

# More-than-Human Game Design: Playing in the Internet of Things

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Professor Paul Coulton is Chair of Speculative and Game Design within Lancaster University's open and exploratory, design-led research lab, Imagination Lancaster. His research can more generally be considered as Speculative Design which combines real and/or hypothetical extrapolations of the development of emerging technologies with a consideration of the cultural landscape into which they may be deployed. This activity is embodied as 'research through design' and, in particular, to the design of speculative physical/digital interactive games, playful experiences, and artefacts. He is internationally recognised for his work by not only academia but also industry and was the first academic invited to speak at the Game Developers Conference. Increasingly, his work encompasses a particular form of Speculative Design; Design Fiction, which is a way of exploring futures for areas such as the Internet of Things and Artificial Intelligence. Design Fictions are collections of artefacts, that, when viewed together build a fictional world. The artificially built world is a prototyping platform for the very designs that define it, meanwhile those designs reciprocate in kind and prototype the world.

## ABSTRACT:

The design of objects requiring human interaction often revolves around methods such as Human Centred Design (HCD). Whilst this is beneficial in many cases, contemporary developments of technology such as the Internet of Things (IoT), which produce assemblages of interactions, lead to the view that human centred approaches can prove problematic leading to the proposal of adopting more-than-human perspectives. This study discusses the creation of a novel board game designed to explore a more-than-human design view for IoT products and services by addressing problematic issues in relation to user data privacy and security within the IoT which arguably arise from the application of traditional HCD approaches. By embracing Object-Oriented Philosophy, The Internet of Things Board Game creates an ontographic mapping of IoT assemblages and illuminates the tiny ontologies of unique interactions occurring within these digital and physical networked spaces. Here the gameplay acts as metaphorism illustrating independent and interdependent relationships between the various 'things' in the network. The study illustrates how critical game design can help develop potential new design approaches as well as enabling users to better understand the complex digital/physical assemblages they create when utilising IoT products and services in their everyday lives.

## KEY WORDS:

board game, design research, game design, internet of things, metaphorism, more-than human.

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# Introduction

In the mid 90's Microsoft bundled their popular Office Software with a virtual assistant they named *Clippy*. The rather annoying and at times intrusive anthropomorphised paper clip arguably did little in the way of providing actual assistance but was amongst the first steps towards a future more recognisable today with smart assistants such as *Amazon Alexa*. Whilst *Clippy* was an add-on for traditional desktop software, many of these new personal assistants come in the form of bespoke internet connected devices and are components of what is commonly referred to as the Internet of Things (IoT). Although *Clippy* has little to do with the evolution of IoT, as its only interaction with the Internet was by occasionally providing a web link to obtain further information, it does offer a starting point through which we might consider our evolving relationship with hardware and software which the IoT is rapidly expanding.

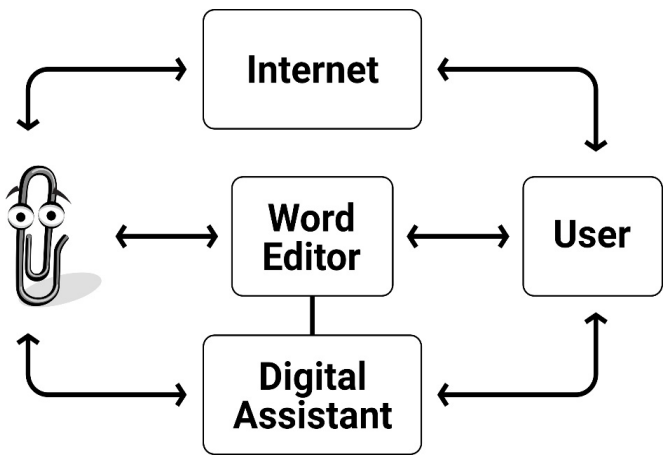
Lurking in the background of our Microsoft Office related activities, *Clippy* 'listened-in' as we began to type a letter or create a presentation. This non-human entity made human monitored and analysed our interactions creating an invisible link between us (the human user) and the computer hardware and software. I. Bogost allows us to view such links as 'alien phenomenologies'<sup>1</sup> through the lens of Object-Oriented Philosophy, introduced by G. Harman,<sup>2</sup> in which segregated links of entities produce various tiny ontologies;

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1 BOGOST, I.: *Alien Phenomenology, or, What It's Like to Be a Thing*. Minneapolis : University of Minnesota Press, 2012, p. 32.

2 For more information, see: HARMAN, G.: *Object-Oriented Ontology: A New Theory of Everything*. London : Pelican Books, 2018.

phenomenological clusters of interactions. Further, Bogost proposes ‘metaphorism’,<sup>3</sup> which allows us to attach meaning to phenomenon producing an understanding of the nature of being and perception of world related to these human and non-human entities. Thus, we could consider the anthropomorphised form of *Clippy* as acting as a playful metaphor for digital assistance. Behind the *façade* however *Clippy* is still lines of computer programming, and when viewed through an alien phenomenology lens it becomes a more-than-human entity creating a tiny ontology including itself as a digital assistant, the human user, and the software between allowing an objective or exploded view to be analysed (Picture 1).



Picture 1: The relationships generated between different entities interacting with Microsoft’s *Clippy* may be seen as tiny ontologies

Source: own processing

The pervasiveness of IoT-enabled (or smart) devices is rapidly expanding the number of these invisible links, going well beyond our interactions with desktop software to include interactions with everyday objects and locations. From smart meters collecting data on which rooms we occupy to smart toasters capable of providing us with the optimum level of toasting required for a *Pop Tart*®, the invisible links created by these devices produce complex networked ecologies of human and non-human entities fuelled by data. J. Lindley et al. describe these ecologies produced within the IoT through the metaphor of ‘constellations’<sup>4</sup> representing the independent and interdependent relationships amongst human and non-human entities. As an example, take a smart kettle connected to the Internet. Though the general understanding is it is directly related to its utilitarian use ergo to boil water for the human-user, the fact that it is connected to the Internet means other stakeholders have a share in this relationship, such as Internet Service Providers (ISP), electricity companies, policies from government assigned regulations, and so on. The object-oriented perspective affords these tiny ontologies to be mapped out, and within these generated constellations of differing ontological relationships it is wrong to assume the human is at the centre. For instance, it could be the data produced through use that is

3 BOGOST, I.: *Alien Phenomenology, or, What It’s Like to Be a Thing*. Minneapolis : University of Minnesota Press, 2012, p. 61.

4 LINDLEY, J. G., COULTON, P.: On the Internet Everybody Knows You’re a Whatchamacallit (or a Thing). In MARK, G., FUSSELL, S. (eds.): *Proceedings of CHI 2017 Conference on Human Factors in Computing Systems*. New York : Association for Computing Machinery, 2017, p. 2.

of more interest to these stakeholders.<sup>5</sup> This fact raises concerns on the efficacy of using orthodox HCD approaches which obfuscate the complexity of relationships in the name of simplicity, often leading to considerable ethical concerns relating to areas such as security and privacy.<sup>6</sup>

In effect, what is achieved is an argument for challenging design orthodoxies in favour of More-than-Human-Centred Design (MtHCD) approaches.<sup>7</sup> We note that while the *more-than-human* concept is also being considered to explore our complex relationships with other entities such as animals,<sup>8</sup> or the environment,<sup>9</sup> this is commensurate with the work presented in this study as the philosophy allows us to consider all these things within various tiny ontologies. Thus, the IoT is an example of how design can better embrace the complexity of interactions rather than adopting approaches that seek to mask such complexity. This study attempts to illustrate this by illuminating the design decisions associated with the interactions within a board game created with the intention of revealing the intimate 'natures' of IoT devices/services.

