

# Play in the Information Age

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**Abstract** This article is an inquiry on the role of play in shaping the cultures of the Information Age. By applying concepts from Postphenomenology and the Philosophy of Information, this paper argues that play and computation share a capacity to shape human experience. I will apply the concept of re-ontologization to describe the effect that computation has had in shaping the world. I will apply the concept of relational strategies to argue that play is a way of interfacing with the computational world. This paper argues that play is a particularly relevant form of shaping the human experience of the re-ontologized infosphere because play, like computation, can create worlds. The goal of this article is to propose a research program that situates play as a relevant perspective to analyze the culture of the Information Age.

**Keywords** Philosophy of Information · Postphenomenology · Information Technologies · Play · Gamification · Design · Interaction design

## 1 Introduction

The advent of the Information Age has encouraged philosophers to propose new theories to address the significant changes occurring in culture and society. According to Floridi (2014), the societies in which the penetration of information and communication technologies (ICTs) has been most successful are increasingly hyperhistorical “where ICTs and their data-processing capabilities are not just important but essential conditions for the maintenance of any further development of societal welfare, personal well-being, and overall flourishing” (Floridi 2014, p.4). In these societies, human and artificial agents interact with each other in an infosphere, an environment “constituted by the totality of information entities, including all agents – processes, their properties and mutual relations” (Floridi 1999, p. 44).

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At the same time, scholars in cultural and media studies argue that we are witnessing a ludification of society (Flusser 2013; Frissen et al. 2015). This observation continues the foundational work of Johan Huizinga's *Homo Ludens* ([1938]Huizinga 1992), which pioneered the analysis of culture from the perspective of play, understood as a mode of structuring human experience (Henricks 2015). Huizinga's lasting contribution was his analysis of culture and society *sub specie ludis*, that is, using the phenomenon of play to inquire into the nature and meaning of cultural and societal phenomena, from law to poetry to war. Huizinga claimed that at the heart of Western culture, there is a ludic drive that creates such forms of expression and that by identifying this drive, we can analyze how these expressions influence social structures.

In this article, I introduce a research program that inquires into the play aspect of computational culture, with the objective of re-thinking Huizinga's concept of the ludic drive. Understanding the manifestation of the ludic drive in the Information Age allows me to formulate a novel hypothesis about computational culture and its technologies. This article discusses two key questions for the research program: first, why can we analyze computational culture from the perspective of play; and second, which concepts do we need to productively further this inquiry?

My argument establishes an important relationship between play and computation. The Philosophy of Information concepts of infosphere and re-ontologization arguably demonstrate that ICTs have fundamentally altered the world in which computational culture takes place. I define this process as world-creating, in order to make the connection between ICTs and the activity of play, which is similarly characterized by creating worlds. Play uses rules and technologies to structure human experience in autotelic, pleasure-driven activities.<sup>1</sup> My main argument is that play has a privileged cultural position as an interface to the ICT-re-ontologized infosphere because it is a world-creating activity. When re-ontologizing the infosphere, ICTs use algorithms and processes much like rules, and it is play that orients human experience within the computational procedural infosphere. This orientation then creates cultural expressions that go on to iteratively define computational culture.

Before I proceed, caveat emptor: I am formulating a very particular argument regarding ICTs, re-ontologization, computation, and play. To a certain extent, it is a reductionist argument: just because computer machines are procedural does not mean that the infosphere itself is a procedural system. What I am analyzing is the gradient of abstraction (Floridi 2010, pp. 68–78) of the infosphere. My goal is to highlight the role that play has in shaping computational culture; however, I am not claiming that computational culture is *essentially* ludic. Similarly, my use of concepts from computational theory is limited to a simplified understanding of how computer machines run processes based on rules. Within these epistemological boundaries, I believe my inquiry on play and computation is philosophically productive, and this is the scope and purpose of the article.

This article is by nature multidisciplinary. As such, it may not satisfy play scholars, philosophers, or computer scientists. However, I aim to bring them together by

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<sup>1</sup> Detailing the concept of autotelic is beyond the scope of this article. I use the concept in the way Csikszentmihalyi (2008) defines it, as an activity that has a purpose in and of itself. In play theory, the concept has a longer, more complicated story, which is related to Kantian esthetics (Laxton 2011; see also Wenzel 2005).

combining the Philosophy of Information and Information Ethics (Floridi 2010, 2013), which provide the theoretical ground for the analysis of computation, with Sicart (2014a, b) play theory, which supports the reflections on play. Furthermore, media and software studies (Manovich 2002, 2013; Galloway 2012; Flusser 2013) provide useful insights that help with the foundation of my arguments.

I start this article by sketching general observations about the Information Age and the “ludified” society. Afterwards, I present my central argument: play and computation share the capacity to create worlds and shape human experience. In the third section, I define play as an interface of (human) experience, the first key concept for the analysis of computational culture from the perspective of play. The fourth section outlines two different ways in which this interface can be conceptualized. The conclusions present the implications of this research program and briefly indicate future steps.

As I have already suggested, I am not claiming that we can understand the Information Age from the perspective of *games*, or that play *defines* the Information Age. My argument is simpler: as a mode of structuring human experience, play is a productive lens for critically analyzing the Information Age. The ludic drive in computational culture needs attention. Huizinga’s analysis of culture from the perspective of play gave key insights to the humanities, the social sciences, and more recently to media studies. All of these insights should be reviewed and updated for the Information Age. If the advent of ubiquitous computing has changed our culture, we should inquire as to if and how play has had a role in this.

An anecdotal approach to history shows that the relation between computation and play has always been present. Turing used games in his reflections on machine intelligence (Turing 1950; Petzold 2008). Some of the very first mainframes were used for creating *SpaceWar!*—the first videogame in history. And each computational technology development has been coupled, if not motivated by, game applications, from Multi-User Dungeons and remote networking to video streaming and e-sports (Donovan 2010). Virtual and real economics are deeply intertwined (Lehdonvirta and Castronova 2014), and gamification has managed to convince corporations that games might be conducive to increased productivity and engagement (Deterding and Walz 2014). Many countries are investing in game-based education, while many private individuals are quantifying various aspects of their lives, from leisure to finance, using computational applications that seek to create pleasurable experiences. All of these technologies, all of these phenomena, all of these experiences can be understood as forms of play: appropriative, expressive approaches to otherwise dull mundane chores and interactions. These are the manifestations of a ludic drive that I will start exploring now.

