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What Is It Like to Be a Game?—Object Oriented Inquiry for Games Research, Design, and Evaluation

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Human-Computer Interaction (HCI) researchers more and more challenge the notion of *technologies as objects* and *humans as subjects*. This conceptualization has led to various approaches inquiring into object perspectives within HCI. Even though the development and analysis of games and players is filled with notions of intersubjectivity, games research has yet to embrace an object oriented perspective. Through an analysis of existing methods, we show how *Object-Oriented Inquiry* offers a useful, playful, and speculative lens to pro-actively engage with and reflect on how we might know what it is like to be a game. We illustrate how to actively attend to a game's perspective as a valid position. This has the potential to not only sharpen our understanding of implicit affordances but, in turn, about our assumptions regarding play and games more generally. In a series of case studies, we apply several object-oriented methods across three methodological explorations on *becoming*, *being*, and *acting as* a game, and illustrate their usefulness for generating meaningful insights for game design and evaluation. Our work contributes to emerging object-oriented practices that acknowledge the agency of technologies within HCI at large and its games-oriented strand in particular.

Keywords: object-oriented inquiry, evaluation, speculation, design, games, play

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1. INTRODUCTION

Digital games evoke visceral emotions in players. Expressing these feelings often comes with tendencies of ascribing human features to games (Müller et al., 2018): games are presented as deliberately thwarting players' efforts or attributed kindness and collaborative potential. However, thins anthropomorphization asserts human modes of being onto non-human games. One approach allowing us to rigorously engage with the question of "What is it Like to Be a Game?" lies in drawing on epistemologies that allow for object-specifics inquiries.

Object- or technology-centered modes of inquiry emerged in the form of different theoretical perspectives. However, they all share that they fundamentally rethink the ontological role of the material world. Being critical of human exceptionalism, they argue for rejecting the dualism of "nature vs. culture" in favor of a relational ontology that accounts for the agency of things. In other words: They argue to take things and artifacts as well as their embedded knowledge, seriously. Technologies and humans are largely understood as fundamentally different entities,

which suggests that it is possible to investigate one or the other independently. Building upon prior theoretical object-oriented work (e.g., Latour, 2005; Bogost, 2012; Hayles, 2014), we argue that human and non-human participants in play mutually shape their relationship and continuously (re-)constitute their ontological (in)separability, i.e., their state of being in the world.

Within Human-Computer Interaction (HCI), we observe a recent surge of research that puts the perspective of objects and technologies explicitly at the core of its inquiry, thus providing a counter-perspective to the strictly human-centered view (e.g., Wakkary et al., 2015; Giaccardi et al., 2016; Chang et al., 2017). However, such work is virtually non-existent in HCI related games and play research. Even though inquiries into game generated data (i.e., logs) exist and are often employed, they are predominantly framed along an explicit interest into players' experiences, effectively decentering the object in their human-centered mode of inquiry. We argue that there is a potential for game design and research practices operating from an object-oriented perspective to generate innovative ideas and insights.

To this extent, we contribute new knowledge to the field of HCI by analyzing existing object-oriented methods and use the notion of *Object-Oriented Inquiry* (OOI) by Hayles (2014) as a theoretical background for our methodological explorations. Our aim is to articulate what we can understand by attending to an object perspective. After outlining the epistemological premises of this theory, i.e. what we can learn through OOI and how it ties into existing HCI and games research. We then explore different methods for *Object-Oriented Inquiry* and exemplify the approach through three *methodological* explorations on *becoming*, *being*, and *acting as* a game. Finally, we illustrate how this approach generates additional parameters for design decisions and the evaluation of digital games. Our work contributes a playful approach to *Object-Oriented Inquiry* stemming from theoretical deliberations with the potential to expand on qualitative methods and understandings for game design practice and research.

2. BACKGROUND

Before diving into the particularities of *Object-Oriented Inquiry* (OOI), we present *Object-Oriented Ontology* (OOO) as the theoretical foundation of the approach. We then show how OOI can be applied to contexts involving digital games.

2.1. Object-Oriented Ontology

Research inquiries, in general, practically position their knowledge paradigmatically (Guba et al., 1994). With situated paradigms come implications for the ontological, epistemological and methodological backdrop thereof. Ontology (the question of "how are things in the world?"), epistemology ("what can we know about things?"), and methodology ("what kinds of methods lead to which kind of knowledge?") comprise individual research areas in their own rights. We draw on *Object-Oriented Ontology* (OOO) as our ontological background, epistemologically position our knowledge as partial and subjective (Haraway, 1988) and offer a *methodological analysis for a range of methods* aimed at identifying object-oriented knowledge in game design and research from these positions.

An early precursor for OOO can be found in Actor-Network Theory (ANT). By arguing for ontological symmetry, ANT emphasizes the agency of things and the interdependent relationships between humans and things: these show themselves in use, practice, maintenance, development, invention, and so on, continuously rearranging each other into networks of relationships (Latour, 2005). These networks are in a state of continuous malleability. ANT is based on highly detailed observations and stories of the series of interactions necessary to sustain a network (e.g., Latour et al., 1999). By placing all actors on the same level and giving them the same amount of attention, ANT lends itself toward the concept of a "flat ontology" Bryant (2011), which blurs the distinction between objects and subjects. This has been made clear particularly for immaterial objects (such as digital objects) even before ANT was formalized. Flusser states that "[t]he future culture of immaterial information (...) will hold objects in contempt: it will consume them without paying any attention to them. In this sense, the human being will no longer be subject to objects" (Flusser, 1986, p. 331), hinting at a dissolution of ontological difference between objects and humans as subjects.

The term *Object-Oriented Ontology* stems from speculative realism (Harman, 2015). It positions *things* central to philosophical inquiry and opposes the consideration that knowledge about them can be potentially absolute or perfectly controllable. OOO is part of a conglomerate of non-humanist theories that reject the different categorizations of humans and objects entirely (Forlano, 2017). The approach focuses on how to engage with objects as they present themselves (Hayles, 2014). In other words, "'objects' does not mean non-humans any more than it means humans. All entities are objects; all have an inscrutable inwardness withdrawn from direct access" (Harman, 2015, p. 407). Understanding all potential actors, including humans, as objects is not meant as a call for passivity, rather this objectification comes from a stance that explicitly seeks to understand the different shapes of agency that are possible from an object perspective (Cussins, 1996). In that regard, OOO is a call for humility in the development of knowledge, a call to be cautious before asserting the specificity of humanity and to acknowledge the material knowledge embedded in things. It cautions us to be humble about the limitations of knowledge production more generally, i.e., even when we decidedly investigate human concerns as humans, our knowledge about these matters cannot be assumed as absolute or complete.

