Divergent Realities Across the Digital–Material Divide

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Abstract

This article utilises the example of Australia's social welfare agency 'Centrelink' and its Online Compliance Intervention (OCI) program to illustrate the process of digital translation and digital determinations of material reality. The article explains the digital translation process through the adaptation of various aspects of Charles Sanders Peirce's philosophy such as the triadic sign model, signification, fallibilism and synechism. Semiotics, or the 'study of meaning making', highlights the subjective nature of data analysis. A semiotic approach not only explains the differing realities of digital and material space and the lack of distinction between digital and material phenomena, but also provides further insight into algorithmic determinations of reality and the inherent limitations on our knowledge of digital or material reality. The same data can produce divergent realities within digital space and between the material and digital spaces. The article concludes that the design of algorithms, the nature of their representations and the outcomes they generate lack the complexity and nuance of reality, and disregards social influences on meaning and interpretation. As illustrated by the real-life failure of Centrelink's OCI, this article warns against interpreting the digital as an accurate rendering of the real.

Keywords: Digital translation; algorithms; reality; semiotics; digital–material divide.

1. Introduction

The all-pervasive nature of digital technology has resulted in a new world order where the digital space has become an increasingly important place of personal existence. Interpersonal relations are commonly conducted or facilitated through digital means, and while individuals feel personally involved and 'present' during these relations, the digital–material divide means that the material person cannot be *present* in the digital space. For online meetings and other bilateral communication and exchange of information, the difference between digital and material reality may be insignificant because the digital is a satisfactory substitute for the material. However, for many digital interactions, this substitution will be incomplete, biased or unsatisfactory. This is particularly problematic where translation occurs in the absence of the material person and without their knowledge. It is only through a process of 'translation' from the material to the digital that such interactions can occur. As digital translations symbolise or signify the physical person in digital space, semiotics (the origin, use and interpretation of signs and symbols)[1] provides a novel approach to the problems of digital space. Further, semiotics provides a new language through which we can re-examine the challenges of digital space.

This article considers the example of Australia's social welfare agency, Centrelink, and its Online Compliance Intervention (OCI) program. It also illustrates the process of translation from material to digital and digital determinations of material reality. By adapting the work of Charles Sanders Peirce, the article explains the digital translation process through Peirce's triadic sign model, signification, fallibilism and synechism. Section 2 uses Peirce's triadic model to explain how this translation occurs, and this is then adapted more specifically to the realities of digital space. In Section 3, Peirce's doctrine of synechism explains the differing realities of digital and material space and the lack of distinction between digital and material phenomena. Fallibilism provides further insight into algorithmic determinations of reality and the inherent limitations on or knowledge of digital or material reality. Section 4 examines the role of algorithms in material and digital determinations of reality and highlights their vulnerability to error. The article concludes by proposing that the digital space cannot accurately represent

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[1] Macquarie Library, Macquarie Dictionary.

materiality for several reasons. First, attempts to capture reality in digital space assume that the digital and material spheres can be treated as distinct. Our existence is not wholly contained within the material, and, likewise, our digital presence will have material influences. Second, digital space constrains interpretations to 'relevant' points of data and excludes collateral information that may also inform the interpretive process. Finally, the article shows the error in assuming data and data outcomes are objective. As a consequence, it argues for a more nuanced view of reality, one that acknowledges the limitations of translation and explains how and why society must avoid conflating digital and material realities.

2. Digital Translation

Digital translation refers to the process of rendering the material in digital form so that a material individual can have a presence in digital space. Therefore, digital translation produces a sign that represents the physical person and their relevant qualities, capacities or preferences. Semiotics refers to the study of signs but also to the study of 'anything which "stands for" something else'.[2] Ferdinand de Saussure and Peirce independently developed fundamental theories of semiotics at almost the same time.[3] Saussure introduced the terms 'signifier' and 'signified' in his *Course in General Linguistics*—the signifier in the form of sounds used to express the signified or related concept.[4] According to Saussure, the dyad of signifier and signified combined or interacted to produce a sign.[5] Many readers will be familiar with Saussure's 'signifier' as a 'graphic'[6] representation that denotes an object and the 'signified' as denoting the object itself. For Saussure, the arbitrary nature of linguistic signs, as well as their order and combination with other letters, enables sounds or letters of script to create all words and sounds that have come into existence as part of language.[7] In short, Saussure asserts that the signifier's versatility arises from a degree of arbitrariness in their *representation* of meaning.[8] This does not mean linguistic signs did not have connotative meaning, merely that *a priori* they have a degree of arbitrariness in form that is unrelated (in presentation) to their signifers,[9] regardless of any *a posteriori* connotations.[10] Many social semioticians have challenged this position, particularly in reference to digital data. They believe that all signs encode the ideological positions of their producers,[11] and that data speaks in response to the way it is 'animated, explained, offered and shared'.[12]

By contrast, Peirce's approach considered the logic of signs.[13] Peirce's signs, as 'something which stands to somebody for something in some respect or capacity',[14] are representative *because* of their connection with the object, be it through similarity,[15] affect or connection,[16] or conventions and habits.[17] Thus, Peircean signs are not arbitrary at all. Peirce's signs 'address somebody' and create an impression in the addressee's mind.[18]

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[2] Chandler, Semiotics, 2.

[3] Saussure's Course in General Linguistics is based on a series of lectures delivered between 1905 and 1911. The lectures were collated and published after his death; see Saussure, Course in General Linguistics, 13. Peirce was a prolific author who wrote on numerous topics from 1866 until 1913, followed by his death in 1914. His early lectures on signs are likely to have been composed around 1894 (see Peirce, The Essential Peirce, 5) but refined and presented as part of his Lowell Lectures in 1903 and further expanded upon until 1910 (see Atkin, 'Peirce's Theory of Signs').

[4] 'Signified' and 'signifier' are the commonly used English translations of *signifié* and *signifiant*, as used in Saussure's *Cours de linguistique générale*.

[5] Saussure, Course in General Linguistics, 98.

[6] Or auditory.

[7] Saussure, Course in General Linguistics, 100–101. For example, the sounds made when we say the word 'book'—or the letters 'b', 'o' and 'k'—have no direct link to the idea of a book. It is because of this lack of connection between the idea and the sounds required to communicate this idea ('b', 'ʊ', 'k', according to the International Phoenetic Alphabet) that these same sounds can be used in other configurations to represent multiple unrelated concepts, such as cities or varieties of birds. Saussure uses the example of 'sister' in Course in General Linguistics, 100. For example, the city, Brooklyn (ˈbrʊk lɪn), contains 'b', 'ʊ' and 'k' but is entirely unrelated to the word 'book' (bʊk). Likewise, see the bird species, Kookaburra (ˈkʊkəˌbaɹə').

[8] See Saussure, Cours de linguistique.

[9] Lévi-Strauss, Structural Anthropology, 91.