## 2 The Information Age

For those of us living in the developed world, it is difficult to think of life without computers. In the last two decades, thanks to smartphones, wireless data, and broadband access, more and more elements of our lives have been digitized. From critical services like health, banking, and education, to more mundane and pleasurable aspects of our lives like socializing, dating, or exercising, everything seems to be mediated or “augmented” by computers. Most “mechanical objects” like cars are now enhanced by

computers, and it is always strange to find someone with whom you cannot connect via a social media service. We live in networks of interfaces, databases, and human and artificial agents. These networks structure our world and contribute to redefining our culture.

These radical changes have been described by the Philosophy of Information (PI henceforth) as the Fourth Revolution, a new time in human history defined by computation technologies and the way that they are transforming Western societies into information societies (Floridi 2014, pp. 87–100). To put it briefly, PI describes and analyzes the world as an infosphere in which agents, human and artificial, exchange information mediated by computer machines (Floridi 2002). The infosphere can be defined “minimally, [as] the whole informational environment constituted by all informational entities (thus including Information Agents as well), their properties, interactions, processes, and mutual relations. It is an environment comparable to, but different from, cyberspace, which is only one of its sub-regions, as it were since it also includes offline and analogue spaces of information”. (Floridi 2013, p. 6).

My application of the concept of infosphere is more specific. When I use the term infosphere in this article I am describing the shared world in which human and artificial agents coexist and relate to one another<sup>2</sup> (Floridi 2013). For example, Danish citizens can access most of their identity and personal data exclusively through the online portal borger.dk. Services such as selling and buying real state, getting a new driver’s license or passport, or seeking medical treatment are all mediated by ICTs. All of this data is processed by agents in the infosphere, both human (caseworkers) and artificial (algorithms that predict credit scores and grant eligibility for loans).

Hyperhistorical societies are moving towards an expansion of the number of agents in the infosphere. The Internet of Things will turn common appliances into informational agents, and self-driving cars will soon become standard. This is the age of the *infosfers* (Floridi 2013, pp. 14–18), informational beings that interact with each other in infospheres via interfaces, understood as sociotechnical assemblages (De Landa 2006). My use of the concept of interface is situated within the tradition of HCI (Bøgh Andersen 1997) and media studies (Manovich 2002; Flusser 1999, 2002; Galloway 2012). The classical understanding of the computer interface refers to the process of relating the computational nature of the machine to human processing and human input (Bøgh Andersen 1997, p. 146). The interface is a process of mediation, a liminal point in which one thing becomes another, yet keeps intact the ontological relation between those two things: “the interface is the place where information moves from one entity to another, from one node to another within the system” (Galloway 2012, p. 31, p. 33).

Interfaces facilitate the exchange of information between agents in the infosphere. Interfaces also regulate that exchange, allowing for some exchanges but not others. From the perspective of a human in the infosphere, an interface is a process which allows for specific interactions in the infosphere. By allowing for those interactions, and not others, the interface mediates with the infosphere and its agents, and it shapes

<sup>2</sup> In more strict PI terms, what I define as infosphere is just a Gradient of Abstraction of the infosphere. However, I still prefer to treat the infosphere as the general concept that defines the environment in which human and artificial agents relate to each other since my argument in this paper does not depend on the granular precision of the method of abstraction. I am not stating here that the infosphere is a Gradient of Abstraction, but that with infosphere I refer to the aspects of the infosphere that can be described and analyzed at a given Gradient of Abstraction.

the experience of that infosphere. For human agents, interfaces to the infosphere are relational strategies in a human-technology mediation relation: they are ways of consolidating how a world is experienced, and the place that technologies have in that experience.<sup>3</sup> Interfaces shape the experience of the infosphere.

The Information Age is the era in which ICTs have re-ontologized the infosphere so human and artificial agents relate to each other through designed interfaces. The experience of the infosphere and its technologies, as well as its cultural products, depends largely on the design of ICTs. This is why it is interesting to consider the ludic in relation to technology.

### 3 The Ludic Century

There has been an increasing interest in designing for play as a form of engagement with and understanding of computational culture (Gaver 2009). Apple once prized its design being “playful”, and we have recently witnessed the trend of gamification being employed as a strategy to make work feel more like a game (Deterding 2016). Digital games have been extraordinarily successful in colonizing the entertainment industry. There is ample data to argue that play is gaining immense cultural capital in the Information Age, from the economic revenue of digital entertainment<sup>4</sup> to recent academic and popular science publications (Bogost 2016; Johnson 2016).

In fact, game designer Eric Zimmerman defined the twenty-first Century as “the ludic century” (Zimmerman 2014), a time in history when game design would become a guiding force in the development of sociocultural structures. Gamification (Deterding and Walz 2014) is an early herald of this ludic century, where game designers are now working with engineers and software developers to make the experience of global infrastructures more pleasurable.

To better understand what the “ludic century” might imply in terms of cultural analysis, and how it relates to the Information Age, we need to look closely at Huizinga’s classic play theory. Huizinga proposed that culture in the Western world has at its core a “ludic drive”. In other words, for Huizinga, play creates culture: “The fact that play and culture are actually interwoven with one another was neither observed nor expressed, whereas for us the whole point is to show that genuine, pure play is one of the main bases of civilization”. (Huizinga 1992, p.5).

Huizingan play is a voluntary activity that requires no goals or rewards outside of itself (i.e., it is autotelic), it structures human experience, gives cohesion to

<sup>3</sup> I am here extending Rosenberger’s concept of abstract relational strategies (2012) and his research on postphenomenology and computers (2009). While in his work a relational strategy is a specific way in which a technology’s multistability is consolidated, in this article I want to extend that concept so relational strategy can be used to understand a number of specific ways of stabilizing our relationship to technology, and therefore the experience of the world. Those ways are related. For example, “to work” is a way of describing different relational strategies that are used to consolidate multistable technologies with the purpose of engaging in labor. In later sections of this paper, I will argue that play is a relational strategy towards the infosphere. This adoption of postphenomenological concepts is a brief attempt at relating postphenomenology and the philosophy of information, much like STS and ANT can be used to complement postphenomenology (Verbeek, 2005).

<sup>4</sup> <http://www.theesa.com/article/u-s-video-game-industrys-economic-impact/>

communities and societies, and creates forms of expression with an esthetic root: “Play has a tendency to be beautiful. It may be that this aesthetic factor is identical with the impulse to create orderly form, which animates play in all its aspects”. (Huizinga 1992, p.10). From player communities that keep games alive even when the developers have abandoned them (Pearce 2011; Consalvo and Begy 2015), to athletes inventing new forms of playing like the Fosbury Flop,<sup>5</sup> play creates its own forms of expression. In fact, a play perspective on esthetics allows us to better understand the avant-garde and its ramifications, from DADA to Fluxus, to contemporary art (Getsy 2011).