*The Internet of Things Board Game* is a work of philosophical carpentry, a method introduced by I. Bogost that infuses philosophical arguments, in this case MtHCD inspired by object-orientated philosophy, within designed artefacts for the purposes of enacting metaphorism through philosophy and gameplay.<sup>10</sup> These appear in-game as descriptions on cards, mechanisms in play, and player-game interactions acting as tiny ontologies between the player, game, and the rhetoric of IoT. This study focuses on the different ways the game approaches the notion of metaphorism through gameplay and procedural rhetoric making the game a case study for possible more-than-human game design. The text is structured as follows, first the core concept of metaphorism and its relation to game design, IoT, and design research is expanded through a review of relevant literature. Second, the different nuances and mechanisms employed for enacting metaphorism for IoT in the game are presented and discussed; note the process of creating the game is not fully presented as this has been detailed elsewhere,<sup>11</sup> along with its ability in illuminating ethical and security concerns in IoT.<sup>12</sup> The study then concludes with a discussion around the present potential and possible pitfalls of using metaphorism in the context of game design for understanding design approaches.

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- 5 LINDLEY, J. G., COULTON, P., AKMAL, H. A.: Turning Philosophy with a Speculative Lathe: Object Oriented Ontology, Carpentry, and Design Fiction. In STORNI, C., LEAHY, K., McMAHON, M., LLOYD, P., BOHEMIA, E. (eds.): *Proceedings of DRS2018 Limerick*. London : Design Research Society, 2018, p. 238.
  - 6 LINDLEY, J. G., COULTON, P.: On the Internet Everybody Knows You're a Whatchamacallit (or a Thing). In MARK, G., FUSSELL, S. (eds.): *Proceedings of CHI 2017 Conference on Human Factors in Computing Systems*. New York : Association for Computing Machinery, 2017, p. 2.
  - 7 For more information, see: COULTON, P., LINDLEY, J. G.: More-Than Human Centred Design. In *The Design Journal*, 2019, Vol. 22, No. 4, p. 463-481. [online]. [2021-03-08]. Available at: <<https://www.tandfonline.com/doi/full/10.1080/14606925.2019.1614320>>; LINDLEY, J., AKMAL, H. A., COULTON, P.: Design Research and Object-Oriented Ontology. In *Open Philosophy*, 2020, Vol. 3, No. 1, p. 11-41. [online]. [2021-03-08]. Available at: <<https://www.degruyter.com/document/doi/10.1515/opphil-2020-0002/html>>.
  - 8 GALLOWAY, A.: Creative Ethnography after Human Exceptionalism. In HJORTH, L., HORST, H., GALLOWAY, A., BELL, G. (eds.): *The Routledge Companion to Digital Ethnography*. New York : Routledge, 2017, p. 470.
  - 9 TSING, A. I.: *The Mushroom at the End of the World: On the Possibility of Life in Capitalist Ruins*. Princeton : Princeton University Press, 2015, p. 256-264.
  - 10 BOGOST, I.: *Alien Phenomenology, or, What It's Like to Be a Thing*. Minneapolis : University of Minnesota Press, 2012, p. 85.
  - 11 For more information, see: AKMAL, H. A., COULTON, P.: Research through Board Game Design. In *Proceedings of RTD 2019 Method & Critique*. Rotterdam, Delft : Science Center, Het Nieuwe Instituut, 2019, p. 1-16.
  - 12 For more information, see: AKMAL, H. A., COULTON, P.: The Internet of Things Game: Illuminating Data Interactions within the Internet of Things. In *Proceedings of Living in the Internet of Things*. London : Institution of Engineering and Technology, 2019, p. 1-5.

# Complexity in the Internet of Things

In his book *Everywhere*, A. Greenfield discusses potential futures where technology takes on a ubiquitous nature, in particular the likelihood of technology consciously processing our daily lives as more and more data is captured.<sup>13</sup> This is a concept stemming from M. Weiser's vision of ubiquitous computing where it becomes invisible and sewn into our daily lives.<sup>14</sup> Greenfield's visions are full of connected everyday objects collectively gathering information about ourselves for an array of purposes. These visions are highly prescient of the exponential expansion of IoT products and services but also of the changes this would instigate in our everyday lives: "When everyday things are endowed with the ability to sense their environment, store metadata reflecting their own provenance, location, status, and use history, and share that information with other such objects, this cannot help but redefine our relationship with such things".<sup>15</sup> One aspect of this change in status comes in the form of loss of privacy with the use of IoT-enabled technology as the data we generate is used for purposes beyond our control or expectation. Whilst our expectation of IoT devices is driven by our previous understanding of their non-smart precursors, the data we generate around their use adds new challenges which are not always made apparent by the devices themselves. R. Vamosi sees this as a "betrayal" by our devices explaining how we have yet to evolve "survival instincts" for living alongside IoT or 'smart' products and services.<sup>16</sup>

Many of the issues emerging around the use of IoT products and services originate in their design and arguably through the use of HCD with its particular focus on simplicity of use.<sup>17</sup> This core axiom of simplicity<sup>18</sup> often means that only the basic operation of the device is presented and its role as part of a wider networked ecology is neglected.<sup>19</sup> For example, the *Roomba*® robotic vacuum cleaner claims to allow you to "forget about vacuuming for weeks at a time" and that it (the robot) is smart enough to know if your cat has tracked its litter through the house.<sup>20</sup> However, many owners were shocked to learn that the latest versions of the device produced detailed maps of their homes.<sup>21</sup> These were then relayed to the manufacturer who could potentially have shared them with third

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13 See also: GREENFIELD, A.: *Everywhere: The Dawning Age of Ubiquitous Computing*. Berkeley : New Riders, 2006.

14 For more information, see: WEISER, M.: The Computer for the 21<sup>st</sup> Century. In *Scientific American*, 1991, Vol. 265, No. 3, p. 94-105.

15 GREENFIELD, A.: *Everywhere: The Dawning Age of Ubiquitous Computing*. Berkeley : New Riders, 2006, p. 23.

16 VAMOSI, R.: *When Gadgets Betray Us: The Dark Side of Our Infatuation with New Technologies*. New York : Basic Books, 2011, p. 16.

17 COULTON, P., LINDLEY, J. G.: More-Than Human Centred Design. In *The Design Journal*, 2019, Vol. 22, No. 4, p. 465. [online]. [2021-03-08]. Available at: <<https://www.tandfonline.com/doi/full/10.1080/14606925.2019.1614320>>; LINDLEY, J. G., COULTON, P., COOPER, R.: Why the Internet of Things Needs Object Orientated Ontology. In *The Design Journal*, 2017, Vol. 20, No. 1, p. 2848. [online]. [2021-03-08]. Available at: <<https://www.tandfonline.com/doi/abs/10.1080/14606925.2017.1352796>>.

18 NORMAN, D.: *The Invisible Computer: Why Good Products Can Fail, the Personal Computer Is So Complex, and Information Appliances Are the Solution*. Cambridge : MIT Press, 1999, p. 67.

19 LINDLEY, J. G., COULTON, P., COOPER, R.: Why the Internet of Things Needs Object Orientated Ontology. In *The Design Journal*, 2017, Vol. 20, No. 1, p. 2848. [online]. [2021-03-08]. Available at: <<https://www.tandfonline.com/doi/abs/10.1080/14606925.2017.1352796>>.