Scholars have used OOO as the inspiration for a variety of methods and tools, e.g., to examine artifacts and digital objects (Hui et al., 2016). As a theoretical framework, it allows researchers to consciously engage with artifacts' perspectives. However, therein also lies the core limitation in that, as humans, we are inherently removed from things and limited in the ways we can inquire about them (Bogost, 2012). To do so, we have to rely on the perceptive apparatus that is available to us, and can only project our own interpretations onto the objects' representations and manifestations when we engage with them (Bryant, 2011). Hence, we cannot separate our knowledge production from

human specificity and can only approximate object knowledge, if at all.

2.2. OOO for Games and Play: Object-Oriented Inquiry

We argue that game design and research benefits from an approach grounded in the work of Hayles (2014), who outlines the foundations for an object-oriented, posthuman, narrative and speculative analysis: *Object-Oriented Inquiry* (OOI). Specifically, we suggest following Hayles' engagement with resistance. "The object responds by resisting the human's inquiry, in a continuing dialectic in which the resistance forces the questions to be modified, and the modified questions uncover new forms of resistance" (Hayles, 2014, p. 169). Hayles further argues that despite this limitation, "human imagination is the best way [...] to move beyond anthropocentrism into a more nuanced understanding of the world as comprised of a multitude of world views, including those of [...] inanimate objects," because it requires scholars to be actively and creatively invested in the relation with the thing and the reactions/resistance they get from it. It argues for a decidedly different stance to think from a perspective that aims to decenter human and subject-oriented approaches.

Nonetheless, we argue that taking this perspective from our position as HCI researchers in the area of games and play allows us to encounter games within their socio-technical context on game-oriented terms. This can be understood as an extension of "staying open to multiple meanings in design and evaluation" (Sengers and Gaver, 2006) within third-wave HCI (Harrison et al., 2011) by putting the focus on the plurality of meanings, some of which might be coming from games. *Object-Oriented Inquiry* can open up further potentially conflicting perspectives on the interaction and relationships between games and players.

Games, toys, and playthings offer excellent opportunities for methodological explorations of OOI. Games are already understood as acting by themselves (Zook et al., 2011), and following their own predetermined rules, most notably in the notion of machine vs. operator actions (Galloway, 2006). When encountering games, players often become viscerally passionate and engage with them through anthropomorphization (Müller et al., 2018), implicitly acknowledging and discursively re-iterating a game's agency. Idle games even present an entire game genre that does not necessarily require player input (Alharthi et al., 2018a). They "tend to play themselves, making the player's participation optional or—in some cases—entirely redundant" (Fizek, 2018). Hence, idle games can be understood as games facilitating object-oriented play that decenters players while also facilitating distinct experiences through gameplay (Spiel et al., 2019).

Digital games have been used in a fashion which Bogost (2012), (in reference to Harman) calls *carpentry* as the act of expertly manipulating material explorations to create objects that *do* philosophy through their embodied knowledge. These are objects (sometimes games) that interrogate their environment through their being, conceptualizing "philosophy as a *practice*" (Bogost, 2012, p. 92) and providing "ontographical tools meant to characterize the diversity of being" (Bogost, 2012, p. 94). Games can provide the ideal playground to experiment with ontography: Bogost (2016) carpentered *Cow Clicker* as an investigation into the practice of supposedly social games; which is also understood as a precursor or early representative within the idle game genre. Similarly, Gualeni (2014) created *Haerfest* to philosophically engage with the question of what it might be like to experience the world as a bat (in reference to Nagel, 1974). This means, games are particularly conducive to object-oriented inquiries as artifacts that are understood as having agency more generally *and* as a medium for the carpentry of object-oriented play.

3. OBJECT-ORIENTED INQUIRY AS A PRACTICE

We reviewed existing approaches in HCI that focus on objects instead of human perspectives or the interaction between them. As work within dedicated games and play HCI research from an object-oriented perspective is exceedingly uncommon, we look to the larger field of research we are embedded in as well as to associated work in the realm of speculative design (Auger, 2013). Through our close reading (Martin, 2005) of available works and subsequent analysis thereof, we identified and classified different strands of methods for data acquisition and analysis: namely *schematic*, *narrative*, and *manipulative* inquiries augmented by *descriptive*, *discursive*, and (purely) *speculative* analysis. Additionally, we briefly discuss data (re-)presentation as a particular concern to object-oriented inquiries.

3.1. Data Acquisition

A range of different methods for generating data within OOI can be understood as either *schematic*, *narrative*, or *manipulative* inquiries. By mixing and combining them, we can continuously change the lens and encounter a game within different states and contexts. We collected several methods and approaches that have already been used in HCI or associated literature and have the potential to enable researchers to acquire a variety of perspectives on and from a game.

3.1.1. Schematic Inquiries

We refer to methods aimed at gaining insight into objects as a *crowd* Bryant (2011) or assemblage of other objects as *schematic* inquiries. Within these, researchers focus on the things that come together to make up another thing, the part that forms a whole. Methodological suggestions for schematic inquiries often stem from an ANT background, and range from *listing* parts, creating *photographs* with things as the focus, assembling *exploded* or *cut/away views* or simply drawing *flowcharts*. Additionally, we see examples of schematic inquiries in the tradition of *system log analysis*, though with the intent to understand a given system, rather than the errors generated when someone interacts with it (McVeigh-Schultz et al., 2012), *workbooks* (Gaver, 2011), *annotated portfolios* (Hauser et al., 2018), or the *visualization of actor-networks* (Spiel et al., 2017). We schematically acquire game-related data in our methodological exploration on *being* a game.

3.1.2. Narrative Inquiries

Several approaches allow researchers to generate narratives from an object's perspective. For example, technology can be *anthropomorphisized* to discuss the different roles it takes up in relation to humans and other objects (Buttrick et al., 2014). Narrative inquiries can also rely on multiple human perspectives, be it through *co-speculation* on a thing with distinct groups (Wakkary et al., 2018), *interviews* with actors who enact being a thing from previously collected data (Chang et al., 2017) or entire *speculative enactments* (Elsden et al., 2017) from an object's perspective. We partly acquire data through a narrative inquiry in our methodological exploration on *acting as* a game.

3.1.3. Manipulative Inquiries

The active manipulation of material and objects to *do* philosophy and inquire through an object's perspective is another form of practizing *Object-Oriented Inquiry*. Especially relevant in inquiring into less tangible actors and concepts as objects, *speculative design* can be a form of *doing* philosophy through the creation of speculative virtual technologies (DiSalvo et al., 2016). It follows the tradition of *carpentry*, which has been actualized in playful (Gualeni, 2014; Bogost, 2016) and techno-physical forms (Wakkary et al., 2015, 2017). Explicit *deconstruction* can additionally be a form of engaging with a thing through actively disassembling and re-configuring it into the same or different things (Murer, 2018). In our methodological exploration on *becoming* a thing, we acquire data by manipulating game related objects.