According to Huizinga, the ludic drive is manifested as agonistic (i.e., competitive) play, that is, as productive contests that structure society. Agonistic contests structure a conflict so that it becomes partitioned from “the real world”. This form of encapsulation establishes a reality of its own and meaningfully organizes its experience through rules: “More striking even than the limitation as to time is the limitation as to space. All play moves and has its being within a play-ground marked off beforehand either materially or ideally, deliberately or as a matter of course” (Huizinga 1992, p. 43).

Roger Caillois undertook a revision of Huizinga’s concept of play, as he found Huizinga’s definition “at the same time too broad and too narrow” (2001, p.4). In his theory of play, Caillois identifies two ways of play: one, *paidia*, is a “kind of uncontrolled fantasy, [...] common to diversion, turbulence, free improvisation, and carefree gaiety” (*ibid.*, p. 13). The other, *ludus*, uses rules to mediate and structure the activity of play, binding it to “arbitrary, imperative, and purposely tedious conventions” (*ibid.*, p. 13). *Paidia* is more commonly found in childish play, whereas most games tend to favor *ludus*.<sup>6</sup>

In this article, I will work with a definition of play that continues this tradition and acknowledges contemporary interpretations (Henricks 2015). Instead of trying to provide a formal definition of play, I will follow Sutton-Smith’s (1997, pp. 7-9) concept of the rhetorics of play that are used to explain the phenomenon itself. Sutton-Smith argues that play cannot be defined per se, but that we can formalize working definitions (rhetorics) to explain certain phenomena, from children’s learning to the pleasures of competition. Each rhetoric of play would be a method to study play and its culture.

In this article, I introduce the basics of a rhetoric of computational play that allows us to use play as a lens to explain the Information Age. To structure this rhetoric, I am adopting Sicart (2014a, b) Romantic theory of play. Sicart only provides a minimal set of observables that are present in play. By doing so, Sicart’s work allows us to see play beyond the domain of games. Despite its shortcomings, this theory’s flexibility contributes to our goal of analyzing many phenomena of computational culture from the perspective of play. For Sicart, play is a mode of being in the world that is characterized by being appropriative, expressive, personal, and autotelic (pp. 1–19). To play is to take over the world for personal expression, creating worlds that have a purpose of their own

<sup>5</sup> See [https://en.wikipedia.org/wiki/Fosbury\\_Flop](https://en.wikipedia.org/wiki/Fosbury_Flop) (accessed 25/5/2017)

<sup>6</sup> Following Caillois, I propose that the ludic drive that Huizinga identified at the heart of culture has been manifested in this “ludic century” mostly through the development of *ludus* experiences. The success of play in contemporary culture is the success of *ludus*, of structured forms of agonistic play. From gamification to digital entertainment like videogames, we enjoy the pleasures of play through structures, systems, points, and competition. While there are other socioeconomic reasons behind the current success of games in the entertainment industry, it is worth pointing out how the structured game with rules has become a dominant form of play. Most videogames are *ludus* devices, competitive challenges to our motor or logical skills.

(autotelic), which are negotiated as the activity of play proceeds. For Sicart, play is a balance between order and chaos, the Apollonian and the Dionysian. This allows him to include forms of play that are not positive or “fun”, from Internet trolling to boundary-exploring works of art (*ibid*, pp. 61–70). For Sicart, play is carnivalesque in the Bakhtinian sense: it creates a world that turns other worlds around, sometimes for mockery, sometimes for political purposes, sometimes just for fun.

Sicart’s theory also defines playfulness as “a way of engaging with particular contexts and objects that is similar to play but respects the purposes and goals of that object or context” (*ibid*, p. 21). Playfulness is an expressive, appropriative, and personal engagement with the world that is nevertheless bound to goals and purposes that are not necessarily determined by the activity of play itself. For example, Siri’s humor still allows it to provide a service, but it affords a different attitude to this conversational interface.

In order to better understand Sicart’s theory of play with regard to the computational world, I propose to see his concepts through the lens of the postphenomenological work of Rosenberger (2009, 2012). Play is a relational strategy towards the technologies that it stabilizes. This stabilization takes place through an appropriation process by which human agents engage in an autotelic activity in a world mediated by that technology.

For example, Apple’s AI-driven assistant Siri is software designed to aid users interacting with their smartphones using their voices. In order to be able to use Siri, the Apple device needs to be online, and the voice recognition software needs to be able to recognize the words that the user pronounces. A voice assistant is an instrument designed to facilitate user interaction with the phone. But there can be many ways to interact with that assistant, depending on how it is designed. Siri is particularly interesting because it can be interacted with playfully. The designers at Apple added some snarky responses to banal questions users might ask, and by doing so, they opened up a relational strategy based on a playful understanding of this technology.<sup>7</sup>

This playful relational strategy requires a specific understanding of the user. As Sicart points out, playfulness is an attitude towards the world. This vague definition needs to be qualified: users of ICT will interact with them playfully when they stabilize the technology to create an autotelic, expressive, personal experience. The user experiences the technology through play to engage with the world by seeking the pleasures of play. Sicart never details what the purpose of play is, so in this article, and following Huizinga, Caillois, and Sutton-Smith, I propose that play is essentially driven by seeking forms of pleasure, in all its diversity. This search for pleasure is the reason why play is so closely connected to motivation and enjoyment (Isen and Reeve 2005).

This model of the user will be complicated in later sections of this article, but it is so far useful to understand how play can be a strategy to stabilize relations with the computational technologies that create the infosphere of the Information Age. I will now look more closely at how infospheres and strategies for playful engagement with them are created.

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<sup>7</sup> A classic play theory interpretation of this design decision would define Siri as a plaything, perhaps even a toy, that is experienced through the lens of play as mimicry or make-believe (Caillois 2001, p.9, 18–23).

## 4 The Infosphere, Play, and Re-Ontologization

My phone knows me intimately. It knows where I am, and how many steps I have taken to get there. It is also familiar with my personal acquaintances, my reading and shopping habits, and my photographing style. Anybody with access to my device would get a fairly clear picture of what I do and how I do it. My phone mediates almost all of my daily activities, and many relations, personal and professional, are facilitated by it. The smartphone is a symbol of the Information Age. It is the most widely used instrument to engage with services and social networks. It is also a tool for payments, identification, and controlling automated services. Smartphones have changed culture and society.

In order to understand these changes, Floridi (2013) proposes to define ICTs as re-ontologizing technologies. His argument is deceptively simple: Computational technologies transform the nature of the infosphere itself because they are information machines: “the ontology of the information technologies available (...) is the same as (and hence fully compatible with) the ontology of their objects, the raw data being manipulated” (*ibid.*, p. 7). Floridi addresses the ethical problems of the Information Age based on this observation, as he argues that re-ontologization is the “source of some of the most profound transformations and challenging problems that we will experience in the close future, as far as technology is concerned” (*ibid.*, pp. 6–7).