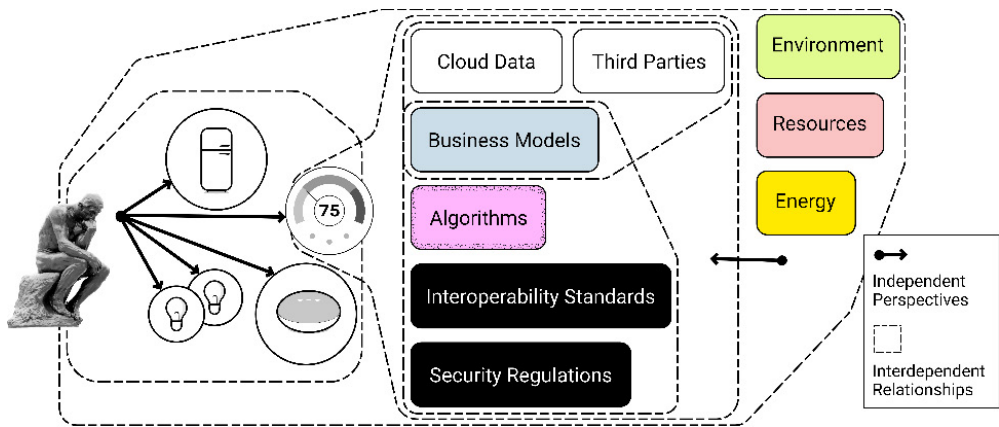
20 *The Future of Clean Takes Shape with iRobot's Most Advanced Robot Vacuum and Mop*. [online]. [2021-03-31]. Available at: <<https://media.irobot.com/2019-05-29-The-Future-of-Clean-Takes-Shape-with-iRobots-Most-Advanced-Robot-Vacuum-and-Mop>>.

21 For more information, see: ASTOR, M.: *Your Roomba May Be Mapping Your Home, Collecting Data that Could Be Shared*. Released on 25<sup>th</sup> July 2017. [online]. [2021-05-19]. Available at: <<https://www.nytimes.com/2017/07/25/technology/roomba-irobot-data-privacy.html>>.

parties. While an automatic vacuum cleaner seems attractive, a digital device which maps the interior of your home in order to – potentially – sell that map to the highest bidder, is clearly a more complicated proposition.

## An Alternative Approach

J. Lindley et al. seek a change of perspective (Picture 2) moving away from the dogmatic use of HCD to a focus on simplicity in the design of IoT systems and have proposed a more-than-human approach based on the contemporary workings of object-oriented philosophies by G. Harman,<sup>22</sup> T. Morton,<sup>23</sup> and I. Bogost<sup>24</sup> among others. The constellation view of IoT they propose presents independent and interdependent relationships among entities in IoT networks as an expanded imagining of interconnectivity viewed by proximity to stakeholders such as the user, IoT device, or ISP.



Picture 2: A constellation view of IoT reveals independent and interdependent relations existing among seeming simple interactions

Source: own processing

G. Harman presents Object-Oriented Ontology (OOO) as a branch of philosophy relating to phenomenology.<sup>25</sup> I. Bogost augmented this with his notion of metaphorism as a means of speculating on the unknown lives (or inner workings) of things.<sup>26</sup> As a practicing game designer and technologist I. Bogost creates games and programs that enact this idea of metaphorism by exploring different object-oriented vantage points leading to him describing himself a philosopher-programmer. Similarly, this approach could be sourced for the creation of say philosopher-mechanics,<sup>27</sup> or in the case of the board game and associated design research artefacts philosopher-designers.<sup>28</sup>

22 For more information, see: HARMAN, G.: *The Quadruple Object*. Alresford : Zero Books, 2011.

23 See also: MORTON, T.: *Realist Magic: Objects, Ontology, Causality*. London : Open Humanities Press, 2013.

24 See: BOGOST, I.: *Alien Phenomenology, or, What It's Like to Be a Thing*. Minneapolis : University of Minnesota Press, 2012.

25 HARMAN, G.: *The Quadruple Object*. Alresford : Zero Books, 2011, p. 20-32.

26 BOGOST, I.: *Alien Phenomenology, or, What It's Like to Be a Thing*. Minneapolis : University of Minnesota Press, 2012, p. 63.

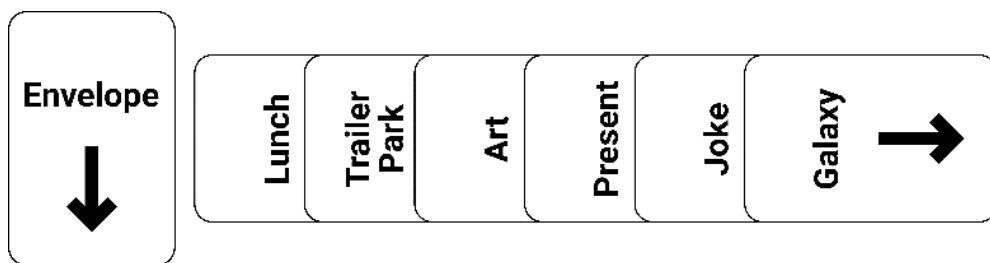
27 Ibidem, p. 109.

28 AKMAL, H. A., COULTON, P.: A Tarot of Things: A Supernatural Approach to Designing for IoT. In BOESS, S., CHEUNG, M., CAIN, R. (eds.): *Proceedings of DRS 2020 Synergy*. London : Design Research Society, 2020, p. 2382.

# Tiny Ontologies

The notion of tiny ontologies in this regard is a main tenet of metaphorism and to explain this a brief interlude into the philosophy is helpful at this stage. I. Bogost<sup>29</sup> appropriates the term from G. Harman's "flat ontologies"<sup>30</sup> coming from his work on OOO where he describes them as the relationships between the properties of 'things' with those of other 'things' presented in an exploded view of their universe. The philosophical example Harman gives is of the relationship between cotton and fire wherein certain properties of cotton on a quantum level must adhere to the logic that cotton should burn in contact with fire.<sup>31</sup> This specific quantum interaction is unknown to humans yet known and understood among the non-human entities that are cotton and fire. I. Bogost's appropriation of this logic takes into account human computer interaction substituting the non-human with software and hardware expanding on the definition as being a dense point containing everything within and in relation to it.<sup>32</sup> He opens a case for 'unit operations' occurring within these tiny ontologies making them independent parts of a whole yet dependent on each other.<sup>33</sup> As OOO places no precedence for humans over non-humans,<sup>34</sup> this logic begins to take shape. Where the exploded view of hardware as tiny ontologies becomes plastic, silicone, metal, glass, screws, or its materiality, the quantum levels of software become its programming language, compiler, metadata, algorithms, etc.

As an example of his tiny ontologies I. Bogost presents the card game *In a Pickle* as an ontographic machine.<sup>35</sup> Players must play a series of cards dealt to them in a specific order with each played card being capable of encompassing the concept of the previous card. For instance, a game of *In a Pickle* could look like this: *Lunch, Trailer Park, Art, Present, Joke, Galaxy* (Picture 3).



Picture 3: Example of a round of *In a Pickle*. Each card expands on the previous creating a linear play of words and a tiny ontology of relations between them

Source: own processing

Each card played expands on the previous card, but in the process, he argues it also creates hidden linkages between physical and conceptual entities with each coupling becoming a 'unit operation'. I. Bogost calls arrangements of words such as these *Latour*

29 BOGOST, I.: *Alien Phenomenology, or, What It's Like to Be a Thing*. Minneapolis : University of Minnesota Press, 2012, p. 19.

30 HARMAN, G.: *Object-Oriented Ontology: A New Theory of Everything*. London : Pelican Books, 2018, p. 54.

31 Ibidem, p. 164.

32 BOGOST, I.: *Alien Phenomenology, or, What It's Like to Be a Thing*. Minneapolis : University of Minnesota Press, 2012, p. 109.

33 Ibidem, p. 22-29.

34 HARMAN, G.: *The Quadruple Object*. Alresford : Zero Books, 2011, p. 106.

35 BOGOST, I.: *Alien Phenomenology, or, What It's Like to Be a Thing*. Minneapolis : University of Minnesota Press, 2012, p. 56.

*Litanies* after sociologist-philosopher B. Latour's act of list making.<sup>36</sup> This central logic of tiny ontologies and unit operations builds the foundations of the constellation metaphor for IoT presented by J. Lindley et al.<sup>37</sup> where each connected entity forms a unit operation functioning with its own inherent requirements.