3.2. Data Analysis

The above-mentioned approaches toward data acquisition lead to a range of artifacts, structured and unstructured texts as well as images that serve as potential data points. These different forms of data lend themselves to different modes of analysis; we identified three strands that can be applied, either individually or in combination. We have identified *descriptive*, *discursive*, and *speculative* analyses. A chosen type of analysis results, in turn, in a range of epistemological implications, which we briefly touch upon for each approach.

3.2.1. Descriptive Analysis

A straightforward form of inquiring into a technological object (including digital games) is to implement the recording of log data as an interface for human analysis. Indeed, quantitative analyses allow us to gather insights into the range of complexity surrounding a thing and/or its communication, and to gain initial pointers for potentially relevant areas for qualitative introspection. This notwithstanding, we would argue that the data can also be analyzed phenomenologically and qualitatively (Ädel, 2014). Descriptive results allow for a reductive overview on the complexity of objects, especially across temporal instances, and allow us to illustrate scale with regard to the complexities surrounding the reliance of objects on other objects as parts or required environments. Hence, schematic inquiries lend themselves particularly well to descriptive analyses. We include some descriptive observations with quantitative and qualitative aspects in our methodological exploration on *being* a game.

3.2.2. Discursive Analysis

Seeing all data sources, including non-textual ones such as images, as an instantiation of meta-text allows researchers to then apply textual methods such as thematic analysis (Braun and Clarke, 2006), grounded theory (Strauss and Corbin, 1990), or discourse analysis (Fairclough, 2013). In a classical ANT-inspired approach, the data could also be used to define actors and their actions by following them—including their relations or "associations" (Latour, 1984)—through their manifestations within given networks (Latour, 2005). This analysis invites researchers to practice ANT, which leads to the necessity of translations back into text, of which the resulting "trahison" (Law, 2006) requires active reflection. Basically, we refer here to any type of analysis that aims to contextualize different texts and construct knowledge through this process. As different manifestations of data are all translated and approached as texts, this form of analysis s allows researchers to engage practically with the notion of flat ontology between core texts, images, objects, and other traces that things leave. We analyse our data in the methodological exploration on *becoming* as well as *being* a game discursively.

3.2.3. Speculative Analysis

Speculative analyses have has been proposed as a necessary practice for HCI and ubiquitous computing research (Bardzell and Bardzell, 2014). We see the potential for explicitly speculative analysis in its application to narratives such as design fictions (Tanenbaum, 2014), fictitious designs (Tanenbaum et al., 2010), or simply attending to the object as represented through what is available and exploring possible avenues for different manifestations (Giaccardi and Karana, 2015). The knowledge gathered from this practice is particularly relevant for design purposes. We employ speculative analysis in our methodological exploration on *acting as* a game.

3.3. Data (Re-)presentation

When aiming to represent data, some form of visualization is often already inherent in the process of acquisition or analysis. Visualization can also constitute a core part of engaging with the complexity of things on their own, as shown in the "Anatomy of an AI" map (Crawford and Joler, 2018) as well as some of the case studies below. These visualizations can illustrate the complexity of assembled things to such an extent that in scientific writing and presentation, researchers may be required to only present selective views. We have encountered this issue when preparing this publication and point interested readers to the **Supplemental Material** which provides the full visual and textual context for our methodological explorations. Many of the methods described above readily lend themselves to a visual representation of data. As static media, these allow us to reflect on the temporal fleetingness they represent as they can only ever be snapshots. Hence, any systematic engagement with an object in general and a game in specific remains necessarily incomplete and partial on this account as well. To put this and the approaches above into practice, we explored their methodological potential in three sets of a total of six cases, each of which illustrates different kinds of object-oriented knowledge we could acquire.

4. METHODOLOGICAL EXPLORATIONS

We conducted three different methodological explorations on *becoming*, *being*, and *acting as* a game. Across several stages in the design process we use them to illustrate the feasibility of *Object-Oriented Inquiry* for HCI research in the context of games and play and how different modes of data acquisition and analysis lend themselves to different insights guiding evaluation and/or design decisions.

4.1. Approach

In choosing the methodological explorations, we aimed to cover different manifestations of different games and the objects surrounding them. We specifically set out to explore different methodological notions embedded in the concept of *Object-Oriented Inquiry* in practice. In the first methodological exploration, we focus on physical aspects of a game which are either intended to integrate with a digital element (as is the case with the Nintendo Labo™) or rely heavily on other technology for their construction (which is the case with the 3D-printed figurine). This endeavor was driven by an interest in identifying an appropriate context for manipulative inquiries and include predominantly physical objects that are augmented in play. For the second methodological exploration, we chose to investigate the assemblage of a browser game without requisite physical manifestations to consider a purely digital schematic context. In the last methodological exploration we engage with directly tangible technological games bridging the two previous forms of play and allowing inquiries into contexts that are embedded in interaction.

Each methodological exploration relies on a combination of the previously described methods for data acquisition and analysis, adapted to the particular context in which they are applied. Across them they illustrate different choices for inquiring into a game and the different types of knowledges that might come from doing so. As the material in the first two methodological explorations is much more extensive than can be described in the body of the paper, we point interested readers to the **Supplemental Material** for more detailed insights.

4.2. Becoming a Game

Making or crafting as an activity people do has been a predominant angle of prior HCI research for example, (for example, Blikstein and Krannich, 2013; Tanenbaum et al., 2013; Toombs et al., 2015; Meissner et al., 2017; Frankjær and Dalsgaard, 2018). There, the focus lies on the people who are seen as the primary initiators and "makers" of artifacts. However, by turning the magnifying glass to the *becoming* of a game, we can investigate another perspective on the process (similar to Huvila, 2016, but using a method with humans removed). It allows us to focus on the process in a different way, potentially uncovering new object-centered perspectives into playful crafting and production material. The leading question here is then: *What is it like to become a game?*

We engaged with two different materials and modes of assembly to take a closer look at the processes entailed in *becoming* a game. In the first case, we aided cardboard material in the construction of a new house as part of the Nintendo Labo™ Variety Kit and reconstructed a previously de-assembled piano from the same set. In the second case, we observed machines supporting the becoming of a small three-dimensional figurine. During both of these processes, we took a vast amount of photographs for documentation, namely 150 in the case of the house, 186 with the piano and 341 for the figurine. We then reviewed the photos and created booklets akin to workbooks (Gaver, 2011) illustrating the becoming process (see **Supplemental Material** and **Figure 1**). Hence, we performed a *manipulative* inquiry and analyzed it *discursively*, i.e., data were acquired through conducting and documenting the alterations on the object and the resulting documentation served as the basis for our analysis.