[10] Lévi-Strauss, Structural Anthropology, 91.

[11] For example, see Kress, "Against Arbitrariness," 174.

[12] Bolin, "Heuristics of the Algorithm," 4.

[13] Chandler, Semiotics, 3.

[14] Peirce, Collected Papers I, 135.

[15] Thus, falling into Peirce's category of 'icons'.

[16] Thus, falling into the category of 'indicies'.

[17] Classified as 'symbols'.

[18] Peirce, Collected Papers I, 135.

For Peirce, semiosis occurred as a result of three independent parts: the object, the representamen and the interpretant. As a whole, these three components create a sign (Figure 1).[19]
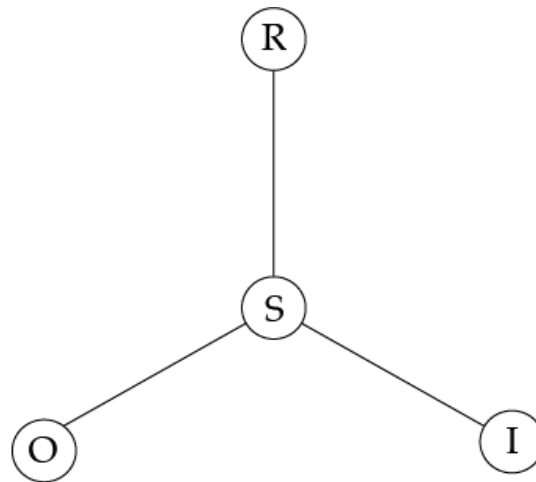
Figure 1. Peirce's triadic sign model

In this model, the sign (S) consists of the object (O) or concept of representation, the representamen (R) as its representative form, (e.g., appearance, sound, smell or other qualities) and the interpretant (I), which is the product of interpretation. Figure 1 shows that the three sign constituents—object, representamen and interpretant—each influence our understanding of a sign. One should note that Peirce used the term 'sign' when referring to all three constituents in his earlier writings.[20] However, from 1873, 'sign' and 'representamen' were often used interchangeably (and sometimes also referred to as the 'representation').[21] As this article considers the digital translation's capacity to capture material reality, it refers to the object—that which is embodied in material space—as 'reality', and the digital translates as 'representamen'.

A sign's meaning is shaped by the representamen used, the object it represents, and the impression it creates. The representamen stands for the object 'not in all respects, but in reference to a sort of idea'.[22] This idea is 'the *ground* of the representamen'.[23] The sign is merely a symbol that stands for the object, its concept and its associated ideas. However, the interpretant is especially key to Peirce's model of meaning making. The interpretant is the net result of interpretation *in this instance*. Nonetheless, this interpretant is no closer to the reality of the object itself. Instead, the interpretant is merely another representamen primed for further interpretation.[24] This is the key to meaning making and something that sets Peirce's theory apart from Saussure's—the recognition that a sign, regardless of convention, may bring innumerable ideas or objects to mind.

Unlike Saussure's model, the interplay between Peirce's *object* and *interpretant* recognises that the *meaning* generated by a sign will, in many instances, depend on its interpretation. This article adopts the term 'digital translation' instead of 'semiosis' or 'signification' when dealing with the representation of the physical person into digital space. The term 'translation' is chosen to indicate that the representation of an individual in digital space also involves the conversion of a materially embodied concept into a digitally recognisable form.

Peirce recognised the importance of the impression created as part of the signification process. According to Lars Elleström it is this third sign constituent beyond Saussure's signifier and signified 'that creates novelty'[25] by recognising the creation of

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[19] Peirce, Collected Papers I, 135.

[20] Elleström, "Material and Mental Representation," 10.

[21] Nöoth, as cited in Elleström, "Material and Mental Representation," 9.

[22] Elleström, "Material and Mental Representation," 17.

[23] Elleström, "Material and Mental Representation," 17.

[24] Peirce, Collected Papers I, 137.

[25] Elleström, "Material and Mental Representation," 13.

new 'mental content' as part of the interpretive process.[26] However, it is also essential—particularly when considering the digital translation of materialilty—that we recognise the importance of the object itself. It is the distinction between the representamen (what is shown) and the interpretant (the interpretation or meaning derived from it) that makes Peirce's triad so valuable when considering the semiotics of material reality and its representation within digital space. As such, digital translation cannot and should not be relied on to capture reality.

In 2016, Centrelink implemented a new OCI program to detect disprepancies between the declared income and taxable income of welfare receipients.[27] Centrelink is an Australian Government entity that delivers social security payments and services to Australians. The OCI relied on the collation and comparison of select digital data to create a digital translation of the material individual. In this case, the annual income of a human social security recipient became a representamen for individuals as part of an automated process for determining and recovering debts. The OCI process is considered in greater detail in Section 4. However, it is important to recognise that the outcome generated is not just an interpretant—that is, that the recipient (as object) *was* or *was no*t compliant with their reporting requirements. This outcome is also a representamen that precedes further determinations or actions by the OCI centred on a digitally based 'reality' about its material object.

A representamen may communicate an idea or object in various different ways and fall into three main categories of 'icon', 'index' and 'symbol'. First, an **icon** 'is a sign which refers to the object … it denotes merely by virtues of characters of its own, and which it possesses, just the same'.[28] Therefore, icons are based on a similarity or resemblance between the representamen and the object.[29] An icon stands for something merely through its resemblance to it.[30] Icons assert nothing:[31] they are merely a representation of the idea they represent that is recognisable as, or similar to, its object. Figures 1, 2, 3 and 4 are all *diagrammatic* icons, not due to a similarity 'in looks… [but in] respect to the relations of their parts' that a likeness will exist.[32]

Second, an **index** also asserts nothing[33] but 'denotes its object by virtue of being really affected by that object'.[34] This 'affect' (or connection) is key to indexical representamens. An index represents its object by being 'modified by them, as a clinical thermometer may represent a fever',[35] or as a symptom indicates an underlying disease.[36] The index as representamen—like smoke as an index of fire[37]—therefore, indicates the presence of its object by its connection with it and by forcing its object into the mind of the person it addresses.[38]

Third, a **symbol** represents its object through association, habit, convention, rule and law.[39] They are 'conventional sign[s]' that are associated with their object through a 'regulated habit that is shared by many individuals'.[40] While there is a 'sort of arbitrariness related to symbols', in that the relationship between the (symbol as) representamen and object is not always 'based on the intrinsic qualities of the representamen and object, it is … not the arbitrariness but … the *habit* … that generates signification'.[41] Just as a green traffic light symbolises permission to proceed while red demands desistance, a symbol is '*whatever may be found to realize the idea connected with the word*; it does not, in itself, identify those things.'[42]

Centrelink's OCI uses individuals' customer reference number (CRN) as an iconic representamen of a person. However, this example does not lend itself to a complete explanation of the representatmen or its various iterations. To fully appreciate the complexity of the representamen one must first look at a more universal example.