Re-ontologization describes how ICTs change the nature of the infosphere they are a part of. For example, prior to the information revolution, banking was a process between human agents interacting with each other using analog calculation tools. The transfer and manipulation of capital were quickly taken over by computer machines, but for a private citizen, banking had a human face. Bank tellers were people we could establish relations with. Banking was a human-machine assemblage (De Landa 2006). With the advent of more powerful and ubiquitous computing machines, financial institutions embraced the possibilities afforded by ICTs, turning most services into digitally mediated *self-services*. Most common banking operations now require just a smartphone, and bank-teller might soon be a profession of the past.

For the stock market, the re-ontologization process has been more radical. High-frequency trading algorithms (Lange et al. 2016) are agents (Floridi and Sanders 2004) that critically shape the behavior of the stock market. The actions of these algorithms in the infosphere have impact on all the other entities that populate it—a market crash might be the consequence of glitches in the trading algorithms and can damage corporations and get workers fired. The choices these algorithms make based on their formal rules affect not only the results of the trades in the stock market but all the other agents in the infosphere.

These radical redefinitions of the infosphere only happen if the ICTs are programmed with a specific *model* for acting in the infosphere: “For a process to qualify as computation a model must exist such as algorithm, network topology, physical process or in general any mechanism which ensures definability of its behavior” (Dodig-Crnkovic 2011, p. 305). In this article, models will be the algorithms that allow computers to run processes that change the nature of the infosphere. By algorithms, I refer to the “finite, abstract, effective, compound control structure[s], imperatively given, accomplishing a given purpose under given provisions” (Hill 2015, p. 47). Re-ontologization is then the radical redefinition of the infosphere by ICTs running

specific algorithms.<sup>8</sup> These processes have an effect in the infosphere and on how agents experience it. To return to the case of banking, the deployment of banking self-service and mobile-based payment forms are based on database, cryptography, and digital signature algorithms, among many others. Abiding by these convenient services has the consequence of the slow demise of cash as an instrument for transaction. This is not a nostalgic cry: for example, this process of re-ontologization makes money-laundering and tax evasion more complicated. However, the disappearance of cash changes the way transactions are handled between agents in the infosphere, as only those with access to computers will have access to certain services and goods, and so it changes the experience of the infosphere for some of its agents.

Let us turn to a more leisurely example. As an amateur runner, I used to enjoy how fitness applications facilitated the evaluation of my progress. My phone is equipped with an array of sensors that can track movement in space, including a dedicated chip that helps process data. My phone will also measure my running distance, conveniently alerting me when I have reached my goal for the day.

From a re-ontologizing perspective, it is important to know how distance is measured. In iOS, the distance tracked is the result of calculations based on data read from the phone's sensors. In most cases, this data is filtered by the software libraries that Apple provides.<sup>9</sup> Many running applications make use of a dedicated motion coprocessor, saving processing power and thus battery life. That is, the raw data comes to the algorithm already filtered by another computational calculation: an averaging of the results based on user data provided by Apple. The calculation of a step is the creation of computational "step" based on sensor data that is interpreted by algorithms in the motion processor.<sup>10</sup> A step in the infosphere is not a physical human step: it is a structure based on sensor data filtered by algorithms that also take into account what an average human step is. For an iPhone and its users, a step is a multitude of steps.

Postphenomenologists have dealt philosophically with this mediation (Ihde 1990; Verbeek 2005). From their theory, I take the argument that all technologies mediate human experience. However, I want to make a slightly more fine-grained analysis. Re-ontologization is not "just" mediation: it is the creation of a world as experienced by agents. Computers change the nature of the infosphere so, maximally put, *being* is what a computer machine running the right algorithms can *process*. Distance is distance as defined by an algorithm, and in the infosphere, it is the only distance that *is*. This process has societal effects too: for example, insurance companies are partnering with Fitbit to provide data for evaluating premiums.<sup>11</sup>

However, if we keep a postphenomenological angle, we can think through the question of agency. If we accept the analytical concepts provided by the Philosophy of Information, then everybody (in hyperhistorical societies at least) is an agent of the

<sup>8</sup> Algorithms can be described as computational processes, as Hill does, but it is also possible to look at them from an experiential point of view, as protocols for action. Cleland (2001) provides an interesting argument for understanding algorithms as procedures, while recent STS research on algorithmic culture provides an experiential analysis of the algorithm (Ziewitz 2017). In future expansions of this research on play I will address this distinction in more detail.

<sup>9</sup> See <https://developer.apple.com/reference/coremotion> (accessed 25/5/2017)

<sup>10</sup> See [https://en.wikipedia.org/wiki/Apple\\_motion\\_coprocessors](https://en.wikipedia.org/wiki/Apple_motion_coprocessors) (accessed 25/5/2017)

<sup>11</sup> See <https://investor.fitbit.com/press/press-releases/press-release-details/2016/Fitbit-Introduces-Fitbit-Group-Health-for-Corporate-Wellness-Weight-Management-Programs-Insurers-and-Clinical-Research/default.aspx> (accessed 25/5/2017)

infosphere. The possibility of opting-out of the infosphere is disappearing: cash is dying; more and more services are redesigned as digital *self-services*, and both leisure and work are becoming computer-dependent. We live in the infosphere. The goal of inquiring into the role of play in the Information Age is to understand *how* we can live in the infosphere, and the role of the ludic in that infosphere. To do this, we need to think about the relation between play and the experience of the infosphere.

Re-ontologization creates and/or defines agencies in infospheres. I propose to treat infospheres as “worlds”, consistent environments of structured experience. From this perspective, play can be understood as a re-ontologizing process that radically changes the experience of the infosphere. Play creates worlds within worlds. The process of creating these worlds is analogous to that of computing machines changing the infosphere: by applying rules that change agency and the experience of the world. Play and computers are deeply related because they both re-ontologize, which is why the Information Age can be experienced from the perspective of play. ICTs re-ontologize the world through formal and imperative rules that run as processes. These rules can be experienced through the lens of play, which is also structured around formal and imperative rules. Play is a way of shaping agency that re-ontologizes the computational rules of the infosphere to shape human experience. As I have said earlier, play is a relational strategy towards the infosphere.