The three things resulting from the becoming process all went on a different journey to arrive at the state that we identified as a preliminary constant. Even though the procedure of arriving at the insights was identical, in assembling the booklets, we could observe different aspects of the process emerging as relevant to each game context.

The house took form from sheets of cardboard with pre-cut parts for assembly (see also, **Figure 1**, left). Hence, before the house became one connected thing, individual objects had to come together. Some of these objects resisted the process, e.g., by clinging to the sheet and only letting go after injury (slight breakage of part of the material). The house itself holds a three-dimensional structure, but the sheets are two-dimensional, which means that external forces had to be exerted on the individual objects to give them the shape that allowed them to interlock with others. The different parts coming out of the cardboard have different relationships to the house. While many came together to build the house, others were left out and did not take part in the process of becoming a house. Instead, they became merged into an assemblage of discarded objects collected as garbage.

As the piano was in the process of becoming *again* instead of merging its parts for the first time, there were no left out pieces, but rather missing ones that left it in a state of permanent incompleteness. The instructions for the piano assumed that it would be built from scratch. These expectations were not met in the particular process of becoming again. On the other hand, some parts had already taken on three-dimensional forms before and presented themselves as such (see also, **Figure 1**, middle). Traces of previous interactions, bends and folds revealed a prior history of the piano, which is independent of the person involved in reassembling. Still, the parts also partly resisted in becoming again—at least in comparison to the expected state given in the instructions. The preliminarily final version of the piano is somewhat crooked as the material consolidates previously known positions with current positions within the piano.

The figurine went through an entirely different process of becoming. It first existed as a digital object, which was virtually malleable. However, the figurine and what it stands for have an entire history of becoming that we were not privy to. This is another point of resistance that illustrates how we can only gain partial insights into the process of becoming due to the limitations of our own embodiment and placement. In the temporal slice we participated in, the figurine engaged the help

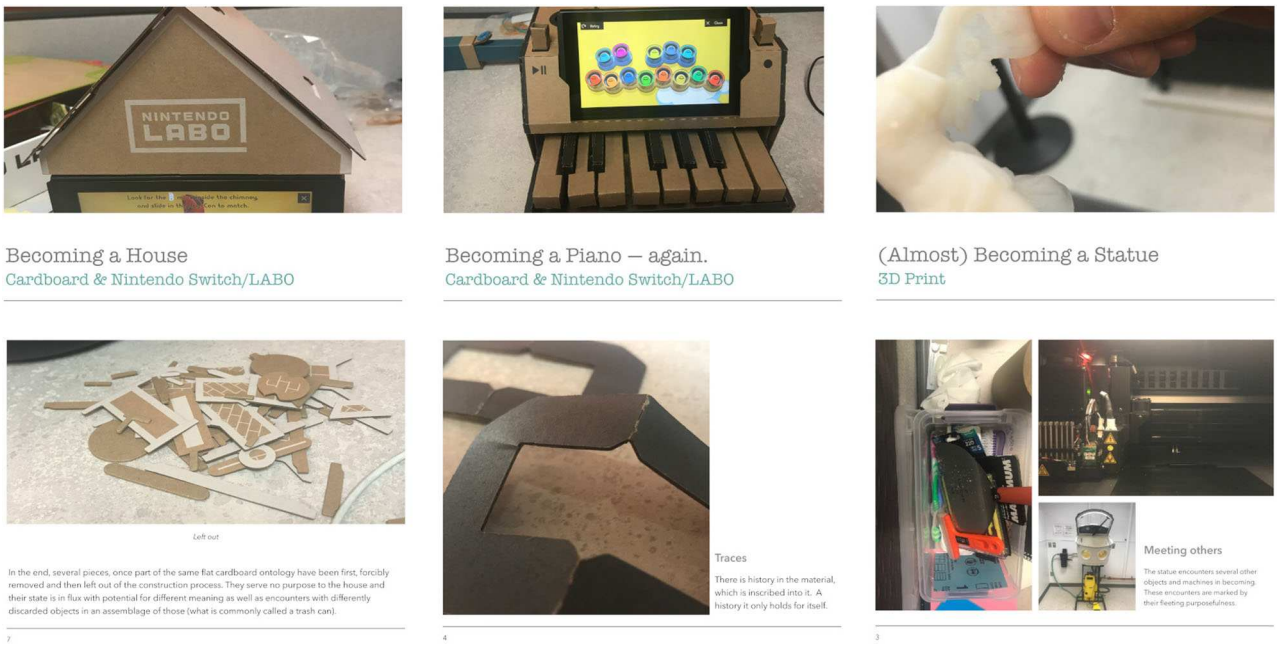

FIGURE 1 | Examples of booklets illustrating the becoming of the cardboard house and piano as well as the figurine.

of several other objects and machines to support the becoming process (see also, **Figure 1**, right). These objects have a primary usefulness in aiding the process, but also resist it in parts as can be seen by the destructive power that the cleaning station exerted on the figurine, breaking part of a wing, which leaves this particular assemblage of material in a state of externally (humanly) assigned incompleteness. We could also observe that the object took on specific meanings for the people involved in its becoming, precisely because it was the focus of our observation. It became a token of its brokenness, instead of being discarded or replaced. Hence, objects are shaped by researchers' observations in a similar way as they are shaped by the actions of humans within such contexts (Obrenović, 2014).

This allows us to consider implications relevant to the potential evaluation and (re-)design of the involved objects, but also, more generally, to technological and material development. The house shows us how, through care for discarded pieces, we could envision alternative futures for these pieces where they have a place outside of garbage and can be sustainably integrated in this or other projects. The piano illustrates design assumptions of an ideal states instead of re-use and appropriation. Instructions and availability of material should be part of design considerations that account for these practices (e.g., Jackson and Kang, 2014). The figurine exemplifies how the design of technology for digital fabrication must not only consider design for use by humans, but also for object-technology interaction to aid the becoming of games appropriately.

Through these three investigations into *becoming* a game, we could observe several aspects of the process being of different relevance to the particular game objects at different times. The method of taking photos during the becoming, and then assembling them into booklets, appears to lend itself to the analysis of different material contexts and processes surrounding the *becoming* of games. We also note that the resulting documentations as workbooks created yet another set of objects that could be inquired into and analyzed in their own right.

4.3. Being a Game

By understanding any game as an assemblage of other objects, the complexity of trying to account for all these entities can increase at an exponential rate. Additionally, considering the different states games might be in at different points in time further increases this complexity. Our leading question through this methodological exploration was thus: *What is it like to be a game of many things?*

We *schematically* inquired into *Kittens Game* through *lists*, which we then analyzed *descriptively*. Concretely, we collected a range of objects contributing to the being of *Kittens Game* in a specific instance at a specific point in time. As a visualization mode that preserves the structural entanglements between the different objects, we used a mind map, parts of which we show in **Figure 2**. On one side (blue), we depict the objects as they are represented at a certain point in time during the game, on the other side (purple), we captured all of the objects as they appear within the code, going down to one level past classes, but covering object instances in arrays. Mirroring these two perspectives allows us to directly contrast between an interface perspective and an assemblage perspective as it pertains to the game. We understand the processes of object collection and visualization as part of acquiring our data, whereas the description constitutes our analysis.