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[26] Elleström, "Material and Mental Representation," 13.

[27] For a more detailed discussion of the Online Compliance Intervention (OCI) process see Park, "Exclusion by Design," 949.

[28] Peirce, Collected Papers I, 143.

[29] Elleström, "Material and Mental Representation," 17.

[30] Elleström, "Material and Mental Representation," 17.

[31] Peirce, Collected Papers II, 165.

[32] Kralemann, "Models as Icons," 3406.

[33] Peirce, Collected Papers II, 165.

[34] Peirce, Collected Papers II, 142.

[35] Cited in Elleström, "Material and Mental Representation," 19. This precise quotation is problematic. Prima facie it would appear that the thermometer is the index. However, it is the digits on the thermometer that are an index, rather than the thermometer itself.

[36] Elleström, "Material and Mental Representation," 19.

[37] Peirce, Collected Papers II, 162.

[38] For example, see Elleström, "Material and Mental Representation," 21.

[39] Elleström, "Material and Mental Representation," 21.

[40] Elleström, "Material and Mental Representation," 22.

[41] Elleström, "Material and Mental Representation," 23, emphasis added.

[42] Peirce, as cited in Elleström, "Material and Mental Representation," 23, emphasis added.

Imagine that a colleague, Bill, drives an ostentatious luxury car. One can interpret the presence of Bill's car in various ways—as an icon, an index and as a symbol:

- In the mornings, the absence or presence of Bill's car is an *indexical representation* of Bill's attendance at the office—a 'symptom' that indicates Bill's presence. The representamen (the presence of Bill's car) indicates that the object (Bill) is present.
- One may also interpret Bill's choice of car as a *symbolic representation* of wealth or perhaps even braggadocio. The car (as representamen) symbolises Bill's personal wealth and financial capacity. Thus, interpretants may induce further impressions of Bill (as object).
- Those who make this secondary connection of vehicle type and braggadocio may then think of Bill as wealthy or a braggart. In this instance, the car has become a metaphorical icon—where the viewer may see a similarity in the semiotic qualities of the car (as representamen) and Bill (as object).[43] Peirce referred to this feedback as a series of 'successive interpretants' with each interpretation building on its predecessors.[44]

In this example, the interpretants induced may be correct, but they may not always be true. Those who know Bill in person have the opportunity to revisit the interpretation process and take into account other collateral information to inform their understanding of the representamen. Dealings that occur in material space allow the freedom to revise the interpretation based on information other than the representamen itself. Collateral information may suggest that while Bill's car is ostentatious, resulting assumptions of wealth or arrogance are entirely unfounded.

In digital space, representamen (e.g., whether they are pictures [icons], signals [indexes] or logos [symbols]) are commonly divorced from their original context. Thus, digital interpretants are based solely on the representamen (and measures such as algorithms) without similar opportunities for review. As governments become increasingly reliant on data and algorithmic determinations (rather than personal review),[45] government agencies have increasing access to information about an individual's family members and health, as well as the products and services they purchase or consume.[46] Bill's car is likely to be flagged a luxury item by some private and public entities and construed as a possible indicator of wealth. If Bill's car needs repair, these purchases will include parts and service for his luxury vehicle and may further confirm the misinterpretation that Bill is wealthy. Perceptions of wealth may limit Bill's eligibility for certain services such as financial assistance or categorise him as a likely purchaser of other high-end goods, making him more likely to purchase these goods in future.[47] This is not to say that all interpretants based on material interactions are infallible, merely that the digital medium may complicate findings of reality beyond those encountered in material space. Therefore, one must consider reality in Peircean terms before looking more precisely at reality in digital space.

3.　Reality and What is Real

Unsurprisingly semioticians and, therefore, those who study signification or 'meaning creation'[48] are likely to struggle when asked 'to give an abstract definition of the real'.[49] Peirce suggests that the 'external reality' of an object are those characters that 'are independent of how you or I think'.[50] Consequently, one *may* 'define the real as that whose characters are independent of what anybody may think them to be'.[51] However, this does not 'make the idea of reality clear'.[52] For Peirce, the role of the interpretant is critical to meaning making. As Elleström says, 'the interpretant is about making sense: it is a mental phenomenon, with an emphasis on cognition.'[53] According to Peirce, 'the only effect which real things have is to cause belief … which they

[43] Kralemann, "Models as Icons," 3408.

[44] Peirce, Collected Papers II, 169.

[45] Cate, "Government Data Mining," 440.

[46] Cate, "Government Data Mining," 441.

[47] See also Englezos, "Forget Consent."

[48] Elleström, "Material and Mental Representation," 4.

[49] Peirce, "Ideas Clear," 298.

[50] Peirce, "Ideas Clear," 298.

[51] Peirce, "Ideas Clear," 298.

[52] Peirce, "Ideas Clear," 298.

[53] Elleström, "Material and Mental Representation," 8.

excite … into consciousness in the form of beliefs'.[54] As a consequence, the important question becomes whether the belief is true or false.[55] Thus, Peirce shows that the *real* may not be always be the *truth*.

Truth extends beyond merely that which we believe to be real. Truth is 'the opinion which is fated to be ultimately agreed to by all who investigate', while 'the object represented in this opinion is the real'.[56] Returning to the aforementioned example, the presence of Bill's car may be an indexical representation of Bill's presence in the majority of instances. However, if Bill falls ill and sends his partner to collect files from Bill's office, the presence of Bill's car is no less real. Regardless, the truth remains that in this instance, the car is not an indexical representation of Bill's *personal* presence at the office. Likewise, those who consider Bill's vehicle as a sign of wealth may correctly interpret the car as having required a significant amount of money to obtain. However, the interpretation that the car is expensive may reflect the reality of the car's cost but may not be a true representation of Bill's financial capacity, wealth or braggadocio. Likewise, the digital representamen created by Centrelink's OCI may produce an interpretant that detects a discrepancy between declared and annual income and require repayment of welfare payments. Regardless of form, the implementation of decisions that involve select information but exclude other relevant materials such as context or collateral information assumes such determinations are infallible.