When we play, we use rules to create a world. Then, we inhabit that world through the experiential lens of play. The actions we take while playing, as well as the identities we may perform, are all related to the world created by the activity of play itself. Play is a re-ontologizing process that creates new worlds and new strategies for experiencing it. Play creates a ludic infosphere, a world for play. This world is part of an infosphere that has been re-ontologized by ICTs. This re-ontologization process is similar to play. Therefore, we can use play as an analytical lens to understand how human agents can experience the re-ontologized infosphere. In the next section, I present the re-ontologizing capacities of play in more detail, and sketch an approach for understanding the entanglements of computational and play-driven re-ontologization.

## 5 Play as Interface

The re-ontologizing process of ICTs involves software designers and other relevant stakeholders developing and implementing algorithms to process data in specific machine architectures (Agre 1997; Hill 2015). But how does play re-ontologize? I will begin by unpacking this process one step at a time, focusing on how play creates worlds. This will allow me to deepen my explanation of the ludic drive as a relational strategy that re-ontologizes the infosphere, already re-ontologized by ICTs.

Let us start with chess, a game with clear and unambiguous rules that dictate the ways in which different pieces on the board can move. These rules define the different mechanics of the game (Sicart 2008), as well as the goals and the end-state: who wins, who loses, and why. Of course, chess cannot be reduced to its rules, and people play it for many different reasons, from mental pleasure to a competitive drive to assert intellectual superiority. But what chess facilitates is the emergence of a particular activity between agents, and a particular experience of the world. This activity is the result of a game focusing human experience using rules and processes.

That is what games do by design: they structure experience, facilitating the mutual engagement of agents. Games create order. To play is to experience a world in a way that is clearly and unambiguously bound by arbitrary yet freely accepted rules (Henricks 2015). This world is constituted by a merging of the agency of the players and the boundaries proposed by formally defined yet contextually-negotiable rules (Goffman 1961).

Playing a game of football, for example, consists of voluntarily bounding ourselves to the confines of a football pitch, with the purpose of trying to make a bouncy ball cross a line demarcated by three poles. If we are playing with friends, we may be lenient with, for example, the offside rule. If we are professionals, a referee will be in charge of strictly interpreting the events of the game according to the rules. The activity has a pleasurable purpose, and the actions of players tend to be guided by their shared goal of keeping this experience in motion. Play is a way of creating forms of order in the world. Play creates processes that orient experience, bound the world, and give it meaning. That is play's re-ontologization.

In order to better understand the role of these play worlds in the structuring of experience and how the rules of the activity are related to individual and collective agency, I turn to Goffman's (1961) account of the way games structure social encounters. According to Goffman's observations, the rules of games structure the world in which play takes place. However, play as a social encounter depends on how players negotiate the rules as well as the purpose behind the activity of play. Play is a voluntary activity with negotiated goals and a purpose of its own. But play is also a social activity of the shared negotiation of meaning and purpose. The worlds created by play are not isolated from the external world: they are separate, but in constant negotiation with what makes the world of play a world (Consalvo 2009). Play creates encapsulated infospheres (Sicart 2009). By encapsulated infosphere, I refer to how play's re-ontologization does not radically re-engineer the infosphere (like an ICT does), but creates a new infosphere within the infosphere, a world within the world. An infosphere, in Floridi's terms, accounts for all of reality. Worlds created by play are consistent infospheres that are nested within the world.<sup>12</sup>

In the age of computing machinery, play creates a nested infosphere based on rules that act as an interface to the ICT re-ontologized infosphere. To play is to experience the infosphere through the *characteristics* of play, that is, as a pleasure-centric autotelic experience that is defined by appropriation and personal expression. The ludic drive at the heart of the Information Age can be observed in the application of play as a relational strategy towards the ICT-re-ontologized infosphere.

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<sup>12</sup> This interpretation of the concept of infosphere is somewhat different than Floridi's canonical definition. However, some applications of the Philosophy of Information's terminology to computer games (Sicart 2009) allow for this somewhat creative interpretation of the concept of infosphere. An alternative to this terminology would be to use the concepts of the Method of Abstraction (Floridi 2010) to define the worlds created by play as gradients of abstraction within an analysis of the infosphere. However, that would be more of an epistemological than an ontological argument, and I think understanding the worlds created by play as having an ontology defined by the assemblage of rules and agency constrained by those rules is more productive.

I started arguing that playfulness has become a common concept that drives digital design (Gaver 2009). The re-ontologization process of ICTs can occasionally seem difficult to understand. Big data, Machine Learning, Evolutionary Algorithms, these are hard concepts to grasp, as is the fact that our smartphones (that powerful computer we carry around to send emojis) can talk to us and make sense. By encapsulating this re-ontologized infosphere in a world created by play, we are creating new modes of engaging and relating to the infosphere. An analysis of the Information Age from the perspective of play should reveal these new relations. If play can serve as an interface to the infosphere, how is the experience of the infosphere shaped by play? Furthermore, how are the ICTs that re-ontologize the infosphere designed to encourage the ludic experience of the infosphere?

Playfulness is a powerful approach to digital design because it engages the dual processes of re-ontologization: digital products re-ontologize the infosphere, and we experience that infosphere with a ludic attitude that allows us as users to experience the infosphere as if it was a matter of play. Invoking the playful attitude by design implies creating interactions based on models structurally similar to the thing they are modeling. Think about skeuomorphic design: the purpose of making a digital application such as a calendar *look* like a desk calendar is to ease our understanding and interaction using a re-ontologized object in the infosphere.<sup>13</sup> Similarly, Siri and Alexa's sense of humor is a tool for facilitating existence in the ICT-augmented infosphere: these assistants are not people, they are artificial enough to avoid the uncanny valley effect (Seyama and Nagayama 2007), but human enough to increase the emotional and cognitive attachment that users experience (Reeves and Nass 1996).

Another example of playful re-ontologization can be found in the dashboard of the 2011 Ford Fusion. In our search for energy-efficient cars, engineering optimizations of engines need to be matched with driving techniques that preserve fuel. In order to make the impact of those techniques visible, carmakers started exploring how game mechanics can illustrate and encourage positive driving habits. The 2011 Ford Fusion had a flower on its dashboard that would grow healthier the more efficient the driving was. Without turning driving into a game, playfulness was used as an interface to the infosphere.<sup>14</sup>

As I mentioned earlier in this article, Siri, the AI-powered voice assistant of Apple's iOS, illustrates another way of using play as an interface. Siri would be just another AI-powered assistant if its programmers had not infused it with a mischievous sense of humor. Ask Siri a silly question and you may get a sassy answer.<sup>15</sup> Siri's playfulness is a way to interface between human and artificial agents in the infosphere, a strategy that can help humans adapt to relating to AIs. This interface appropriates the characteristics of play in order to make a world that is more personable and expressive for users

<sup>13</sup> Completely re-ontologized because the calendar has become a portable, networked instrument in constant, invisible, conversation with other digital services such as reminders and email.