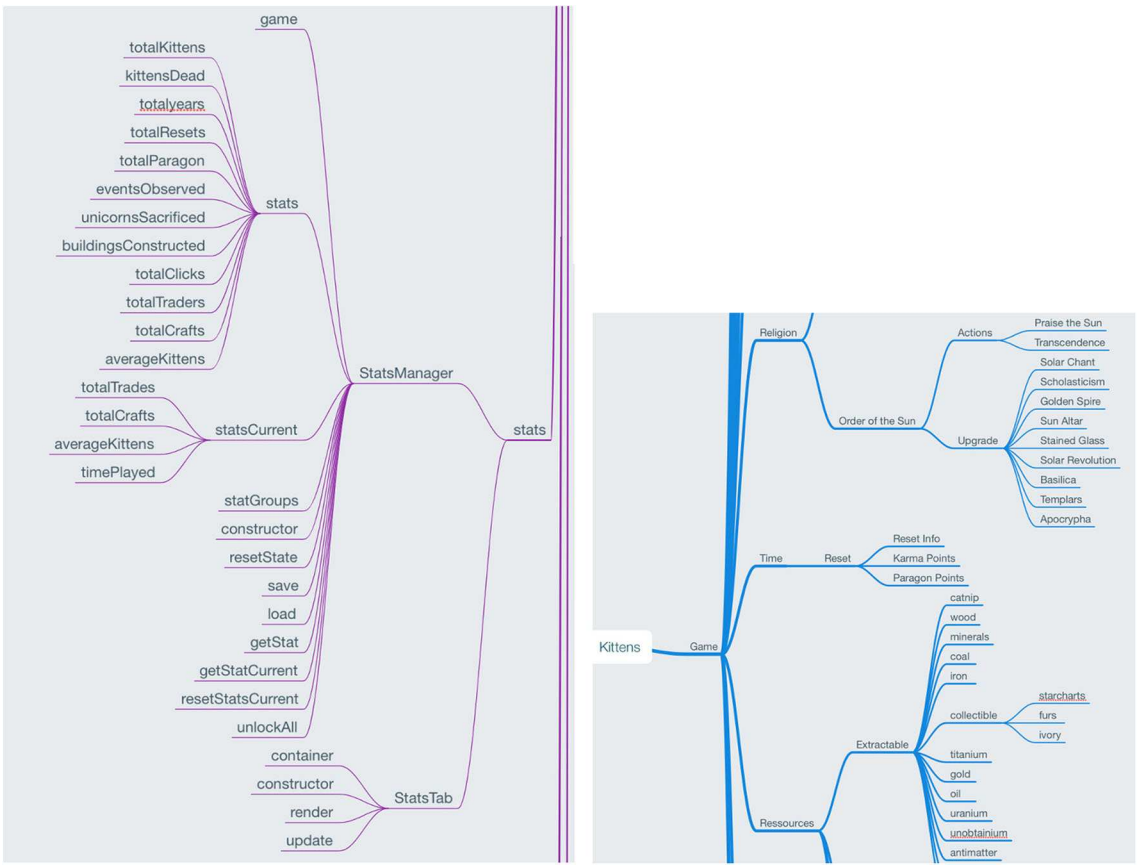

FIGURE 2 | Partial view on the objects who are part of *Kittens Game*. The left side depicts objects as represented in the code structure whereas the right side lists objects as presented to a potential player at a certain time.

Kittens Game[1] was developed in 2014 and belongs to the genre of idle games. At the beginning of *Kittens Game*, human players are represented as a single kitten in a catnip forest. Through gathering and refining catnip, more and more proverbial kittens gather together and advance their civilization beyond even current human technological progress. The system reveals itself gradually, becoming more and more complex over time (Alharthi et al., 2018b).

We extracted 282 objects as they were available to the first authors after five months of interrupted play (including four resets). We also collected 2,034 objects within the code. Individual instantiation and underlying implementation are only two ways in which we could think of the things which contribute to the existence of *Kittens Game*. We ignored several other physical and conceptual objects that might be relevant here, such as texts from players and developers, the genre context, influences from other games, metaphorical references seeping into and out of the game, the range of platforms and technologies the game could be played on or the different instances for each context of play—all of which co-constitute of what *Kittens Game* is. These could provide further alternative perspectives on the manifestations of the game.

On the right hand side of **Figure 2** (blue), there is a selection of objects as they present themselves to a potential human player during a specific state of the game at a specific point in time. Objects can refer to metaphysical as well as physical representations. Resources, buildings, concepts and game mechanics are all considered to be objects in this context. Only in acting with and on each other do they make a *being* of *Kittens Game* possible.

The implementation of the game is additionally tied to an object-oriented perspective through the use of JavaScript as the programming language. The left hand side of **Figure 2** illustrates the objects responsible for collecting, defining and manipulating the statistics of *Kittens Game*. The file is separated into calculations (*StatsManager*) as well as a class for representation (*StatsTab*). The objects themselves range from references to the game instance (*game*) to containers for statistics (e.g., *kittensDead*) and functions which are both specific (e.g., *getStatCurrent*) and general (e.g., *save*). Hence, internally, all virtual objects are declared and instantiated as a flat ontology. Regardless of their later behavior (e.g., variable, container,

[1]Available online at: http://bloodrizer.ru/games/kittens/. In reading the entire graph in the **Supplemental Material**, readers might be confronted with spoilers.

function) they are equally objects. Only by looking at the concrete mechanics can we distinguish their purposes.

Creating such schematic lists and analysing them descriptively enables designers to understand the complexity of the games they aim to create—not just as a complexity of the code base but with the added complexity of the semantic objects presented to players. By aiming to capture the assemblage of parts, designers might find this a useful tool for understanding potential additions and missing objects that can meaningfully alter a given status quo. In that regard, this approach relates somewhat to existing practices in software engineering (Bruegge and Dutoit, 2009), e.g., the use of the Unified Modeling Language (UML) (Medvidovic et al., 2002). However, while the UML is used to specify, structure and document software architectures, whereas our approach aims to understand more ontologically of "what there is" and not necessarily conceptually tied to the code base or its representation in the game. It operates from the concept of ontological lists (Bogost, 2012) decidedly without illustrating relationships or complexities. In differentiating between semantic and structural objects the aim is more to identify differences and commonalities from different perspectives. If a given software is created while making use of UML, this can very well be the starting point that can be reduced ore expanded upon to be suitable for a list based investigation.