According to Joseph Margolis, Peirce's doctrine of fallibilism is commonly underdeveloped and misapplied in academic discussion.[57] Margolis asserts that fallibilism should be considered the 'linchpin' of Peirce's philosophy.[58] To Peirce, fallibilism is the doctrine that 'our knowledge is never absolute but … swims … in a continuum of uncertainty and … indeterminacy'.[59] Fallibilism stands in sharp contrast to the belief 'that law or truth [can find] its last and perfect formulation'.[60] Instead, Peirce argues that we can never 'be absolutely certain that our conclusions are even approximately true'.[61]

However, to relegate an interpretation to the realm of 'correct' or 'incorrect' would be to neglect Peirce's doctrine of synechism. The term 'synechism' came from Ancient Greek and the concept of *synechismos* or 'how things are "held together" '.[62] Thus, synechism is a 'tendency of philosophical thought which insists upon the idea of continuity as of prime importance'.[63] Instead of categorising or distinguishing one from the other, a synechist looks for the underlying continuity—a form of 'perfect generality'[64]—through which complex relations become comprehensible.[65] Instead of the dualist approach that separates different outcomes into different groups—positive or negative, good or bad, fast or slow—synechists argue that these 'supposed differences of kind are … only significant differences of degree'.[66] Perhaps the most noteworthy outcome of such an approach is the lack of clear differentiation between mental and physical (or, in Peircean terms, 'psychical' and 'physical').[67] Again, the difference between mental and physical may only be one of degree, with some 'physical' objects having more materiality than those that are 'mental' or metaphysical.[68] The same argument follows when one considers the digital and material divide. The distinction between the two is not as arbitrary as 'in person' or 'through digital means', as the extension of the material person into the digital space and vice versa is similarly a 'difference of degree' in materiality.

It is this (in)distinction in reality that gives Peirce's semiotic theory added relevance to our new dealings and existence within, across and without digital space. The physical and material person cannot exist in the immaterial digital space. Within digital space, the *ground* (or 'true nature') of the person may not be relevant to the purpose of signification. Instead, the object—such as income and expenditure—may be all that is 'relevant'. Thus, digital space adds another meaningful layer to the perception of a material person, one that may be treated as entirely separate yet remains inextricably linked with the person in physical space. Figure 2 updates Peirce's model to incorporate the digital space.

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[54] Peirce, "Ideas Clear," 298.
[55] Peirce, "Ideas Clear," 298.
[56] Peirce, "Ideas Clear," 300.
[57] Margolis, "Peirce's Fallibilism," 535–536.
[58] Margolis, "Peirce's Fallibilism," 535.
[59] Peirce, Collected Papers I, 70.
[60] Peirce, Collected Papers I, 58.
[61] Peirce, Collected Papers I, 58.
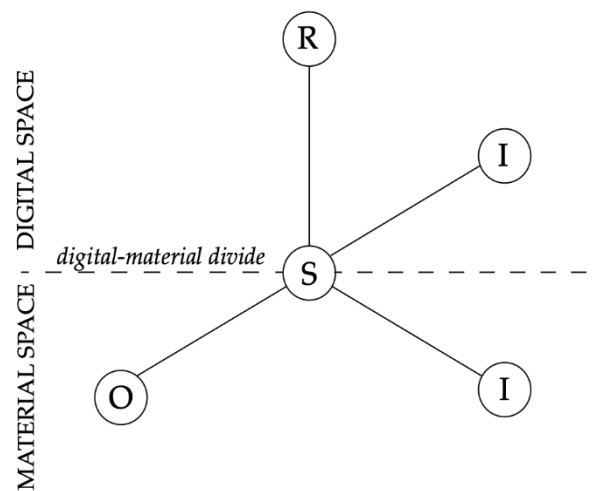[62] Hall, "Continuity and Consciousness," 350.
[63] Haack, "Synechism," 240.
[64] Haack, "Synechism," 241.
[65] Haack, "Synechism," 241.
[66] Haack, "Synechism," 240.
[67] Hall, "Continuity and Consciousness," 351; Peirce, Collected Papers VII, 345.
[68] Hall, "Continuity and Consciousness," 351; see also Calcaterra, "Varieties of Synechism," 415.

Figure 2. Peirce's triadic sign model and in digital and material space

In Figure 2, Peirce's triad remains intact despite introducing the digital and physical divide and the distinct areas of physical and digital space. There is one critical difference. Digital translation may produce one (initial) representamen only in digital space. However, interpretants may follow in both the digital and physical space. For example, take Bill's physical address as a representamen used in digital space. A possible digital interpretant could be the inclusion of Bill on a digital mailing list for his local branch of a particular store. Bill will then receive emails advising him of instore specials and at a store allocated to him through the use of his address (as representamen). A possible material interpretant could be his categorisation as a resident of Beach Shire. As such, Bill will receive council services from the Beach Shire Council, regardless of whether he prefers those offered by River Shire or another neighbouring council. The outcomes may or may not be trivial, but they will follow his digital representamen in both the digital and material space.

In digital space, the material person may have some control over their representamen. Avatars, profile pictures and carefully managed photographic representations or digital manipulations of the published image provides for some curation of the digital self. However, the material person has no such control over their resulting interpretant. Many representamen will be produced without human involvement and through the actions of algorithms. In digital space, algorithms also determine the interpretant, which is then open to further interpretation ad infinitum.[69] In dealings with the data of identifiable persons, limitations constrain the successful application of algorithms in digital space, but may not occur in material space. Section 4 considers the role of algorithms in digital translation before explaining the effect of these limitations on an algorithm's ability to faithfully represent the material individual.

4.   The Role of Algorithms

The preceding sections considered reality and the process of digital translation. Digital translation was positioned as an event that occurs without an opportunity to test the accuracy of these determinations. Algorithms play a significant role in digital translation and its outcomes, and these decisions often enjoy the assumption that they are fair, objective[70] or reliable. This section now examines the operation of algorithms. Peirce's doctrine of fallibilism offers critical insight into our presumptions based on probability and reveals a great shortcoming in algorithmic models. The reliance on probability and reasoning to predict future outcomes means that our presumptions are likely to be correct *until* we find otherwise.[71] However, those decisions based on erroneous presumptions are not subjected to automated correction.

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[69] Peirce, Collected Papers I, 137.

[70] Kroll, "Accountable Algorithms," 680.

[71] Peirce, Collected Papers I, 64.

Algorithms inform automated decision-making by using select data to classify the physical person according to particular groups (relative to others). Algorithms often use probability theory to translate individuals into digital representamen, which can subsequently generate predictive interpretants for qualities as varied as employability,[72] mental stability[73] or viewing preferences.[74] The outcomes will have further consequences for individuals. Despite their effect, automated decisions occur without a person's knowledge.

As Peirce notes, 'we cannot be … certain that our conclusions are even approximately true [as in real]'.[75] Thus, probability and reasoning depend on the presumption that one can '[judge] the proportion of something in a whole collection by the proportion found in an example'.[76] This presumption assumes that the samples in which we identify a particular truth, reality or tendency are representative of the whole, and ignores that any sample will consist of 'but a finite number of instances and [will only admit] special values of the proportion sought'.[77] This approach supposes that 'what we haven't examined is like what we have … that [the laws of the universe] are absolute, and the whole universe is a boundless machine working by the … laws of mechanics'.[78] However, this approach denies the role of human consciousness in human outcomes,[79] relegating us to 'like results under like circumstances'.[80] Peirce cites natural diversity and spontaneity as proof that no matter how often a rule applies, no rule or principle is infallible.[81]

Unfortunately, algorithms are particularly vulnerable to bias. The presumption of infallibility also introduces further error and bias into algorithmic models by relying on the presumption that things stay the same and are unlikely to change. The assumption of stasis is especially problematic where the prioritisation of specific datasets or other subjective components of the algorithm are already predisposed to biased results. Not only does such an approach exclude spontaneity and diversity, but also its effect can be heightened or mitigated by the algorithm's preference for data from narrow or broad subsets. Figure 3 offers a detailed schematic of the role of algorithms in digital translation. By determining the appearance of the representamen, or prescribing the interpretant, algorithms can shape future reality. Indeed, they also have the potential to defy it.