## Metaphorism and Game Design

This talk of metaphorism might seem tangential to game design but games and metaphor are no strangers. The use of metaphor within games (particularly video games) is common, and several sources can be found attesting to games representing a vehicle for moving metaphor and play together.<sup>38</sup> I. Bogost's use of metaphorism can be understood by an example from his book of how a camera takes photographs.<sup>39</sup> Unlike the human eye cameras process light differently taking into account how the sensor present within the camera functions, making the interaction between subject-sensor unique for different kinds of cameras with different manners of sensors. For the user it's a click of a button, a flash, and a processed image. Even if they were to be aware of the functioning inner reflections of the camera, the camera would still be 'seeing' the image through its sensor according to what rules and limitations it presented. The metaphor suggests that our understanding of how a camera experiences sight is very different than what the actual experience of 'seeing' for a camera truly is.

In relation to game design, another example is presented by J. Gee who argues that video games allow embodied thinking by throwing players into living the lives of virtual characters, ergo enabling them to think as if the virtual world were theirs.<sup>40</sup> Combining the two metaphors a game designed with the intent of making one 'see' through the eyes of a camera could enable a player to embody the camera to a certain degree. Especially if it were programmed to direct the player to experience sight and the processing of image as a camera would. The digital games *I am Bread*<sup>41</sup> and *Untitled Goose Game*<sup>42</sup> attempt this notion of metaphorism and more-than-humanness through gameplay by having the player exist in-game as a slice of bread or a goose respectively. That said, both games arguably lose fundamental *bread-ness* and *goose-ness* in favour of gameplay by employing tasks and gamifying the experience; these are not necessarily experiences bread or geese might have.

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36 BOGOST, I.: *Alien Phenomenology, or, What It's Like to Be a Thing*. Minneapolis : University of Minnesota Press, 2012, p. 38.

37 For more information, see: LINDLEY, J. G., COULTON, P.: On the Internet Everybody Knows You're a Whatchamacallit (or a Thing). In MARK, G., FUSSELL, S. (eds.): *Proceedings of CHI 2017 Conference on Human Factors in Computing Systems*. New York : Association for Computing Machinery, 2017, p. 1-5.

38 See: GEE, J. P.: Video Games and Embodiment. In *Games and Culture*, 2008, Vol. 3, No. 3-4, p. 253-63.; LAW, B.: Puzzle Games: A Metaphor for Computational Thinking. In CONNOLLY, T. et al. (eds.): *Proceedings of European Conference on Game Based Learning*. Kidmore End : Academic Conferences Ltd., 2016, p. 344-353.; MELERO, J. et al.: Puzzle-Based Games as a Metaphor for Designing in Situ Learning Activities. In ESCUDEIRO, P. (ed.): *Proceedings of the 7th European Conference on Games Based Learning*. Kidmore End : Academic Conferences Ltd., 2013, p. 674-682.; MÖRING, S.: *Games and Metaphor – A Critical Analysis of the Metaphor Discourse in Game Studies*. [Dissertation Thesis]. Copenhagen : IT University of Copenhagen, 2013.; STATHIS, K., SERGOT, M.: Games as a Metaphor for Interactive Systems. In SAASE, M. A. et al. (eds.): *People and Computers XI*. London : Springer, 1996, p. 19-33.; GUALENÌ, S.: *Virtual Worlds as Philosophical Tools: How to Philosophize with a Digital Hammer*. London : Springer, 2015.

39 BOGOST, I.: *Alien Phenomenology, or, What It's Like to Be a Thing*. Minneapolis : University of Minnesota Press, 2012, p. 67.

40 GEE, J. P.: Video Games and Embodiment. In *Games and Culture*, 2008, Vol. 3, No. 3-4, p. 258.

41 BOSSA STUDIOS: *I Am Bread*. [digital game]. London : Bossa Studios, 2015.

42 HOUSE HOUSE: *Untitled Goose Game*. [digital game]. Portland : Panic, 2019.



Two examples that present a better attempt at embodiment in play are in the survival-horror digital game *Soma*<sup>43</sup> and the board game *Dead of Winter: A Crossroads Game*. Where the former places players in the virtual footsteps of a literal digital embodiment of the human in-game character through collated memories, the latter involves a defector element in play making players actively embody their assigned character traits within gameplay. Halfway through *Soma* the players are faced with the reality that they have been playing a digital avatar of their original human character all along, bringing to light existential questions for the in-game character and player. As the protagonists in *Soma* players take an active part in being non-human by reflecting on existential constructs making decisions that affect their player's future. Likewise, as *Dead of Winter* is a board game with a defector element, players actively try to keep their true identities hidden taking on different strategies to achieve their personal goals which could in many cases undermine the goals of others, as they might be playing as hidden traitors in an otherwise cooperative game. Though arguably *Soma* being a digital game bound by algorithms achieves this dynamic more effectively than *Dead of Winter*, where players may opt to alter the course of play by bringing in house rules or not wanting to be the defector in the game. In that case without the presence of an assigned traitor in play, *Dead of Winter* still manages enforcing players to keep their personal goals secretive and thus having them embody unique character traits often going against the grain of 'cooperative play'. Either way, both these games present I. Bogost's metaphorism within the produciorial rhetoric of play with minimal sacrifice to the fundamental aspects of their character or entity in play.

## Metaphorism in the Internet of Things Board Game

Through different ways of utilising in-game mechanics and theme the *Internet of Things Board Game* (Picture 4) attempts its metaphorism of IoT. This section gives a brief account of its creation before illustrating how this metaphorism is employed. Interest in the creation of the board game came out of early research classifying IoT interactions through philosophical discourse in an attempt at understanding the nature of interactions within constellations.<sup>44</sup> The design underwent an iterative research through design methodology similar to universal methods of game design and production.<sup>45</sup> Taking inspiration from popular mainstream board games *Dead of Winter*, *Betrayal at House on the Hill*, and *Eldritch Horror*, the game exercises similar paratextual experiences coming from its assigned theme.<sup>46</sup> A common trait in what are considered Ameritrash games which employ rich complexities involving engaging conflicts between players and/or the game, and a heavy association with theme over abstract strategy through integrated mechanics.<sup>47</sup> Paratextual games exist in two worlds, one the playable game world which could be in a digital medium

43 FRICTIONAL GAMES: *Soma*. [digital game]. Malmö : Frictional Games, 2015.

44 For more information, see: AKMAL, H. A., COULTON, P.: Using Heterotopias to Characterise Interactions in Physical/Digital Spaces. In STORNI, C., LEAHY, K., McMAHON, M., LLOYD, P., BOHEMIA, E. (eds.): *Proceedings of DRS 2018: Design as a catalyst for change*. London : Design Research Society, 2018, p. 269-278.

45 See also: AKMAL, H. A., COULTON, P.: Research through Board Game Design. In *Proceedings of RTD 2019 Method & Critique*. Rotterdam, Delft : Science Center, Het Nieuwe Instituut, 2019, p. 1-16.

46 BOOTH, P.: *Game Play: Paratextuality in Contemporary Board Games*. New York : Bloomsbury Publishing, 2015, p. 4.

47 COSTIKYAN, G.: Boardgame Aesthetics. In CONSTIKYAN, G., DAVIDSON, D. (eds.): *Tabletop: Analog Game Design*. Pittsburgh : ETC Press, 2018, p. 181-183.

or physical board game, and two the world it references from often media associations like film or literature.<sup>48</sup> For example, *Lord of the Rings: Journeys in Middle-Earth* by Fantasy Flight Games and *Back to the Future: Back in Time* by Prospero Hall may be considered paratextual games owing to the fact that they both associate with their source media; the novel of the same name in case of the former, and the popular film franchise in the latter. P. Booth presents an in-depth discussion around paratextuality in board games arguing for how they reveal significances of either world they relate to (playable game world or referenced), as conjoined versions of each other representing different faces of these different worlds each open to interpretation.<sup>49</sup> Ameritrash games present this through algorithmic execution of their complex rules. To that Booth gives the example of *Arkham Horror*, a game very similar to our referenced game *Eldritch Horror*, which through its complexity and structure of play executes a narrative of Lovecraftian literature a world arguably more complex than the game.<sup>50</sup> *Dead of Winter* manages this through its aptly named crossroads cards which often bring about dilemmas in play, having players reassess their situations and even hidden tactics that they may have invested time in. The cards along with other mechanics enforce the theme of a post-apocalyptic undead world where play exists.