Our schematic approach sheds light on the complexity of games, even though this can never be completely captured. Nevertheless, the differences in how *Kittens Game* manifests through its interface and through its implementation provide a basis for further investigation. For example, researchers could consider including some of the other objects we identified as co-constituting a game or evaluate mismatches between objects instantiated in code and toward players, or gain a deeper understanding into how the mental models of players are guided and might, hence, differ from the mental models of developers.

4.4. Acting as a Game

While games might act without humans around them, within HCI we are mostly concerned with how technologies (and, subsequently, games) manifest themselves through interaction with human or other animate actors animals (e.g., animals in Mancini, 2011). However, in these interactions, we focus on animate agency with technologies and games, neglecting other potentially relevant actors and perspectives that contribute to the enactments. Actively erasing these animate actors from our analysis allows us to reflect on the infrastructures (De Angeli et al., 2014) and additional requirements that are relevant to the design of virtual and physical playful artifacts and technologies. The leading question in this methodological exploration is, hence: *What is it like to act as a game?*

In contrast to ontographs, a form of schematic inquiry which focuses the photographic lens solely on objects (Bogost, 2012), we deliberately chose images that originally included humans interacting with technologies. We then redrew the photographs, focusing on the things that contribute to the technological dispositive with which people interact, but decisively cut out human actors (see **Figure 3**). We focus on two different contexts: (1) during the design of musical pads that allow several people to playfully create music through spatial movement (left hand side) and (2) a player engaging with a finished commercial product which projects a virtual environment on a head-mounted screen (right hand side), effectively allowing insights into a more evaluation driven context. In visually creating alternative perspectives on the interaction, we understand this procedure as a form of *narrative* inquiry that also follows certain actors and traces them visually. Through our editorial intrusion into the picture, we change the potentials of narratives it presents

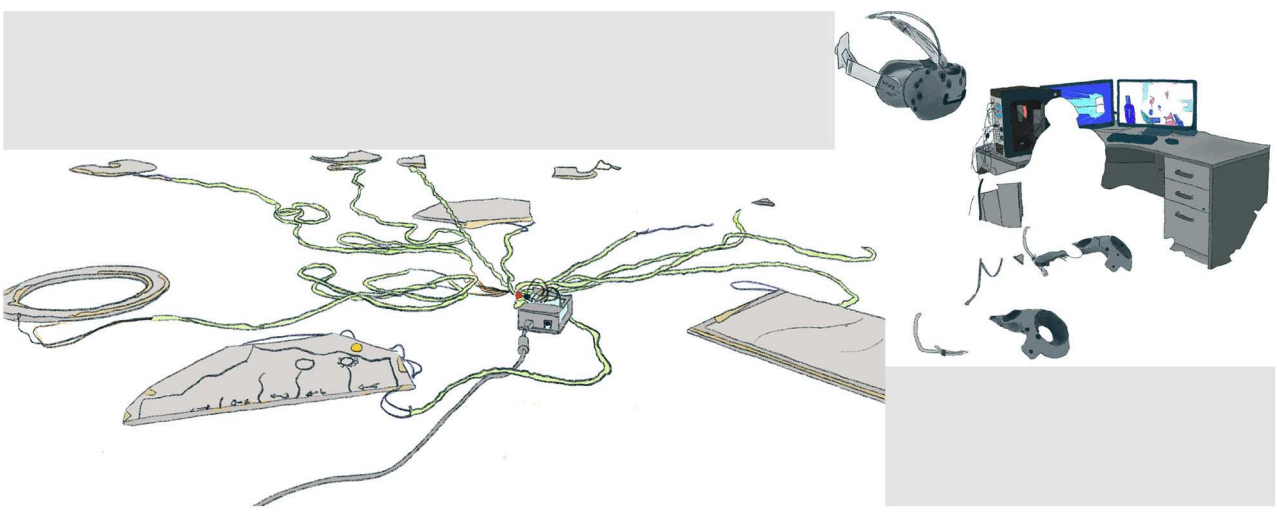

FIGURE 3 | Different illustrations of acting as a game in different contexts with human and non-human actors. Both illustrations have all human actors removed. To the left, a prototype of music pads refocuses our view on the mess of cables, whereas to the right, the context of a VR scenario indicates the relevance of not just the technological artifacts but the necessity of furniture to enable play. Note that non-essential actors as well as human actors create artificial white space.

to us and prepare the data basis on which we *speculate* on these different potentials from the objects' perspectives.

Both cases, individually, point to different aspects relevant to *acting as* a game. However, tracing the relevant objects from a given perspective is limited to exactly that perspective. As such, it might ignore other things which were not in the focus of a photographer who might not necessarily have been attuned to an object-oriented perspective and might have missed aspects that are relevant to the games' perspective.

With the musical pads, we deliberately worked off of such an unattuned image to understand how an *Object-Oriented Inquiry* can support reflection on ongoing design processes. One consequence of this is that there is a cable leading outside the picture, leaving the other objects it might have been attached to (plugs, computers) outside of our analysis. However, this perspective taking is precisely what allows us to reflect on the focus we take when attempting to capture technological objects during interaction. Additionally, some parts were occluded by humans actively engaging with the technology. As we only traced the relevant non-human actors, this creates artificial white spaces that actively remind us of the limited perspective we have available when inquiring into a technology through a snapshot in time.

In particular, this image shows us the messy state (cf. Dourish and Bell, 2011) in which the thing finds itself at this current moment in design. Cables are everywhere, obstructing the freedom of the plates to move into different spaces. They try to distance themselves from a centralized entity, but never manage to get rid of it entirely. A potential design decision following from this is that a wireless version of this design idea might be preferable. While designers might reach this conclusion in other forms as well, this is one way to reach it from the object's perspective.

In the case of the VR play scenario, the white space illustrates the need for another human to position a cable in just the right way. This leads to humans being effectively objectified as assistants to the technology. Even when that human actor is systematically excluded from the representation, they are relevant to the manifestation of the game as an object in play. We further notice that the game is instantiated not just by the apparent technological bits and pieces, but also by more circumstantial objects such as the furniture on which parts of the technology are placed. These are objects that have not been actively designed for, but are instead a matter of happenstance. They are assembled according to availability or convenience as perceived by the people who focus on interacting with what they view as the core technology.

While human actors in this space are visually (and potentially also auditorily) re-placed into a virtual environment outside of the space, the physical aspects of the technology are strongly tied to their environment and have to collaborate with things that might not be ideal to their instantiation. It resists and subjects human actors to do its bidding in cooperation. Otherwise it refuses to collaborate with another human actor. Considering this refusal, designers could target this as an identified weak spot and resolve it to a point where the technology does not require as much intricate attention from humans. Again, these issues can also be reported from humans or identified through other methods, but this is another part in designers' toolsets to do so by engaging speculatively—we dare say, artistically— and productively with the objects in the interaction.