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[72] For example, see Kiviat, 'Deciding with Data', which discusses the practice of employers reviewing applicants' credit ratings during the application process. Applicants with poor credit ratings are considered less 'employable'.

[73] For example, see Hull, "Successful Failure," where the author considers some of the more unforeseeable uses of data. Hull states that certain algorithms will consider those who, like the Japanese cat cartoon 'Hello Kitty', are likely to be 'less conscientious' and more 'emotionally unstable' than those who do not.

[74] See Hallinan, "Algorithmic Culture," which considers the algorithmic development of Netflix's recommender system.

[75] Peirce, Collected Papers I, 58.

[76] Peirce, Collected Papers I, 58.
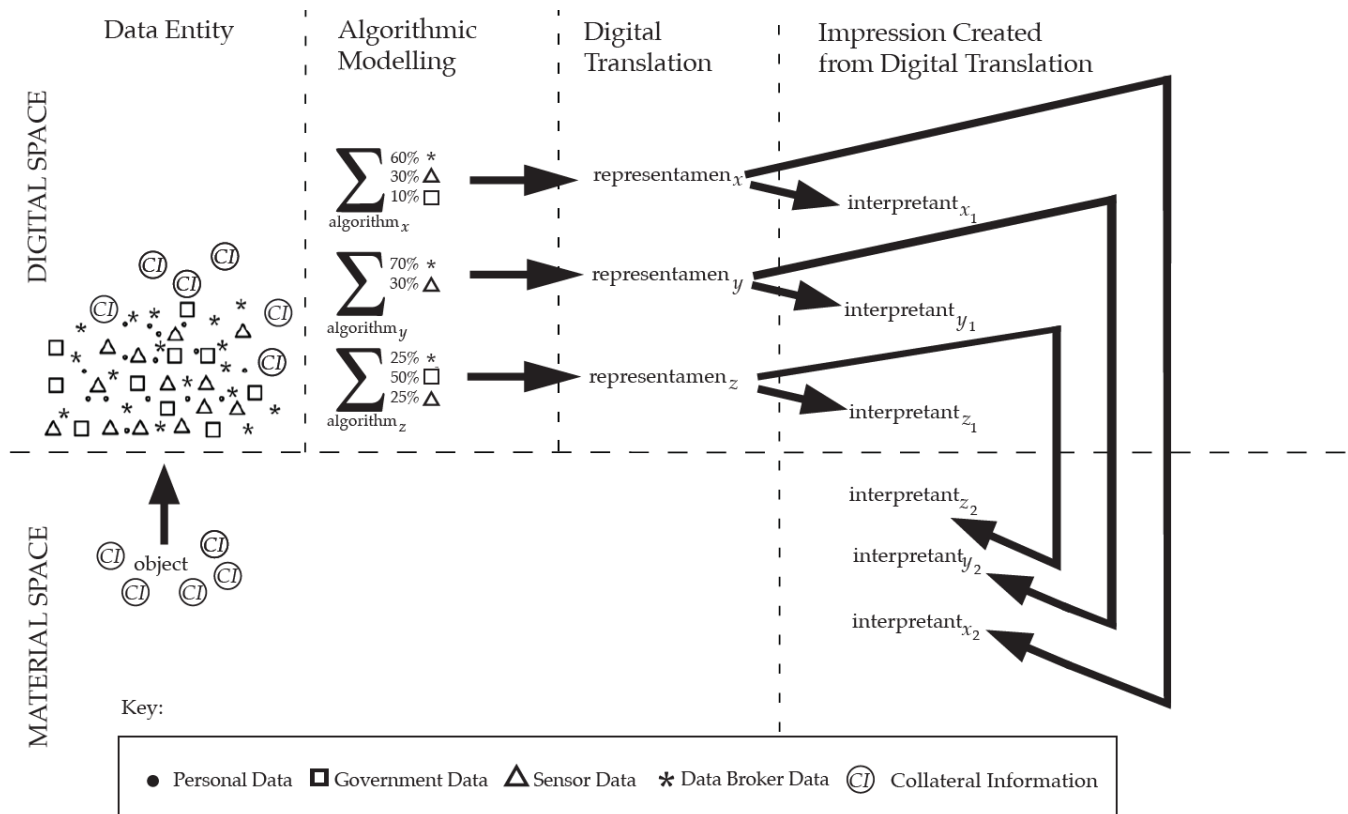
[77] Peirce, Collected Papers I, 58.

[78] Peirce, Collected Papers I, 66.

[79] Peirce, Collected Papers I, 66.

[80] Peirce, Collected Papers I, 66.

[81] Calcaterra, "Varieties of Synechism," 415–416.

Figure 3. The role of algorithms in digital translation

As shown in Figures 1 and 2, the material person (referred to as the *object*) exists in material space. The material and digital spaces are separated by the material–digital divide, and this allows the exchange of data and information between the two spaces. In the digital space, the object's digital data will coalesce to form a data entity, which will contain all of the available data about the object regardless of temporality, origin or format. The data entity will also include collateral information that can otherwise inform interpretation. In other words, not only is the data without context, but also a proportion of the relevant data may be out of date, inaccessible or unreadable. The data entity is merely an archive of available data about the individual. Data is included within the data entity regardless of its reliability.

The diagram in Figure 3 depicts four different types of data. Personal data (●) refers to data consciously uploaded into the digital space by a physical person. Often, personal data is more indicative of the aspirational self than reality and can give an impression different from the other sources of data included in this diagram. Government data (□) refers to data sourced through government channels. This subset of data may be more related to the individual demographics of the object. Government data may also be more (or possibly less) reliable than other sources depending on the context. Sensor data (△) refers to data uploaded by passive means. Common sources of passive data are smart watches, mobile phones and other Internet of Things devices such as smart televisions or refrigerators. This data is likely to be more challenging to fabricate than personal data but not infallible. Next, data produced by 'data brokers' (*) refers to the outputs of data-mining practices. In this instance, the term 'mining' is potentially misleading. It presumes that mined data exists in its available form without intervention or manipulation and is merely awaiting discovery. 'Mining' does not acknowledge that such data is typically the result of prior algorithmic processes (and, therefore, new interpretations).[82] Depending on the purpose of translation, different algorithms are likely to prefer different combinations and proportions of data available from numerous different data sources. Finally, exposure to collateral information (CI) provides further opportunities to identify misinterpretations or miscategorisation. The exclusion of collateral information is a crucial difference between material and digital space. In material space, one can passively receive collateral information that provides context or qualifies available data, while algorithms only consider actively selected data.