In a similar way our second important means of enforcing metaphorism is through storytelling and creating what I. Bogost refers to as vignettes.<sup>51</sup> As a large part of this research involved crafting a unique procedural rhetoric that worked in tandem with core philosophical research backgrounds, storytelling became an important factor in realising metaphor in-play through narrative. As players took their characters along the board different vignettes are crafted having players reinforce the rhetoric of the games paratextuality with the world of IoT. In the case of the Internet of Things Board Game the narrative around which play wrapped itself was security in IoT. The intention though not initially to reflect privacy/security concerns in IoT, the iterative process managed to have it overlap with the core areas of philosophical spatial configurations in IoT which was the original research concern. This was not planned; yet for certain reasons it became the most comfortable means of expressing the metaphorism (more on this ahead). To that effect the game pits players against a fictional corporation attempting to gather their data a common anti-IoT stance. Players work cooperatively as fictional avatars in-game with their own unique abilities and skillset relating to different ways of experiencing the in-game imagined network of devices and interactions.

Besides their unique special abilities each avatar includes the following skills *Observation*, *Coding*, *Security*, and *Speed* which they improve as play goes on. Each signifies a number of dice the player may roll when prompted, as can be imagined the higher the skill level the higher the chances of a successful dice roll. The game attempts to interfere with this by enforcing dice-rules throughout. Collectively players then use their abilities to strategically secure physical locations from digital insecurities and security hazards against rising digital threats and vulnerabilities. As players begin to play, they quickly realise that they have little control over their actions, thus requiring a more focused understanding of what is happening in the spaces before them. Dice rolls are common in Ameritrash games facilitating a level of chance in actions, their usage here is done to highlight the fallibility of IoT networks. Players can have multiple arrangements of cards that could improve their abilities, increasing their dice rolls, but twists of fate through dice rolls bring about an ever-present air of dread in the game. These supposedly secured IoT networks can very easily fall because of a single weak link in the constellation.

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48 BOOTH, P.: *Game Play: Paratextuality in Contemporary Board Games*. New York : Bloomsbury Publishing, 2015, p. 23.

49 Ibidem, p. 4-7.

50 Ibidem, p. 25.

51 BOGOST, I.: *How to Do Things with Videogames*. Minneapolis : University of Minnesota Press, 2011, p. 15.



of Carcosa<sup>52</sup> from Lovecraft. An astral plane visited in a dream-like trance that players interact with through the game as an alternate space. Here the trance is substituted for our smart devices, and Carcosa the digital space where the Internet exists. The board game thus attempts its exercise of metaphorism on three main levels. Play encourages the formation of metaphors and establishes rhetoric in relation to players (or users of IoT) with each level expanding on the previous.

## Metaphorism Level 1: Unit Operations

This first level of play involves the direct relationship of the game with its players and is most prominently seen within the use of *Item Cards* (Picture 5). Through these cards and other items on the board players create unit operations that propel the game forward. Each player collects item cards representing IoT-enabled devices and services. These are traded for connection tokens which create linkages with the physical location in-game where the players are, or have been, present and their traded devices. Represented as blue cubes on their personal device cards (smart phones and tablets) these tokens enact the general understanding of IoT-enabled spaces with these interactions akin to setting up a smart device like a smart toaster in a physical location such as a kitchen. How the game manages this through the rhetoric of metaphorism is when players trigger inevitable consequences through unsuccessful dice rolls. These manifest in two forms: external network attacks, and local network attacks on personal items held by players. As a result, a player who rolls unsuccessfully must perform a series of vulnerability checks (further dice rolls) on each item and/or connection token they have on hand. In the event of any of these subsequent rolls being unsuccessful, the players execute the advised *Risk* portion of the victim card.

As an example, we can look at the *Polly Kettle*<sup>53</sup> item card (Picture 6). The card may be carried by players and used to create connections in-game but if a player were to trigger the *Risk Phase* of play while holding the card in hand then they would need to begin their vulnerability check on the card. Failing that would cause the player to take a *Daemon Card* (Picture 5) temporarily altering their abilities in the game. Alternatively, if the card was used at some point in play to make a connection the player would have a marker indicating they had performed that action. The penalty on failing a successful dice roll on these tokens is discarding the players primary card (smart phone or tablet), hence restricting them from making further connections in the game and halting their progress towards their end goal.

Larger scale attacks may also be seen through this same method if we take the *Toaster* item as an example. On failing its vulnerability checks the toaster drops a *Privacy Token* (Picture 6) in the space occupied by the player indicating a highly insecure location. These tokens are difficult to remove and at certain points in the game cause further vulnerabilities to emerge in that particular space, which may turn into threats bringing the players closer to failure.

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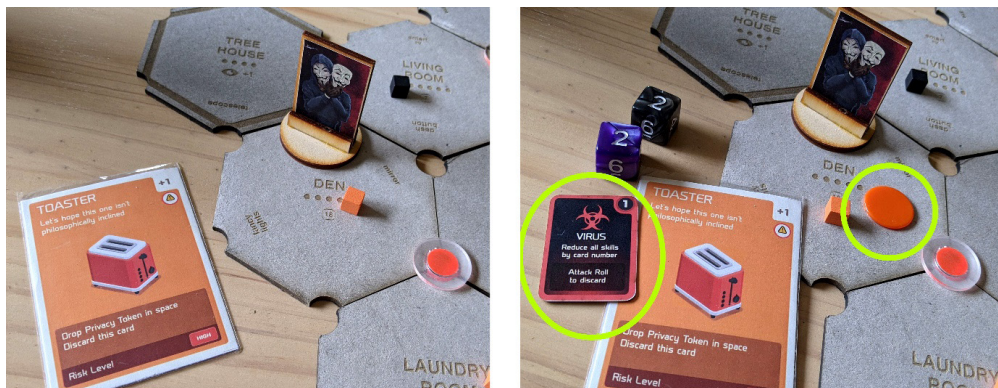
52 Remark by the authors: Though not originally associated with H. P. Lovecraft's writings and dating back to the Latin name of medieval southern French city of Carcassonne, Lovecraft heavily incorporated Carcosa in his writings existing as an extra-terrestrial city often visited by his characters through dream states or out of body experiences.

53 Cameo of a parallel design fiction research on IoT and Philosophy from: LINDLEY, J. G., COULTON, P.: On the Internet Everybody Knows You're a Whatchamacallit (or a Thing). In MARK, G., FUSSELL, S. (eds.): *Proceedings of CHI 2017 Conference on Human Factors in Computing Systems*. New York : Association for Computing Machinery, 2017, p. 3.





Picture 5: Item Cards (top) depicting IoT entities or concepts, Risks and Daemons (middle) disrupting play, Privacy Cards (bottom) allowing players to achieve their end goal  
Source: own processing



Picture 6: The player has failed to evade the Risk Phase of play, forcing them to do vulnerability checks on their in-hand items. After failing the dice roll over the Toaster item, they are forced to place a Privacy Token in the space and take a Daemon Card. This token exploits late-game threats against players  
Source: own processing

On this level a number of metaphors are being employed to establish the idea of insecure IoT systems. The personal restrictions applied by *Daemon Cards* intend to replicate the way security breaches would affect usage of IoT devices. The naming of the card as 'daemon' is in itself enacting a metaphorism as daemon's are software processes occurring in the backgrounds of our computing actions. Vulnerabilities such as trojans and viruses often employ a daemon-esque approach. Step by step the *Risk* cards inform the player of the severity and their associated consequences which gradually settles in through the procedural rhetoric of the game. The paratextuality presented is through created metaphors of physical digital locations/objects which co-exist and become intertwined through in-game mechanics, replicating real world scenarios produced by IoT products and services. There is another level of playful metaphorism coming from this as players see odd combinations emerging such as being able to connect the *Living Room* to the *Kitchen* with an IoT-enabled *Shoe*, for example. This highlights the current design trend of solutionism whereby IoT products are solving problems that don't really exist.<sup>54</sup>

## Metaphorism Level 2: Tiny Ontologies

Moving outwards the game begins to act as a map of all the different interactions having taken place with players being able to visualise which spaces are becoming insecure and which are still safe. As explained previously the board makes it possible to read some of the tiny ontologies in play such as with the *Laundry Room* tile which has a *Washing Machine* that can be connected to the adjacent space. This manner of linguistically listing out the connections is similar to I. Bogost's referencing of B. Latour's lists or 'litanies'<sup>55</sup> and to the previously mentioned card game *In a Pickle*. The list of *Laundry Room*–*Washing Machine*–*Conservatory* (Picture 7) for instance is possible as are any number of combinations particularly when considering players using their in-hand items to make connections.

