segments of the game which have been identified via other means to be of interest.

Another limitation inherent in the framework is its lack of focus on the valence of the relationships between objects. This limitation was a result of a conscious choice between providing a high resolution to the analysis or a grounding, unified variable across which the game experience can be compared. The latter was chosen due to the rationale that providing a grounding frame of comparison allows analytic expansion towards more granular examinations. Having a rationale for the choice does not erase the limitation. However, an unanswered question by one tool of analysis can be addressed by others, such as a game design patterns framework explored above.

Another limitation is posed by the construction of the situation typology and the limited corpus of games it draws on. Many genres have not been included in the analysis, which points to the possibilities of expansion of both the situation typology as well as the macro analysis taking place in chapter 6. It is less of a possibility, and more of a fact, that the inclusion of more diverse titles and more expensive games could have provided more insight. However, the practical limitations of the framework discussed in the previous paragraph were present in my own application of the framework. Another related drawback is that the analysis was purposefully confined to single-player video games. As this work included both the development and the first application of the framework, I considered it necessary to start with a game type that limited the number of situation participants to two. The presence of other players will invariably create further complexities in the distribution of control present in the network, as well as a greater variety of situations. The same is true for analog games. However, while the framework has not been applied to other types of games, it does not mean that it cannot be. As the central pillars of the framework are only the game objects as an instantiation of the rules and mechanics and their relations, it is safe to consider that the applications across media and with multiple participants are possible. As such, the framework still leaves a lot of questions unanswered. But hopefully, wearing its limitations on its face incentivizes the search for other methods, such as the ones presented in the previous section, to aid it.

A further limitation of the work is the lack of empirical validation of the situation typology. Future research could benefit from the empirical evaluation of the similarity between situations assigned to the same type. To not fall back into the trap of circular assessments, however, the evaluation should limit itself to the similarity of the situations, at first, and not the presence or absence of the desired variables.

Hopefully, the unified concepts of influence and control will also incentivize research into the translation of behaviors in virtual environments. For instance, while aggression has been conceptualized thus far as a simulation of a violent act, it is possible that its instantiation in video games can take other forms. For instance, we can consider a small example from the game *Hearthstone: Heroes of Warcraft* (Blizzard Entertainment, 2014). *Hearthstone* is a competitive collectible card game developed by Blizzard entertainment and released in 2014. To participate in a competitive game session, the players are first required to build a deck by selecting 30 cards out of their collection, which is accrued primarily via purchasing card packets. Following the construction of the deck, players engage in competitive gameplay, drawing cards from the preestablished pool and playing them according to their cost and the available resources on alternative turns. The game system controls the turn order and length of the turn, with players having the option to end their turn before the timer runs out, once they have taken all of the actions they could, or wanted to take. This particular feature gives rise to a behavior called ‘roping’, where players may intentionally leave the timer to run out in order to antagonize their adversary by intentionally wasting their time (Arjoranta & Siitonen, 2018). Thus the configuration of control privileges the opponent, who can refuse the players access to their cards, and thus effectively the access to the game engagement. Could this seemingly nonviolent act be considered aggressive? The position of domination afforded to the opponent may suggest that. It would be possible and interesting that research into the effects of violent and aggressive content takes into consideration the unintuitive features that can be discerned from the distribution of control.

Finally, the framework invites, aside from the opportunities for expansion, the opportunity for further questions to be asked and avenues to explore. This typology consists of 9 situation types. A set of only five nodes can be combined to produce a range of 9364 distinct graphs. Are there specific object configurations that are not suitable or simply not encountered in video games? If so, why? Can the process of distinguishing objects relationally, according to their role in the player-game relationship aid in terminological clarifications surrounding terms like avatar? Can an aggressive action in a game be better understood from the perspective of direction and proximity of control elicited? These are only a few of the questions that the framework can generate and may help answer in time.

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