Figure 3 illustrates the use of three different algorithms and the selection of data from the data entity to generate a representamen of the physical person. Algorithm x prioritises data from data brokers (*), selecting 60% of its total dataset from data broker

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[82] For example, see Sadowski, "When Data is Capital," 2.

sources, supplementing it with sensor data ($\triangle$) and a small amount of government-sourced data ($\square$). Algorithm *y* exhibits a similar preference for data broker (*) and sensor data ($\triangle$) but disregards government data completely. Algorithm *z* prioritises government data ($\square$) above data broker data (*) and sensor data (*) sources. All three algorithms exclude personal data ($\bullet$) from their determinations.

Additionally, each of these algorithms prefers third-party data to data provided by the object about themselves. However, by excluding personal data, more nuanced aspects of the physical person and their identity are ignored. Each of these algorithms will then produce a representamen (representamen x, *y* and *z*). On interpretation, the representamen will create outcomes in the digital space, which are interpretant x_1, y_1 and z_1. However, the effect of these algorithms may not be limited to the digital space. Interpretant x_2, y_2 and z_2 depict potential for outcomes within the material space. Figure 3 highlights the first of three fundamental limitations considered in this article—prioritisation. By prioritising specific data over others, algorithms may exclude some relevant subsets of data entirely or rely too heavily on data that misrepresents an individual.

The second limitation—subjectivity—results from the need for human input to inform initial determinations of probability. Bayes' theorem is one such example that relies on a subjectively determined value to define the likelihood of a particular event.[83] Bayes' theorem can be used to predict the likelihood of an event given an associated variable. A simple example is the likelihood that drivers of luxury cars have high disposable income. Another commonly used method is the 'known nearest neighbour' (k-NN) method. This is commonly used to categorise an object into particular subgroups, and is popular because of its efficiency and the ability for machine learning to continuously refine the accuracy (read, reproducibility) of the results.[84] The categorisation will then depend on two things—the way different data is labelled and categorised, and the boundaries of each 'neighbourhood'. Similarly, one's address and their neighbourhood of residence may indicate wealth, poverty or something in-between. However, first, the algorithm's designers would need to consign specific addresses into different socio-economic neighbourhoods or groups.[85] Mislabelled addresses that assign wealthy addresses to poorer neighbourhoods (or vice versa) will carry forward in an algorithm until identified and corrected. Such errors, while unintentional, will undermine the quality of the results. The k-NN method also relies on the creation of 'neighbourhoods' or categories for data allocation.[86] Categorisation, according to address, assumes all within the group have the same or similar circumstances. So, participants who live in share-house arrangements in desirable neighbourhoods are vulnerable to miscategorisation as a result. It is precisely this dualistic approach ('neighbourhood A' or 'not neighbourhood A'; 'neighbourhood B' or 'not neighbourhood B') that Peirce's doctrine of synechism seeks to avoid. Peirce refers to this as a cleaving of objects into 'unrelated chunks of being',[87] and asserts that such groups are not unrelated but in different positions along a continuum. The algorthmic labelling, catergorsation and application of data creates different outcomes that may not reflect reality.

Thus, algorithms play an influential role in 'meaning making' within digital space and produce subsequent outcomes in both the digital and material spaces. As mentioned, Centrelink's OCI offers a pertinent example of adverse outcomes and highlights the potential for misinterpretation when such determinations occur without proper oversight. In Australia, Centrelink administers the governmental welfare scheme of payments according to the legislated welfare entitlements, including unemployment benefits,[88] parenting allowances,[89] student assistance payments[90] and so on.[91] A key part of this scheme is the role of Centrelink in recovering overpayments as debts.[92]

Tax file numbers (TFNs), account numbers and Centrelink CRNs are digital symbols that represent the material person within digital space. Through the habit of association, these numbers stand in (as representamen) for the material person (object) during the decision-making process.[93] Thus, translation allows the representamen to (inter)act in the digital space independently of the material person. The representamen is an actor and, therefore, has the potential to cause significant material world outcomes for the material person. The material person has minimal or no input in the process. In the absence of collateral

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[83] Sarwar, "Collaborative Filtering," 180.

[84] Harrison, "Machine Learning."

[85] Kotliar refers to this categorisation as a 'resocialisation' based on 'communicative needs, and from inter-organizational factors, rather than from technological attempts to accurately depict users' identities': "Return of the Social," 1156.

[86] Sarwar, "Collaborative Filtering," 180.

[87] Calcaterra, "Varieties of Synechism," 415.

[88] *Social Security Act 1991* (Cth) pt 2.12; see Services Australia, 'JobSeeker Payment', for available payments for the unemployed.

[89] *Social Security Act 1991* (Cth) pt 2.10; see Services Australia, 'Payments for Families', for a list of payments available to families.

[90] *Social Security Act 1991* (Cth) pt 2.11; see Services Australia, 'Payments for Students and Trainees'.

[91] See generally Services Australia, 'Centrelink'.

[92] Social *Security Act 1991* (Cth), pt 5.2.

[93] Elleström, "Material and Mental Representation," 21.

information or the material person to make, correct or qualify these representamen, algorithms provide context-specific formulae to guide the digital translation process and its outcomes. These determinations can have far-reaching consequences, yet opportunities for 'oversight' or 'intervention' (if available) are retrospective at best.[94]

Centrelink's OCI process was adopted in 2016. The system, commonly known as 'Robodebt', set out to increase the detection of discrepancies between declared income and taxable income[95] from approximately 20,000 cases each year to 783,000.[96] Robodebt 'streamlined' the procedure by removing the need for departmental personnel to manually identify any discrepancies and in its place applied an algorithm to detect indebtedness.[97] Many of these 'discrepancies' affected casual workers by adopting a fortnightly income figure based on data from the Australian Taxation Office (ATO).[98] On identification of the discrepancy, recipients had 21 days to respond, with debt-recovery activities commencing once the time had elapsed.[99] Additionally, government departments, such as Centrelink, have greater power than other private entities to collect and enforce debts.[100] This is particularly the case for individuals currently receiving assistance from Centrelink, as debt recovery can commence without court action for enforcement.[101] Robodebt also reversed the onus of proof by deeming unchallenged debts as correct.[102] However, the process often over-calculated the debt as well as alleging debts where no such debt existed.[103]

The OCI initially matched declared income tax data from the ATO to records held by Centrelink.[104] In the event of a discrepancy, an automatically generated letter invited recipients to update their details through Centrelink's online portal.[105] This page estimated income based on the assumption that any income was earned evenly throughout the financial year.[106] Where the discrepancy remained unresolved, recipients were advised that they had been overpaid and a subsequent debt raised against them.[107] Some of the money recovered under the OCI was paid by those who had legitimately received their payments but did not challenge these determinations due to the difficulty and stress involved in such applications.[108] Figure 4 considers the OCI as it applies to two different Centrelink recipients.