<sup>14</sup> A careful reader might think that a car is not necessarily an object re-ontologized by ICTs. However, modern cars like those I have mentioned are essentially computers on wheels. Much like the aforementioned case of running apps, the idea of optimal driving is derived from sensor fusion and algorithms evaluating the behavior of the car. Driving is not anymore just a human operating a mechanical device: algorithms are often copilots.

<sup>15</sup> See a sample of actual and fake replies at <http://shitsirisays.com> and <http://shitthatirsays.tumblr.com>. A more appropriate guide can be found here: <http://www.macworld.co.uk/feature/iphone/funny-things-ask-siri-3656639/>

relating to AI agents in the infosphere. In other words, play helps to make the experience of the infosphere pleasurable.<sup>16</sup>

As an interface, play is then a relational strategy that allows for the infosphere to be experienced through the lens of the ludic. Play, as an autotelic, expressive, and personal engagement with the world, is a powerful way of interfacing with the ICT-created infosphere because it shares the re-ontologizing capacities that shape experience and structure agency through processes and rules.

In the Information Age, two re-ontologization processes are redefining sociotechnical culture. One is driven by ICTs changing the nature of the infosphere. The other interfaces this change using the world-creating capacity of the play activity. If we want to understand the role of play in the Information Age, we need to specify how this interfacing works. This is the topic of the next section.

## 6 Resistance and Submission

Play is commonly defined as a voluntary activity. It is something we choose to do, we can stop whenever we want, and it has relatively clear boundaries. The ludic drive at the heart of the Information Age is the impulse of using play as an interface to the infosphere. Because both play and computation re-ontologize, it is easier to make the rules and procedures that shape the infosphere more pleasurable.

This is not to say that every agent in the infosphere is a player. One of the challenges of educators and technology designers is to help as many people as possible live fulfilling lives in the infosphere. To do so, we develop conceptual and technical interfaces, ways of relating to the infosphere, ways of shaping our experience of it. Play is one of these interfaces. But it requires an understanding of living in the infosphere: not a detailed one, but a rudimentary acknowledgement that there are computers shaping our world, and that they are part of the world as we experience it. In this sense, the play interface to the infosphere requires a voluntary engagement of agents with this ludic drive. As an interface, play is then a *voluntary, conscious* relational strategy to the infosphere.<sup>17</sup>

In order to understand how play interfaces with the infosphere, I propose two modalities of playfulness. These are not absolute: play as experience will always move between these two poles (Caillois 2001; Henricks 2009). The concepts I am proposing provide an explanation as to why agents play, how is play structured, and how is play facilitated by specific design/technical choices.

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<sup>16</sup> Besides Apple's efforts to make Siri more playful, Amazon (<http://lovemyecho.com/2015/05/12/stupid-alexa-tricks-for-starters-edition/>) and Google (<https://www.wsj.com/articles/your-next-friend-could-be-a-robot-1476034599>) are also invested in the expressive possibilities of giving AIs a personality. Playfulness is a design approach to this goal.

<sup>17</sup> Art theory and performance studies have questioned the idea of play as a voluntary activity, especially through Schechner's (1988) concept of Dark Play. The possibility of having a form of play that is not voluntary yet creates cultural expressions will be central to extending this rhetoric of computational play to the understanding of phenomena like trolling or fake news. However, that is beyond the scope of this article; for now, suffice to say that while I adopt the classic idea of play as a voluntary activity, I am also aware of the need to extend this concept to non-voluntary play if we want to properly understand the ludic drive in the information age.

The first mode of operation of play is founded on a voluntary compliance to the conditions of the infosphere created by computer machines. Let me repeat the core point of the previous section: the activity of play is a voluntary activity that creates a world. We play because we accept and agree to play, and a large part of the experience is the negotiation of the goals of the play activity. These goals are derived from the acceptance of a number of rules that create the world in which we play. In non-digital games, rules are upheld by humans as a social process. In an ICT-re-ontologized infosphere, rules are upheld by an assemblage of human and artificial agents, as well as computational technologies. To play means to accept these rules. This mode of play accepts rules without questioning them and embraces the world they create in an effort to uphold them.

This is not to say that every agent in the infosphere is a player who has voluntarily accepted the rules of the computers that shape that world. Play still has to be a voluntary act, and therefore, the mode of play as submission requires the agent's voluntary engagement with those rules through the lens of play. Following concepts defined in BDSM literature (Newmahr 2011), I call this process a playful submission to the infosphere. BDSM provides us with the appropriate notion of submission: a voluntary acceptance of rules that bind agency in forms that are pleasurable. Submission is not only voluntary, it can also be interrupted, and does not so much suppose a *delegation* of agency but a *negotiation* of agency, limiting it for the sake of a pleasurable experience.

In this sense, play is a relational strategy towards the ICT re-ontologized infosphere that turns the submission to (computational) rules into a form of negotiated pleasure. Let us return to fitness applications. The tracking that turned a human step into an assemblage of sensor data, statistical quantification, algorithmic evaluation, and actual embodied practices, requires a certain degree of commitment. Users who want to live by the principles of this quantified self need to accept that the steps calculated by the device are *their* steps. To foster this ludic experience, these applications encourage users to challenge themselves by presenting data in a playful, engaging way, and by using methods from game design to visualize the data and make it interactive. These services are designed for submission through playfulness. The re-ontologized human step is encapsulated in a playful experience, so that users feel emotionally attached to these systems. Gamification and other similar Interaction Design trends are ultimately based on this submissive approach: if the computational rules that re-ontologize the infosphere are presented through a ludic interface, users who voluntarily engage with such an interface will find the experience of the world to be playfully pleasurable.

The other mode of play is a form of resistance to the ICT-re-ontologized infosphere. The history of play as a form of resistance to the order the world can be traced back to the critical esthetics of participatory art (Bishop 2012). The work of Augusto Boal (2008) or Allan Kaprow (2003) reinforces the idea that play can be used to create alternative world that resist established orders. Even though this is not the place to explore the critical esthetics of play, it is important to notice that the work of these artists appropriated the world so it could be politically subverted. Their appropriation often took a playful turn, focusing on performativity, humor, and the imposition of absurd rules on the world. Similarly, play as resistance to a computationally re-ontologized infosphere implies acknowledging the existence of rules, but playfully upending them so they can be questioned.

In the infosphere re-ontologized by ICTs, the capacity of playful resistance is a manifestation of carnivalesque play (Sicart 2014a, b). One of the characteristics of play is identifying and mocking the power structures of the world that it appropriates. If we rephrase this approach using the concept of re-ontologization, I argue that the carnivalesque nature of play is expressed by appropriating the re-ontologized world into a play world that mocks and contradicts the world in which the play takes place, in particular, the ICT-enforced rules that structure the re-ontologization process.