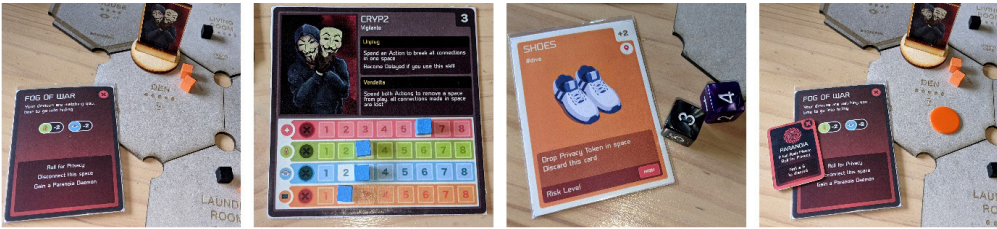


Picture 7: By connecting physical locations with physical objects through digital networks hidden linkages are constructed during play. In these instances, the linkages may be of unorthodox natures exploring possibilities in IoT networks

Source: own processing

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- 54 GRADINAR, A. et al.: *The Little Book of the Internet of Things for the Home*. Lancaster : Lancaster University, 2019, p. 10.  
 55 BOGOST, I.: *Alien Phenomenology, or, What It's Like to Be a Thing*. Minneapolis : University of Minnesota Press, 2012, p. 38.

On a higher level though, during the *Risk Phase* of play when a player unsuccessfully rolls their dice they must draw from the *Risk Deck* before checking for vulnerabilities on their items in hand. Cards in this deck act on a secondary level of play enforcing additional rules upon players that dictate their future moves. They reel in the storytelling element allowing a dialogue between players and the game. For instance, the *Fog of War* card (Picture 8) suggests that the players' devices are 'watching' them and once the player finishes their vulnerability checks irrespective of whether any of their devices (cards) proved vulnerable or not, they must do the following: roll for privacy, disconnect the space, and gain a *Paranoia Daemon*. Each forced action is harsher than the previous and alludes to establishing paranoia towards IoT devices. The first brings about further privacy related vulnerabilities and threats in the game, the second makes the player remove all connection tokens from the space in a panic, and finally the third reduces the players' skills for the remainder of the game.



Picture 8: Failing the Risk Phase the player has drawn Fog of War. Following the cards instructions the player must restrict their dice, though they have 3 Observation and Security traits they may only roll 2 dice in this instance. Having failed the dice roll they not only execute the items Effect but also must continue the Risk cards extended effects.

Source: own processing

In both cases described the game is creating constellations of tiny ontologies. More direct in the former with objects and locations while the latter takes it further by implying a layer between these direct linkages. One could ask just how are the devices 'watching' the player? In a similar vein another *Risk* card is the *Legislation Change* card which informs all players that the policies affecting their IoT devices have altered and therefore each player must do a dice roll to secure their fate. This card hints towards current and potential future real world examples of legislative alterations affecting digital corporations and users of digital services/devices. The General Data Protection Regulation Act of 2018<sup>56</sup> and Australia's News Media Bargaining Code currently under negotiation<sup>57</sup> are examples of what this in-game card implies. The game attempts to make these widely affecting changes towards stakeholders visible as these subtle interactions between players and the game feed into the grander rhetoric of interconnectivity and the notion of constellations in IoT. A variety of these situations are explored between the 36 cards present in the *Risk Deck* each a unique metaphorism pertinent to IoT usage.

56 For more information, see: SCHULZ, M., HENNIS-PLASSCHAERT, J. A.: Regulations. In *Official Journal of the European Union*, 2016, Vol. 65, No. 119, p. 1-88. [online]. [2021-05-28]. Available at: <<https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32016R0679>>.

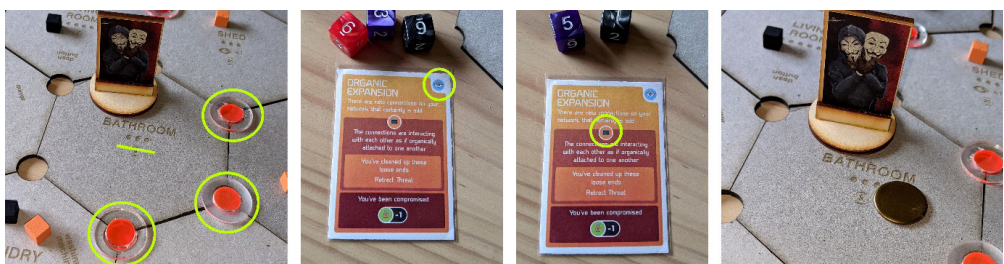
57 For more information, see: *News Media Bargaining Code*. [online]. [2021-05-28]. Available at: <<https://www.accc.gov.au/focus-areas/digital-platforms/news-media-bargaining-code>>.



# Metaphorism Level 3: The Digital Layer

The final level emerges from the assemblage of all the different mechanics working together in play. From being able to visualise the constellations to the story telling element present within the cards, the game hints towards two things: the fallacy of considering an IoT system capable of being made permanently secure, and the presence of a digital layer atop the physical world. Both notions coming from the paratextuality of the games referenced world, the real-world of networked devices that comprise of the IoT. This is perhaps best understood when looking at cards in the *Privacy Deck*. As the objective of the game is for players to secure a number of spaces by acquiring golden *Databox*<sup>58</sup> tokens, players are only capable of doing this by successfully navigating cards from this separate deck. Once a tile's connection requirement is achieved a player can attempt to secure it by drawing a *Privacy Card*. These cards take on a similar vein to those from *Eldritch Horror* where they play out a story between the player and the game presented as a conditional loop which players must navigate through rolling successful dice according to the limitations defined by the cards. Aside from the technical expertise required to resolve such issues in the real-world, the game incorporates players assigned skills and cards allowing them to navigate these issues in a similar manner to real-world problem solving for IoT. The game explores the metaphorism in a broader manner through incorporating storytelling proudly in these cards.

For instance, the *Organic Expansion* card (Picture 9) begins by informing the player that there are new unrecognised connections on their network. They are instructed to roll a dice according to their *Observation* skill and then depending on the result they enter into the loop. The card further informs them that these connections are 'leaving traces' wherever they connect to further points in the network. After the player rolls again this time with a different dice count based on their characters *Coding* ability, they either are informed that they have cleaned the network of these false connections securing a *Databox* token or have been compromised and are now facing consequences.



Picture 9: Having successfully connected the space to its requirement, the player has opted to deploy a *Databox*. The card drawn has the player first roll for *Observation*, succeeding that they must then roll for *Coding*. The successful attempt gives the player the golden *Databox* token to secure the space

Source: own processing

58 Remark by the authors: As the game was designed from real world concerns around IoT and present research, many of the concepts present in the game have real world counterparts. The "Databox" concept by Mortier et al. is one such construct that made its way into the design of the game. It enables a unique ecology for exploiting personal data in privacy-preserving ways for IoT systems.; See also: MORTIER, R. et al.: Personal Data Management with the Databox. In YUKSEL, M., WOOD, T. (eds.): *Proceedings of 2016 ACM Workshop on Cloud-Assisted Networking*. New York : Association for Computing Machinery, 2016, p. 49-54.