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[94] For example, see the right to appeal a decision made by government bodies such as Centrelink, which can be raised for internal review by an authorised review officer or external review by application to the Administrative Appeals Tribunal or Federal Court (as stated in Economic Justice Australia, Appealing a Centrelink Decision, regarding claims for compensation and complaints).

[95] For a more detailed discussion of the OCI process see Park, "Exclusion by Design," 949.

[96] Park, "Exclusion by Design," 950.

[97] Park, "Excusion by Design,"

[98] Park, "Exclusion by Design," 960.

[99] Park, "Exclusion by Design," 950.

[100] Radcliffe, Social Welfare System Initiative, 93.

[101] Radcliffe, Social Welfare System Initiative, 93.

[102] Henman, "Algorithms, Apps and Advice," 71, 76.

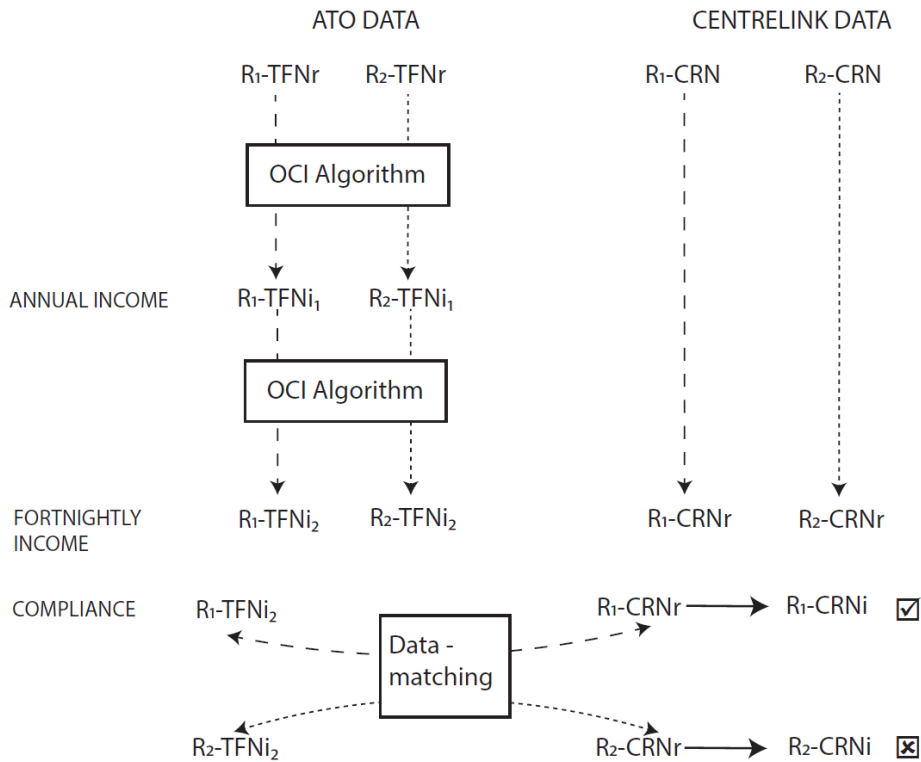[103] Henman, "Algorithms, Apps and Advice," 75.

[104] Radcliffe, Social Welfare System Initiative, 3.

[105] Radcliffe, Social Welfare System Initiative, 17.

[106] Radcliffe, Social Welfare System Initiative, 3.

[107] Radcliffe, Social Welfare System Initiative, 3.

[108] Radcliffe, Social Welfare System Initiative, 4.

ATO DATA CENTRELINK DATA

R₁-TFNr   R₂-TFNr   R₁-CRN   R₂-CRN

OCI Algorithm

ANNUAL INCOME   R₁-TFNi₁   R₂-TFNi₁

OCI Algorithm

FORTNIGHTLY INCOME   R₁-TFNi₂   R₂-TFNi₂   R₁-CRNr   R₂-CRNr

COMPLIANCE   R₁-TFNi₂   R₁-CRNr → R₁-CRNi ☑

Data - matching

R₂-TFNi₂   R₂-CRNr → R₂-CRNi ☒

Figure 4. Applying the OCI algorithm to assess Centrelink compliance based on ATO data and recipient declarations of income for a regular low income recipient (R₁) and a sporadic low-medium income recipient (R₂)

ATO: Australia Taxation Office; OCI: Online Compliance Intervention

Recipient 1 (R_1) had consistent employment and income throughout the relevant financial year. As shown in Figure 4, Recipient 2 (R_2) had sporadic casual employment only, but received a reasonable income during those periods of employment. The OCI algorithm began by reviewing the Centrelink CRNs of Recipient 1 (R_1-CRN) and Recipient 2 (R_2-CRN) and supplying their TFNs (R_1-TFN and R_2-TFN) to the ATO. Data linked to an individual's TFN was used as a representamen of each recipient (R_1-TFNr$_1$ and R_2-TFNr$_1$) and was evaluated by the OCI algorithm. ATO data is based on 'pay as you go' (PAYG) statements provided by employers for each financial year.[109] The ATO identified each recipient through their TFN and responded with their annual income amount for the relevant financial year. Thus, the OCI converted the representamen into the initial interpretants (R_1-TFNi$_1$ and R_2-TFNi$_1$, respectively). As R_1-TFNi$_1$ and R_2-TFNi$_1$ gave no indication of the period of employment,[110] the initial interpretants were based only on the total income earned in the relevant year. Moreover, R_1-TFNi$_1$ and R_2-TFNi$_1$ includes additional income sources such as investments and other data.[111]

Next, the OCI algorithm converted R_1-TFNi$_1$ and R_2-TFNi$_1$ to fortnightly income, creating the secondary interpretants R_1-TFNi$_2$ and R_2-TFNi$_2$. Thus, annual income was automatically applied as though this income were received evenly over the course of the year.[112] The OCI algorithm then used data matching to detect any discrepancies between ATO data estimates of fortnightly income (R_1-TFNi$_2$ and R_2-TFNi$_2$) and recipients' fortnightly income declared to Centrelink, as per their CRN (R_1-CRNr and R_2-CRNr).[113]

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[109] Radcliffe, Social Welfare System Initiative, 14.
[110] Radcliffe, Social Welfare System Initiative, 16.
[111] Radcliffe, Social Welfare System Initiative, 16.
[112] Radcliffe, Social Welfare System Initiative, 3.
[113] Radcliffe, Social Welfare System Initiative, 14.