I mentioned before that training applications can be seen as an example of submission to the re-ontologized world. An interesting example of playful resistance to this world was put in practice by Nike+ user Claire Wyckoff,<sup>18</sup> who used its map visualization to draw penises. Wyckoff's intervention is a clever and funny comment on the voluntary surveillance that is implied when using these systems. This is a mild form of resistance, a personal, expressive, appropriative experience of these technologies. It is a form of carnivalesque resistance to the way that tracking data can become a form of surveillance sugar-coated by the rhetoric of competitive play (Sutton Smith 1997, pp. 74–90). Making fun of the way that this data is presented and the rhetorics around it, Wyckoff reveals a way of appropriating the ICT-re-ontologized infosphere to express a playful understanding of the world.

A similar example is provided by the website [unfitbits.org](http://unfitbits.org). This art project presents users with creative strategies to cheat fitness trackers. These strategies work on the assumption that the way fitness trackers record movement data is what becomes “real” for the user as well as for other agents in the infosphere. Our health status becomes what can be quantified by the sensors and algorithms embedded in wearable computers. This is a re-ontologized concept of health. “Health” is now “computable health”, the results of algorithmic processes on the data sensed by a computing machine. [Unfitbits.org](http://unfitbits.org) suggests strategies to cheat those algorithms with a double purpose: first, to take this tracking less seriously. And second, to reveal how these machines re-ontologize the infosphere so health can be computed. Subverting the use of these machines is also subverting the computational understanding of health.

Playful resistance processes have a two-step approach: first, they require a certain understanding of how computing technologies are actually changing the infosphere.<sup>19</sup> Both Claire Wyckoff and the creators of [unfitbits.org](http://unfitbits.org) understood how fitness software and hardware act on the infosphere. And second, the appropriative nature of play introduces disorder into the way these computers re-ontologize the infosphere. Playful resistance uses the capacity of play to create encapsulated worlds that propose alternative arrangements of human-machine assemblages.

Resistance and submission describe two types of playful relational strategies that can shape the experience of the infosphere. Play shapes the culture of the information age through these strategies, sometimes surrendering to algorithms in search of pleasure, sometimes rebelling against them. From the arts to the new

<sup>18</sup> See <http://runningdrawing.tumblr.com/> (accessed 26/5/2017)

<sup>19</sup> As the Critical Engineering manifesto puts it, “the exploit is the most desirable form of exposure” (Oliver et al. 2011)

configurations of work, the relational strategies of play are shaping how the infosphere is experienced, and how cultures emerge from it.

## 7 Conclusions

There is still so much work to be done on this research project. The next step will be to ask, what does it mean to be a *homo ludens* in the age of computing machines? A future step will be to trace the historical origins of the affinity between play and computation, from early computer games to the first computerized toys, or the first manifestations of playable/playful interfaces. More work needs to be done on the ethics of play in the age of computers. One of the most interesting aspects of the theories of play applied in this article is that they are open to dark play. Analyzing phenomena like trolling or fake news (Berkowitz and Schwartz 2015), as manifestations of a type of play facilitated by the ICT-re-ontologized infosphere, can provide useful insights.

In fact, the latter might be the most interesting future research direction. Submission and resistance are not the only forms of playful relational strategies. A third, and more malign form based on the manipulation of computational rules to create dark play experiences (i.e., experiences that are designed to be like play, but in which players are non-consensual agents) deserves more attention. The results of this manipulation strategy, from fake news to trolling, are proving to be an effective tool in shaping the politics of the Information Age. Understanding its roots in play might help us deal with the current and future dangers of online culture.

Another line of inquiry should focus on the esthetic nature of play and how it affects the re-ontologized infosphere. The work of hacker/artist collectives such as !mediengruppe bitnik<sup>20</sup> or the Critical Engineers (Oliver et al. 2011) represent new modes of esthetic discourse based on a playful and subversive understanding of ICTs. Given the political nature of many of these artworks, this might be one way to engage with the complicated politics of the infosphere.

The ultimate goal of this project is to propose a comprehensive rhetoric of play that provides new insights about humanity, its values and technologies. If Huizinga and Caillois' theories are based on Romantic esthetics, I propose to base the rhetoric of computational play on the philosophy of computing and information.

After presenting these research areas, I realize how much work there is still to be done. The flaws are many: this theory needs a more precise concept of interface, a more detailed explanation of submission and resistance as modes of experience, and a more detailed engagement with philosophical theories of technology. In any case, my goal was to introduce a new perspective on the Information Age, one that productively questions the role of the ludic in the shaping of computational culture.

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<sup>20</sup> See <https://www.bitnik.org> (accessed 26/5/2017)