The radical exclusion of human actors and the explicit inclusion of potentially relevant additional objects provides a different view on how a game manifests itself through interaction with players. By removing humans from the picture, we are invited in "speculating about how that object encounters the world" (Hayles, 2014). The illustrations offer active and reflective engagement as the process of redrawing encourages researchers to explicitly focus their attention on inanimate actors. This approach relies on capturing the limited perspective of an in-the-moment snapshot of a thing's manifestation in action. Potentially, a series of drawings along different moments in time or covering a broader range of perspectives could provide further insights, while still only marginally mitigating this limitation.

Across the three methodological explorations, we conducted six case studies probing into a range of different modes of object-oriented knowledge productions and their implications for analysis. We favored the illustration of breadth (in the form of several methods) instead of depth while hinting at further opportunities to dig deeper in specific contexts. Subsequently, we now discuss the epistemological and methodological implications of our explorations.

5. DISCUSSION

Considering our framing of *Object-Oriented Inquiry* and its actualization in our methodological explorations, we now connect our insights to more general epistemological and methodological deliberations. We then shed some light on the usefulness of *Object-Oriented Inquiry* as a productive agenda for game design and research.

5.1. Epistemological Insights

Our exploration on *becoming* a game illustrated the perspective of different types of physical manifestations around two sets of play contexts regarding issues like re-use, repair, object context, and instructional materials. While we started with object-oriented *ontology*, our work was fundamentally oriented toward knowledge production and how we might use the ontological backing to gain insights on games. It was not our aim to establish *what* a given game is, but rather explored *how* we can know what it might be like to be a game and *how* we might know about it differently using speculative object-oriented approaches. It was useful to compare and reflect on how we perceive, define and understand different reconfigurations of the material elements that might be associated with a game. We could know about these through different means but as a decidedly playful and creative approach, we deem this procedure particularly conducive to game design contexts.

Our exploration on *being* a game showed how analysing which concrete parts constitute it can inspire additional features or point out missing ones. It supports thinking about different (re-)presentations of a game and associated scale biases. These types of engagements invite explorations of the complexity

associated with games, to think about details within the context of a larger picture. In that regard, we expect this approach to be potentially useful in both, design and research settings.

Our exploration on *acting as* a game provided indications for more holistic game design and offered critique on existing prototypes. It further draws attention to the roles objects of play inhabit when radically reduced to themselves. As a mode of knowing about games, this approach provides design opportunities as a part of iterative game development or evaluation.

Hence, each of the three methodological explorations lead to distinct insights and let us know different aspects of what it might be like to be a game without assuming individual or collective completeness. Additionally, the explorations can be understood as referring to different types of relations in Bryant's flat ontology. Analysing the *becoming* of a game, means taking a look at what Bryant (2011) calls the *endo-relations* of an object as it manifests rapidly through several instances. We closely examine all the things that come together to create another thing—a game, to be specific—be it through a temporary or permanent relationship. Through re-focusing our attention on the *being* of an object, we can switch between *endo- and exo-relations* (in Bryant's terms), where the inwardly and outwardly formed relationships of a thing gain relevance. Finally, in *acting as* a game, we concentrate on its situatedness in the moment of an active *exo-relation* with another human. In all of these methodological explorations, though, it becomes apparent how "all objects are a crowd" (Bryant, 2011, p. 217), an assemblage of other objects manifesting in a temporally and spatially flexible form.

These object-oriented approaches decidedly limit the perspective taken by Human-Computer(game) Interaction and can, hence, not inform us on many matters relevant to human sociality. They are somewhat static snapshots of an objects' perspective on interaction. While not lending themselves easily to an understanding of process of interaction, they do, however, illustrate how taking an object's perspective means following a plan whereas interaction is often signified through situated actions (Suchman, 1987). While objects could feasibly attributed those actions as well (as we have shown in the case on *becoming* a game, our approaches do not (yet) do so. Another relevant methodological limitation lies in how all approaches remove players' perspectives from the analysis—albeit deliberately. However, they do not support questions concerned with players' experiences or are conducive to tackling equity issues (e.g., privileged immersion Passmore et al., 2018) appropriately. As such, it is a somewhat apolitical perspective to take, one that does not lend itself well to transformative research. As every method or set of methods limits how we can know about a specific context, we deem it relevant to point out the limits of the knowledge produced by using the approaches we delineated in our explorations. Given the political and transformative potential speculative design itself has brought forward (cf. de Oliveira, 2016), we see potential in the development of object-oriented methods that include such considerations.

5.2. Methodological Insights

These different perspectives on a range of game contexts were subjugated to different methods —albeit all of them sharing a *speculative* core. In our case study on *becoming* a game, we performed a manipulative inquiry into physical objects and digital fabrication, which we analyzed discursively. In our case study on *being* a game, we descriptively analyzed a schematic inquiry into an idle game. Finally, in our case study on *acting as* a game, we speculated on a visual narrative inquiry. These states and inquiries are not necessarily tightly coupled, though. One could imagine a schematic inquiry into becoming as much as a manipulative inquiry into acting, a speculative analysis of being and a descriptive analysis of becoming (and many other combinations). A mix of potential inquiries and analyses on the same thing yield different perspectives on it, which potentially become disruptive and disjoint between them, opening up the option of creative action for resolving these multiple meanings coming from the same thing. We chose our cases along the options they illustrate.

Part of our contribution also lies in identifying the strands of existing speculative object-oriented approaches as *schematic*, *narrative* and *manipulative* inquiries for data acquisition as well as *descriptive*, *discursive*, and (purely) *speculative* analysis in section 3. By categorizing them as such and situating our explorations within them, we aimed to show how game design and research could adapt these to different contexts. In that, we invite further adaptations and explorations that might illustrate more breadth in these approaches as well as how they might be combined with more classical methods to contribute to a range of insights from different perspectives. For example, we envision our approaches to be used in practice alongside more established methods such as contextual inquiry through interviews and observations (Holtzblatt et al., 2005) or other approaches oriented on gathering data for interaction design from humans (Preece et al., 2015).

A core challenge in Object-Oriented Inquiry remains in being *humble* (Hayles, 2014) about the insights we gain from these endeavors. The knowledge and perspectives we have access to remain necessarily partial. As human researchers we engage with games and inquire into them through our distinct perceptive apparatus, resulting in fundamentally limited access to appropriately claim an understanding of a game *as a game*. While this is a core methodological limitation (with adjacent epistemological implications), there is also no way around it. In addition, there was an inherent focus on visually charged representations and inquiries. All methods assume some kind of textual or visual engagement, ignoring the knowledge we could gather through analysing smell, haptics, taste, and other sensations potentially acting on us through a technology. While we encountered these modalities in our research, we somewhat discarded them incidentally during our analysis, due in part to being lured by the temptation of textual and visual representation modes as relevant to communicating this research through academic papers.