Eldritch Horror execution of Lovecraft's concept of Carcosa and other worldliness is presented here acting as metaphors in the rhetoric of the game. Here, this story telling element informs the player of a hidden layer between themselves and their physical IoT devices; the digital layer. In this layer there are interactions occurring which they might not be aware of, feeding back into the concept of tiny ontologies coming from Level 2.

What is explored here as a post-phenomenological perception of technology feeding into the object-oriented philosophical research roots of the game.<sup>59</sup> P.-P. Verbeek and P. Kockelkoren's appropriation of the post-phenomenological argument around the perceptions of technology by humans as an 'embodiment of objects' are among their mediations of technology.<sup>60</sup> They view this through a lens of background relations or technological relations, that exist in our peripherals having become mundane through use. Think of the refrigerator humming away in the background, or the Google Nest keeping track of the time to regulate temperature. They require minimal interaction to fulfil their tasks existing in their digital realms parallel to our own. The game subtly touches upon the philosophy of a digital layer among us through cards such as *Sisyphus Syndrome* (Picture 10), *Redrum*, and *Curious Circuits* each discussing a post-anthropocentric perspective of IoT-enabled devices with either the devices taking on their own needs and/or opinions or provoking their existence.



Picture 10: Several cards from the Privacy Deck attempt to engage players in the philosophical discourse of more-than human-ness coming from the roots of this research

Source: own processing

# Discussion and Conclusion

Before beginning this discussion, it is important to point out that though this study highlights the game as one that informs players of the insecurities involved in IoT, the true effect of this metaphorism exercise may only be understood through play and many levels of understanding are lost in the translation to text. Although the level of understanding achieved of the underlying philosophy among players is of debate, as during play-testing players had mixed views as to how much of this metaphorism came through, the game acted as an excellent vehicle for visualising the constellation concept and some players familiar with the IoT lauded its accuracy to real world scenarios as there were moments

59 For more information, see: AKMAL, H. A., COULTON, P.: Using Heterotopias to Characterise Interactions in Physical/Digital Spaces. In STORNI, C., LEAHY, K., McMAHON, M., LLOYD, P., BOHEMIA, E. (eds.): *Proceedings of DRS 2018: Design as a catalyst for change*. London : Design Research Society, 2018, p. 269-278.

60 VERBEEK, P.-P., KOCKELKOREN, P.: The Things that Matter. In *Design Issues*, 1998, Vol. 14, No. 3, p. 39.

where connections became very apparent. For example, describing the different connections as they played – such as connecting the *Living Room* to the *Garden* with a *Toothbrush* – it helped some imagine the premise of the game further. However, to situate this success with producing a sense of more-than-humanness not all players fully appreciated was an underlying concept.

To most players it was a board game that helped them 'see' the digital layer connecting them and their physical IoT devices. It informed them of the insecurities and concerns relating to these devices in what many considered a negative way. This was not the original purpose of the game at least not for the initial iterations. The rhetoric insecurity and the carrying of this paratextuality of IoT through the game became a necessity half-way through iterations as the design processes revealed the game was difficult to understand without it. Having said that, this is still an acceptable outcome as the game's intention is for players to take back a lesson of the need to be vigilant when managing their digital devices and services. The understanding of vigilance might be different, with the original intention more geared towards enlightening one of the designed actions/intentions of their smart devices as opposed to 'these devices are dangerous, because they are insecure'. On a core level players were associating the narrative of the game with their own lives raising concerns around how much of the game's concepts were possible to affect them.

Translating the effectiveness of philosophical rhetoric is difficult to measure, with most players taking the philosophy at face value and disregarding it as an interesting aside. From those that did engage it was not enough to produce deep philosophical questions about their relationship to things. In the end, the game managed to at once bring some players closer to an understanding of IoT but for others it also served to isolate them from considering the real-world consequences, as these players were tackling it for the satisfaction of a strategy game having forgotten about IoT in the process of play. From a post-phenomenological perspective R. Rosenberger and P.-P. Verbeek give the example of an adapter often found with digital devices.<sup>61</sup> In a Heideggerian sensibility it is when the adapter breaks that we are aware of its presence. They argue that the broken adapter effectively withdraws us from the world we inhabit with it because our collective involvement comes from its functional nature. Our relationship with the adapter is not as an object of meaning but resides in functional fulfilment. These technological objects are not asking for engagement as they are not designed to. He compares this to an example of a piano. The piano's existence is predicated around the music it can emit. It has no direct relation to that around it, but rather it is through the act of playing the piano that it becomes what it is mediating our relationship with the world it exists in:

"Rather than thinking in terms of alienation, it [post-phenomenology] thinks in terms of mediation. Science and technology help to shape our relations to the world, rather than merely distancing us from it. This perspective of mediation embodies a reinterpretation of the foundations of phenomenology. It does not see phenomenology as a method to describe the world, but as understanding the relations between human beings and their world".<sup>62</sup> The game's carpentered usage of phenomenological constructs through metaphorism alludes towards the relationship between humans and technology. Design methodologies such as HCD are employed to make technology such as AI and IoT perform as if they are subject to human-users' values and considerations. An unwarranted expectation of non-human entities that MthCD perspectives towards design attempt to address. The board game does this through playful enactment and appropriation of real-world

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61 ROSENBERGER, R., VERBEEK, P.-P.: A Field Guide to Postphenomenology. In ROSENBERGER, R., VERBEEK, P.-P. (eds.): *Postphenomenological Investigations: Essays on Human-Technology Relations*. Lanham : Lexington Books, 2015, p. 40.

62 Ibidem, p. 11.

contemporary technological concerns. Many of the instances of connecting devices and services within the physical location of the game appear as unorthodox pairings of objects and spaces which during established human-centred design and analysis approaches might be disregarded but subsequently prove equally hazardous. Vulnerabilities in the network may emerge from an IoT-enabled spoon in the tree house causing havoc in the study, with storytelling further fuelling the whimsical nature of play.

The mentioning of *Clippy* at the start of this was intended to point towards this use of playfulness and metaphor within the board game. In his book D. Rose discusses of his 'Enchanted Objects' a series of Internet connected devices designed with the intention of infusing wonder within their users, in effect becoming extraordinary objects.<sup>63</sup> These enchanted objects come as umbrellas inspired by Bilbo Baggins' magical sword 'Sting' from *The Hobbit* that glows when it's going to rain, pill dispensers that inform you of when to take medication, and jackets that inflate simulating hugs as their wearer receives likes on Facebook. These playful appropriations enact a kind of metaphorism as well (a like to a hug, and glow to rain) which often mask the reality of those operating the platforms on which they reside. The board game created attempts to use the enchantment of metaphorism through play to challenge the notion or perceiving IoT products and services as enchanted highlighting a need for a design perspective incorporating MTHCD. The efficacy, of course debatable, this works none-the-less presenting an avenue for imagining what MTHCD and game design perspectives could entail, and how they might be used to challenge more established human centred approaches.