As a consequence, the assumption that annual income was earned consistently throughout the financial year resulted in a TFN representamen (R_1-TFNi_2 and R_2-TFNi_2) that was inconsistent with R_1-CRNr and R_2-CRNr. Final interpretants, R_1-CRNi and R_2-CRNi, indicated whether recipients had complied with Centrelink requirements. As Figure 4 indicates, R_1-CRNi fulfilled these requirements, while R_2-CRNi was deemed noncompliant.

The presumption of a regular and consistent income had significant effect beyond those of Recipients 1 and 2. More than half of the total recipients received an inconsistent employment income during the relevant financial year.[114] Difficulty arose because while fortnightly income is critical to the determination of income support payments,[115] ATO data does not indicate periods of unemployment. More than half of the reviewed recipients had been unemployed for a proportion of the relevant financial year.[116] Prior to the OCI's implementation, a department officer would seek date-specific data in the event of discrepancy.[117] However, on the implementation of the OCI (from November 2016 onwards), the requirement for departmental review was removed.[118]

Centrelink's OCI implemented an algorithm that it presumed could accurately capture material reality based on digital data alone. The algorithm decided eligibility for payments and gave 'ineligible' individuals a 21-day period within which they could challenge this decision. The approach removed personal oversight and opportunities for the introduction and review of pertinent collateral information. While allowances for periods of unemployment may have improved the algorithm, it is not the decision-making by algorithms per se that is of concern. When appropriately designed and employed, recommendations and personalisation are highly valuable.[119] However, the automated application of algorithmic determinations and the consequent exclusion of the material person's input warrants further examination. Once the representamen becomes the actor within digital space, the material person has limited oversight, involvement or control over their appearance to third parties. The resulting interpretant (or outcome) can have a significant digital and material effect. As the algorithm's design will be specific to a particular context, there are infinite opportunities for digital translation and potentially infinite representamens created for each physical person. Yet, we have no assurance of their accuracy.

As datasets expand, inaccuracies are likely to decrease. From here, we see the rationale that with enough data we should be able to predict everything accurately. Ergo, insufficient data leads to false predictions. However, Peirce's synechism maintains that there is no golden rule that applies in every instance.[120] Thus, failures in prediction cannot be prevented by infinite data. Fallibilism explains that we cannot 'claim an exactitude of knowledge' just as we cannot 'suppose that any observed phenomenon is simply a spontaneus irregularity … [that] departs from the ordinary course of things'.[121] To do so would close off new avenues to further inquiry[122] and deny any value to human agency or consciousness.[123] Thus, we return to Peirce's doctrine of synechism; that is, we exist on innumerable continuums of being at any one time. Our ideologies are forever 'swimming' along these continua.[124] Our existence, our presence, our materiality or digitality all exists on similar continua. Allowing probability to dictate whether we are or are not, for example, suitable for employment,[125] financially solvent[126] and/or emotionally stable[127] denies the existence of any continuum at all. Thus, digital translations affix individuals to an assumed reality that is informed by a rudimentary view of reality, even if many predictions may be correct, appropriate and inconsequential.

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[114] Radcliffe, Social Welfare System Initiative, 16.

[115] Radcliffe, Social Welfare System Initiative, 16.

[116] Radcliffe, Social Welfare System Initiative, 16.

[117] Radcliffe, Social Welfare System Initiative, 15.

[118] Radcliffe, Social Welfare System Initiative, 15.

[119] For example, see Linden, "Amazon Recommendations"; Hallinan, "Algorithmic Culture."

[120] For example, see Peirce, Collected Papers I, 70, where he states, 'for where there is continuity, the exact ascertainment of real quantities is too obviously impossible'.

[121] Peirce, Collected Papers I, 65.

[122] Peirce, Collected Papers I, 64.

[123] Peirce, Collected Papers I, 66.

[124] Peirce, Collected Papers I, 70.

[125] For example, see Kiviat, "Deciding with Data," 2.

[126] See Grafanaki, "Autonomy Challenge," 816.

[127] See Hull, "Successful Failure," 92.

5.   Conclusion

The digital space presents an exciting new venue for (self-)representation and (self-)determination. The inability for the material person to traverse the digital–material divide mandates a form of digital translation over which we will have varying degrees of control. Algorithms play an essential role in our digital presence but have a significantly limited ability to represent the totality of physical and 'psychical' reality. We cannot rely on algorithms and digital space to accurately capture reality without denying the influence and importance of human consciousness and agency. The OCI demonstrates the possible consequences of simplistic digital translations and the injustice that comes with such poorly nuanced translations of individuals into digital form. Centrelink recipients affected by the OCI received a letter advising them of a debt to Australia's government welfare agency, and required recipients to prove no such debt had occurred.[128] The process has been described as difficult to navigate,[129] stressful and frightening,[130] and disproportionately affecting people from culturally and linguistically diverse backgrounds.[131] Further, the OCI process required those contesting the OCI determinations to source difficult-to-obtain documentation[132] from previous financial years.[133] Many people feared retribution if they contested the debt[134] and 'felt forced to pay it up-front',[135] with potential recipients deterred from finding work or accepting payments in fear of raising later debts.[136] In addition, once a debt is raised, recipients become ineligible for advance payments, which provides crucial assistance for those who might otherwise rely on this facility to pay their bills.[137] For those who no longer received benefits, debt recovery was contracted out to debt collectors. The OCI has been linked to the suicide of a 28-year-old Australian man who suffered from severe depression and was unable to cope with the onslaught of letters from the allocated debt collection agency.[138]

As the OCI demonstrates, the digital space has become more than part of reality. In this instance, conduct in the digital space *determined* material reality. In other instances, the digital space may have its own reality confined within it, yet the divide between digital and material is increasingly unclear. The ubiquity and quantity of digital data make it easy to conflate digital with real. Likewise, the reliance on algorithms to accurately determine material reality is fraught with risk. The design of algorithms, the nature of their representations and the outcomes they generate clearly show that reality is far more complex than algorithms suggest and reveals the danger of interpreting the digital as an accurate rendering of the real. As the digital–material divide continues to dissolve and more digital outcomes resonate in material space, this article illustrates *how* and *why* society should remain cautious about conflating digital materiality (or material reality) with reality itself.

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[128] Radcliffe, Social Welfare System Initiative, 79.

[129] Radcliffe, Social Welfare System Initiative, 77.

[130] Radcliffe, Social Welfare System Initiative, 78.

[131] Radcliffe, Social Welfare System Initiative, 78.

[132] In many instances, such documentation was impossible to retrieve from past employers; see Radcliffe, Social Welfare System Initiative, 79.

[133] Radcliffe, Social Welfare System Initiative, 78.

[134] Radcliffe, Social Welfare System Initiative, 80.

[135] Radcliffe, Social Welfare System Initiative, 80.

[136] Radcliffe, Social Welfare System Initiative, 80.

[137] Radcliffe, Social Welfare System Initiative, 82.

[138] McKenzie-Murray, "Centrelink's Debt Collection."

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