## References

- Agre, P. (1997). *Computation and human experience*. Cambridge: Cambridge University Press.
- Berkowitz, D., & Schwartz, D. (2015). Miley, CNN and *The Onion*. *Journalism Practice*, 10(1), 1–17.
- Bishop, C. (2012). *Artificial Hells. Participatory Art and the Politics of Spectatorship*. London. New York: Verso.
- Boal, A. (2008). *Theatre of the oppressed*. London: Pluto Press.
- Bogot, I. (2016). *Play anything: The pleasure of limits, the uses of boredom, and the secret of games*. New York: Basic Books.
- Boudreau, K., & Consalvo, M. (2014). Families and Social Network Games. *Information, Communication & Society*, 17(9), 1118–1130.
- Bøgh Andersen, P. (1997). *A Theory of Computer Semiotics: Semiotic Approaches to Construction and Assessment of Computer Systems*. Cambridge: Cambridge University Press.
- Caillois, R. (2001). *Man, play and games. Urbana and*. Chicago: University of Illinois Press.
- Cleland, C. (2001). Recipes, algorithms, and programs. *Minds and Machines*, 11, 219–237.
- Csikszentmihalyi, M. (2008). *Flow: The psychology of optimal experience*. New York: HarperCollins.
- Consalvo, M. (2009). There is no magic circle. *Games and Culture*, 4(4), 408–417.
- Consalvo, M., & Begy, J. (2015). *Players and their pets: Gaming communities from Beta to sunset*. Minneapolis: University of Minnesota Press.
- Deterding, S., & Walz, S. (2014). *The Gameful world: Approaches, issues, applications*. Cambridge: The MIT Press.
- Deterding, S. (2016). Make-believe in Gameful and playful design. In P. Turner & J. T. Harviainen (Eds.), *Digital Make-Believe* (pp. 101–124). London: Springer.
- Dodig-Crnkovic, G. (2011). Significance of models of computation, from Turing model to natural computation. *Minds and Machines*, 21, 301–322.
- Donovan, T. (2010). *Replay: The history of video games*. East Sussex: Yellow Ant.
- Floridi, L. (2014). *The 4th revolution: How the Infosphere is reshaping human reality*. Oxford: Oxford University Press.
- Floridi, L. (2013). *The ethics of information*. Oxford: Oxford University Press.
- Floridi, L. (2010). *The philosophy of information*. Oxford: Oxford University Press.
- Floridi, L. (2002). On the intrinsic value of information objects and the Infosphere. *Ethics and Information Technology*, 4(4), 287–304.
- Floridi, L. (1999). Information ethics: On the philosophical Foundation of Computer Ethics. *Ethics and Information Technology*, 1(1), 37–56.
- Floridi, L., & Sanders, J. W. (2004). On the morality of artificial agents. *Minds and Machines*, 14(3), 349–379.
- Flusser, V. (1999). *Shape of things: A philosophy of design*. London: Reaktion Books.
- Flusser, V. (2002). *Writings*. Minneapolis: University of Minnesota Press.
- Flusser, V. (2013). *Post-history*. Minneapolis: Univocal Publishing.
- Frisson, V., Lammes, S., de Lange, M., de Mul, J., & Raessens, J. (2015). *Playful identities: The Ludification of digital media cultures*. Amsterdam: Amsterdam University Press.
- Galloway, A. R. (2012). *The Interface effect*. New York: Polity.
- Gaver, W. W. (2009). Designing for Homo Ludens. Still. In T. Binder, J. Löwgren, & L. Malmberg (Eds.), *(Re)searching the Digital Bauhaus*. London: Springer.
- Getsy, D. J. (Ed.). (2011). *From Diversion to Subversion. Games, Play, and Twentieth-Century Art*. Pennsylvania: Penn State University Press.
- Goffman, E. (1961). *Encounters. Two Studies in the Sociology of Interaction*. Indianapolis: Bobbs-Merrill.
- Henricks, T. S. (2009). Orderly and disorderly play: A comparison. *American Journal of Play*, 2(1).
- Henricks, T. S. (2015). *Play and the human condition*. Chicago: University of Illinois Press.
- Hill, R. K. (2015). What an Algorithm Is. *Philosophy & Technology*, 29(1), 35–59.
- Huizinga, J. (1992)[1938]. *Homo Ludens. A Study of the Play-Element in Culture*. Boston: Beacon Press, 1992.
- Ihde, D. (1990). *Technology and the lifeworld. From garden to earth*. Bloomington: Indiana University Press.
- Isen, A. M., & Reeve, J. (2005). The influence of positive affect on intrinsic and extrinsic motivation: Facilitating enjoyment of play, responsible work behavior, and self-control. *Motivation and Emotion*, 29(4).
- Johnson, S. (2016). *Wonderland: How play made the modern world*. New York: Riverhead Books.
- Kaprow, A. (2003). *Essays on the blurring of art and life*. Berkeley: University of California Press.
- De Landa, M. (2006). *A new philosophy of society: Assemblage theory and social complexity*. New York: Continuum.

- Lange, A.-C., Lenglet, M., & Seyfert, R. (2016). Cultures of high-frequency trading: Mapping the landscape of algorithmic developments in contemporary financial markets. *Economy and Society*, 45(2), 149–165.
- Laxton, S. (2011). From judgement to process: The modern ludic field. In D. J. Getsy (Ed.), *From Diversion to Subversion. Games, Play, and Twentieth-Century Art* (pp. 3–24). Pennsylvania: The Pennsylvania State University Press.
- Lehdonvirta, V., & Castronova, E. (2014). *Virtual economies: Design and analysis*. Cambridge: The MIT Press.
- Manovich, L. (2013). *Software takes command*. London: Bloomsbury Academic.
- Manovich, L. (2002). *The language of new media*. Cambridge: The MIT Press.
- Newmahr, S. (2011). *Playing on the edge: Sodomasochism, risk, and intimacy*. Bloomington: Indiana University Press.
- Oliver, J., Savičić, G. & Vasiliev, D. (2011). *Critical Engineering Manifesto*. <https://criticalengineering.org>.
- Pearce, C. (2011). *Communities of play: Emergent cultures in multiplayer games and virtual worlds*. Cambridge: The MIT Press.
- Petzold, C. (2008). *The annotated Turing: A guided tour through Alan Turing's historic paper on computability and the Turing machine*. Indianapolis: Wiley Publishing.
- Reeves, B., & Nass, C. (1996). *The media equation: How people treat computers, television, and new media like real people and places*. New York: Cambridge University Press.
- Rosenberger, R. (2009). The Sudden Experience of the Computer. *Ai & Society*, 24(2), 173–180.
- Rosenberger, R. (2012). The Importance of Generalized Bodily Habits for a Future World of Ubiquitous Computing. *Ai & Society*, 28 (3). Springer London: 289–96.
- Schechner, R. (1988). Playing. *Play & Culture*, 1, 3–19.
- Seyama, J., & Nagayama, R. S. (2007). The Uncanny Valley: Effect of realism on the impression of artificial human faces. *Presence: Teleoper. Virtual Environments*, 16(4), 337–351.
- Sicart, M. (2014a). Playing the good life: Gamification and ethics. In S. Deterding & S. Walz (Eds.), *The Gameful world: Approaches, issues, applications* (pp. 225–245). Cambridge: The MIT Press.
- Sicart, M. (2014b). *Play matters*. Cambridge: The MIT Press.
- Sicart, M. (2009). *The ethics of computer games*. Cambridge: The MIT Press.
- Sicart, M. (2008). Defining game mechanics. *Game Studies* 8, 2. <http://gamestudies.org/0802/articles/sicart>
- Sutton-Smith, B. (1997). *The ambiguity of play*. Cambridge: Harvard University Press.
- Turing, A. M. (1950). Computing machine and intelligence. *Mind*, 49, 433–460.
- Verbeek, P.-P. (2005). *What things do: Philosophical reflections on technology, agency, and design*. University Park, Pa: Pennsylvania State University Press.
- Wenzel, C. H. (2005). *An introduction to Kant's aesthetics. Core concepts and problems*. Oxford: Blackwell.
- Ziewitz, M. (2017). A Not Quite Random Walk: Experimenting with the Ethnomethods of the Algorithm. *Big Data & Society*, 4(2), 1–13.
- Zimmerman, E. (2014). Manifesto for a ludic century. In S. Deterding & S. Walz (Eds.), *The Gameful world: Approaches, issues, applications* (pp. 19–23). Cambridge: The MIT Press.