What these methodological explorations offer, however, are insights into different manifestations of things through distinct perspectives. They contribute to an understanding of the complexity of the assemblage of games and, together with other methods of inquiries into humans, interaction and conceptual relevance, provide us with a toolset that augments the

perspectives, questions and analyses of classical research, both in lab settings and in the wild.

5.3. Revisited: Object-Oriented Inquiry for Games and Play

Object-Oriented Inquiry has a place in game design and research akin to speculative methods within HCI (Bardzell and Bardzell, 2014). However, while traditional speculation is oriented toward alternative potential futures, *Object-Oriented Inquiry* speculates about the present, and the role of currently existing technologies within it (Hayles, 2014). In that, it can be a structured approach for creating design heuristics, especially when prototypes are not refined enough yet for playtesting.

Further, through attending to the games as technological objects, designers and researchers can use *Object-Oriented Inquiry* to critically engage with the limitations of any perspective they encounter in their respective and shared practices. With objects, it becomes painfully obvious that a complete picture about their 'experience' is never achievable (Bogost, 2012). *Object-Oriented Inquiry* can function as an exercise to reflect on the boundaries of empathy (Spiel et al., 2017) toward other actors (animate or inanimate) but particularly to our games.

5.3.1. Design

Each of the methodological explorations provided us with some indications on how to step forward in game design. The methodological exploration on *becoming* a game illustrated issues around dealing with *remaining* or leftover materials, issues around instructions for *re-building* and the associated messiness of having some parts in different states than others as well as issues around *destruction* and the becoming of an incomplete object. Engaging with these issues inspire investigations into how processes can be altered to avoid material and time waste while keeping physical components interesting and relevant to players.

The methodological exploration on *being* a game provided insights into their assemblage and how different structured ways of conceptualizing these can guide a deeper understanding of potential mismatches, new solutions and alternative re-presentations. Particularly for highly detailed and complex games, this can directly lead to improvements in code that make further development easier through mindful refactoring. It can be seen as a potentially playful adaptation of already existing object-oriented software engineering practices (Bruegge and Dutoit, 2009). However, in contrast to those, our approach deliberately leaves out aspects of the system architecture (particularly relations) as to leave room for speculation and imagination and has the potential to include objects not related to a game's software implementation. It takes a structured activity to allow for creative freedoms (Makhaeva et al., 2016) with familiar tools, but serves an entirely different function within the design process.

Finally, the methodological exploration on *acting as* a game makes way for deliberations about incidental objects that are a necessary part of a playful technology setup, but not deliberately designed for. It further leads to an understanding of potential avenues for redesign by speculating about the emotional state of the game but also identifying opportunities for meaningful change.

Hence, *Object-Oriented Inquiry* lends itself to a range of different insights that can be beneficial as part of a well-rounded design practice. We do not claim that this is not already happening and showed that, indeed, it is, as in Murer (2018), but we offer a vocabulary and useful theoretical context to articulate these kinds of knowledges by presenting a speculative thought experiment of how we might approach games and play from an object oriented perspective not just pragmatically (like UML does), but also ontologically. In that regard, future work could conduct empirical studies investigating whether there is actually an epistemological difference between the two approaches.

5.3.2. Evaluation

We understand evaluation as a form of inquiring into game use with the intent to understand particularities about the interaction and to inform future re-design and improvements. It can be a part of iterative game design as well as research into games and play. In particular, through speculating from a game's perspective, we can gain additional insights compared to relying on eloquent and available humans to convey their perspective. For example, people might tell researchers how they enjoyed interacting with a given design, whereas logs indicate that this was rarely the case. By putting these logs into a first-person narrative statement (e.g., "I was barely used." Spiel et al., 2017), we can uncover frictions that not only tell us about the current stage of a design, but also give way to further developments (cf. Sengers and Gaver, 2006).

Investigating the *becoming* of a game might only be relevant to contexts in which others are expected to drive the becoming of an object (as is the case with the Nintendo Labo™, but not necessarily with 3D printing devices). Looking at how the material rebels against manipulation provides an additional perspective to inquiring into how long people took to assemble a certain object or which steps they followed, and in which way. It can qualitatively aid us in understanding *why* we observe certain behaviors and patterns that might be part of playful interactions.

Analysing the *being* of a game allows for an in-depth analysis of heuristics for evaluation and can inform other studies by generating specific questions about a game and subsequently trying to address them. Hence, while not directly lending itself to definitive results, *Object-Oriented Inquiry* can be used as a starting point for evaluation.

More directly, inquiring into the *acting as* a game can be a way to further consider the particularities of an interaction by decidedly focusing on the game in that interaction. By taking a step back from privileging players' perspectives, we might just reach into a space that could, in return, become relevant to all actors, animate, or inanimate.

This is not to say that game designers and researchers could not arrive at such insights in a different manner as well. However, there is something inherently *playful* in a speculative engagement with games as objects. Such an approach might lend support to those who prefer to inquire into their environment with a more playful mindset. Hence, these explorations and methodological suggestions are not meant to replace existing ones but rather expand the toolset game designers and researchers can use to understand (their) games.

6. CONCLUSION

We have provided an overview of existing object-oriented practices in HCI research and applied them to a set of methodological explorations in the context of games and play to structurally inquire into the kinds of knowledges that is embodied and materialized within games. Focusing on *becoming*, *being* and *acting as* a game, we took a look on three different manifestations of games. We showed that *Object-Oriented Inquiry* can provide an opportunity for game design and research activities by allowing us to gather holistic insights into different perspectives pertaining play, players, and playful engagements between them.

Future work in this area could investigate and critique our analysis through additional methodological explorations and the investigation of the usefulness of these perspectives as part of larger studies. Additionally, it could be fruitful to find methods that address other human modalities through which we experience objects and subsequently inquire into them, such as smell, sound, and haptics. Another line of research could look into making *Object-Oriented Inquiry* applicable to animate actors.

Our work illustrated the feasibility of *Object-Oriented Inquiry* for game design and research from the perspective of HCI games researchers. It provides a range of indications on the kinds of knowledges games and, potentially, other technologies embody, and presents several methodological explorations as examples for OOI oriented practices. We encourage game designers and researchers to take on an object-oriented perspective to gain deeper insights into the intricacies of all parts pertaining to the interaction between games and players.

DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding author.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Office of Research Ethics—University of Waterloo. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

The work described in the is manuscript has been conducted by KS under mentorship and guidance from LN. KS then led the process of producing this manuscript with iterative feedback and contributions by LN.

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SUPPLEMENTARY MATERIAL

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