## BIBLIOGRAPHY

- AKMAL, H. A., COULTON, P.: A Tarot of Things: A Supernatural Approach to Designing for IoT. In BOESS, S., CHEUNG, M., CAIN, R. (eds.): *Proceedings of DRS 2020 Synergy*. London : Design Research Society, 2020, p. 2377-2391.
- AKMAL, H. A., COULTON, P.: Research through Board Game Design. In *Proceedings of RTD 2019 Method & Critique*. Rotterdam, Delft : Science Center, Het Nieuwe Instituut, 2019, p. 1-16.
- AKMAL, H. A., COULTON, P.: The Internet of Things Game: Illuminating Data Interactions within the Internet of Things. In *Proceedings of Living in the Internet of Things*. London : Institution of Engineering and Technology, 2019, p. 1-5.
- AKMAL, H. A., COULTON, P.: Using Heterotopias to Characterise Interactions in Physical/Digital Spaces. In STORNI, C., LEAHY, K., McMAHON, M., LLOYD, P., BOHEMIA, E. (eds.): *Proceedings of DRS 2018: Design as a catalyst for change*. London : Design Research Society, 2018, p. 269-278.
- ASTOR, M.: *Your Roomba May Be Mapping Your Home, Collecting Data that Could Be Shared*. Released on 25<sup>th</sup> July 2017. [online]. [2021-05-19]. Available at: <<https://www.nytimes.com/2017/07/25/technology/roomba-irobot-data-privacy.html>>.
- BOGOST, I.: *Alien Phenomenology, or, What It's Like to Be a Thing*. Minneapolis : University of Minnesota Press, 2012.
- BOGOST, I.: *How to Do Things with Videogames*. Minneapolis : University of Minnesota Press, 2011.
- BOOTH, P.: *Game Play: Paratextuality in Contemporary Board Games*. New York : Bloomsbury Publishing, 2015.
- BOSSA STUDIOS: *I Am Bread*. [digital game]. London : Bossa Studios, 2015.
- COSTIKYAN, G.: Boardgame Aesthetics. In CONSTIKYAN, G., DAVIDSON, D. (eds.): *Tabletop: Analog Game Design*. Pittsburgh : ETC Press, 2018, p. 179-184.

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63 See also: ROSE, D.: *Enchanted Objects: Innovation, Design, and the Future of Technology*. New York : Scribner, 2014.

COULTON, P., LINDLEY, J. G.: More-Than Human Centred Design. In *The Design Journal*, 2019, Vol. 22, No. 4, p. 463-481. ISSN 1460-6925. [online]. [2021-03-08]. Available at: <<https://www.tandfonline.com/doi/full/10.1080/14606925.2019.1614320>>.

FRICTIONAL GAMES: *Soma*. [digital game]. Malmö : Frictional Games, 2015.

GALLOWAY, A.: Creative Ethnography after Human Exceptionalism. In HJORTH, L., HORST, H., GALLOWAY, A., BELL, G. (eds.): *The Routledge Companion to Digital Ethnography*. New York : Routledge, 2017, p. 470-477.

GEE, J. P.: Video Games and Embodiment. In *Games and Culture*, 2008, Vol. 3, No. 3-4, p. 253-263. ISSN 1555-4120.

GRADINAR, A. et al.: *The Little Book of the Internet of Things for the Home*. Lancaster : Lancaster University, 2019.

GREENFIELD, A.: *Everywhere: The Dawning Age of Ubiquitous Computing*. Berkeley : New Riders, 2006.

GUALENI, S.: *Virtual Worlds as Philosophical Tools: How to Philosophize with a Digital Hammer*. London : Springer, 2015.

HARMAN, G.: *Object-Oriented Ontology: A New Theory of Everything*. London : Pelican Books, 2018.

HARMAN, G.: *The Quadruple Object*. Alresford : Zero Books, 2011.

HOUSE HOUSE: *Untitled Goose Game*. [digital game]. Portland : Panic, 2019.

LAW, B.: Puzzle Games: A Metaphor for Computational Thinking. In CONNOLLY, T. et al. (eds.): *Proceedings of European Conference on Game Based Learning*. Kidmore End : Academic Conferences Ltd., 2016, p. 344-353.

LINDLEY, J., AKMAL, H. A., COULTON, P.: Design Research and Object-Oriented Ontology. In *Open Philosophy*, Vol. 3, No. 1, 2020, p. 11-41. ISSN 2543-8875. [online]. [2021-03-08]. Available at: <<https://www.degruyter.com/document/doi/10.1515/opphil-2020-0002/html>>.

LINDLEY, J. G., COULTON, P.: On the Internet Everybody Knows You're a Whatchamacallit (or a Thing). In MARK, G., FUSSELL, S. (eds.): *Proceedings of CHI 2017 Conference on Human Factors in Computing Systems*. New York : Association for Computing Machinery, 2017, p. 1-5.

LINDLEY, J. G., COULTON, P., AKMAL, H. A.: Turning Philosophy with a Speculative Lathe: Object Oriented Ontology, Carpentry, and Design Fiction. In STORNI, C., LEAHY, K., McMAHON, M., LLOYD, P., BOHEMIA, E. (eds.): *Proceedings of DRS2018 Limerick*. London : Design Research Society, 2018, 229-243.

LINDLEY, J. G., COULTON, P., COOPER, R.: Why the Internet of Things Needs Object Orientated Ontology. In *The Design Journal*, 2017, Vol. 20, No. 1, p. 2846-2857. ISSN 1460-6925. [online]. [2021-03-08]. Available at: <<https://www.tandfonline.com/doi/abs/10.1080/14606925.2017.1352796>>.

MELERO, J. et al.: Puzzle-Based Games as a Metaphor for Designing in Situ Learning Activities. In ESCUDEIRO, P. (ed.): *Proceedings of the 7<sup>th</sup> European Conference on Games Based Learning*. Kidmore End : Academic Conferences Ltd., 2013, p. 674-682.

MORTIER, R. et al.: Personal Data Management with the Databox. In YUKSEL, M., WOOD, T. (eds.): *Proceedings of 2016 ACM Workshop on Cloud-Assisted Networking*. New York : Association for Computing Machinery, 2016, p. 49-54.

MORTON, T.: *Realist Magic: Objects, Ontology, Causality*. Michigan : Open Humanities Press, 2013.

MÖRING, S.: *Games and Metaphor – A Critical Analysis of the Metaphor Discourse in Game Studies*. [Dissertation Thesis]. Copenhagen : IT University of Copenhagen, 2013.

News Media Bargaining Code. [online]. [2021-05-28]. Available at: <<https://www.accc.gov.au/focus-areas/digital-platforms/news-media-bargaining-code>>.

NORMAN, D.: *The Invisible Computer: Why Good Products Can Fail, the Personal Computer Is So Complex, and Information Appliances Are the Solution*. Cambridge : MIT Press, 1999.

ROSE, D.: *Enchanted Objects: Innovation, Design, and the Future of Technology*. New York : Scribner, 2014.

ROSENBERGER, R., VERBEEK, P.-P.: A Field Guide to Postphenomenology. In ROSENBERGER, R., VERBEEK, P.-P. (eds.): *Postphenomenological Investigations: Essays on Human-Technology Relations*. Lanham : Lexington Books, 2015, p. 9-41.

SCHULZ, M., HENNIS-PLASSCHAERT, J. A.: Regulations. In *Official Journal of the European Union*, 2016, Vol. 65, No. 119, p. 1-88. [online]. [2021-05-28]. Available at: <<https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32016R0679>>.

STATHIS, K., SERGOT, M.: Games as a Metaphor for Interactive Systems. In SAASE, M. A. et al. (eds.): *People and Computers XI*. London : Springer, 1996, p. 19-33.

*The Future of Clean Takes Shape with iRobot's Most Advanced Robot Vacuum and Mop*. [online]. [2021-03-31]. Available at: <<https://media.irobot.com/2019-05-29-The-Future-of-Clean-Takes-Shape-with-iRobots-Most-Advanced-Robot-Vacuum-and-Mop>>.

TSING, A. I.: *The Mushroom at the End of the World: On the Possibility of Life in Capitalist Ruins*. Princeton : Princeton University Press, 2015.

VAMOSI, R.: *When Gadgets Betray Us: The Dark Side of Our Infatuation with New Technologies*. New York : Basic Books, 2011.

VERBEEK, P.-P., KOCKELKOREN, P.: The Things that Matter. In *Design Issues*, 1998, Vol. 14, No. 3, p. 28-42. ISSN 0747-9360.

WEISER, M.: The Computer for the 21<sup>st</sup> Century. In *Scientific American*, 1991, Vol. 265, No. 3, p. 94-105. ISSN 1946-7087.

