Commentary

The problem of researching a recursive society: Algorithms, data coils and the looping of the social

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Abstract
This commentary article outlines and explores the key problem that faces anyone interested in researching and understanding what might be thought of as a recursive society. It reflects on the problem that is posed by the layering of multiple feedback loops as a result of algorithmic sorting and data processes. This article is concerned with the difficulties of understanding the social where recursive algorithmic processes have repeatedly shaped outcomes, practices, relations and actions over time. This is not just about the sinking of algorithms into the everyday, it is about the way that loop-upon-loop of data processes lead to the social world itself being recursive. This repeated looping is described here as a kind of data coiling. The article argues for a focus on recursivity and for an engagement with the conceptual problems and questions that this notion implies.

As readers of *Big Data & Society* will already know, the algorithm has become the focus of a very active subplot in critical data studies. Collectively, these accounts of what Taina Bucher (2018: 19) has referred to as the 'multiplicity of algorithms' have come to show just how embedded decision-making bits of code are in the functioning of the social world. As we also now know, informed by a vast data assemblage, algorithms are everywhere and are implicated in all sorts of social processes, actions and outcomes. The picture painted, we might conclude, is of a deeply *recursive society*.

We can understand a recursive society to be built upon feed-back loops, multiple feedback loops, each endlessly feeding into the next. As data are produced by an action they then feed into future actions, repeatedly. This is not a single or unified set of processes, but multiple feedback loops cross-pollinating – or cross-data-pollinating – and implicating other feedback loops. The recursive society is found in these algorithmic sorting processes that are built out of data circulations, but it goes beyond this. It is about what happens when the world itself becomes deeply analytic. The recursive society emerges where algorithmic processes are long-established and the feed-back loops spiral far into the past. This looping of the social creates a fundamental problem for social research of all types.

The presence of these feedback loops, in effect, adds extra steps into social life. A staggering of social processes occurs

that goes far beyond the recursions that have long been part of social life. Where algorithms are present then actions are taken based upon, informed by or shaped by the presence of data from previous actions. In this sense, and with these extra steps informed by previous steps, the many and vast integrations of data, analytics and algorithms lead to a society defined by feedback loops and processes of recursivity. Circulation upon circulation. Loop upon loop. A multiplied repeating of algorithmic processes has built up over time.

The recursive society is a society founded in various types of overlapping analyses (as described previously in Beer, 2018). Much of this analysis is at least partly automated into algorithmic systems and is a result of a combination of forms of thinking or agency. Illustrating this type of deeply integrated thought-processing, Katherine Hayles (2017: 115) has tellingly come to think of these as 'cognitive assemblages'. We are surrounded by highly active

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versions of what Hayles (2017: 2) calls 'cognizers'. These cognizers are drawing-off data that is implicated by the data that came before. The feeding-back of data through algorithmic processes goes, as Louise Amoore (2020: 54) puts it, 'on and on iteratively, recursively making future worlds'. The notion of the 'on and on' is the thing I'd like to pick up on here. It is the repeated nature of the iterative and recursive that is important in shaping the world and, as Amoore points out, making the future. It is the layering of recursive processes that make up the present that is crucial. Repetition is important for understanding these circumstances, so is the way that processes intervene in later processes. In particular, it is the repetition of recursive processes that is at stake. As Helen Kennedy's (2016) book title puts it: 'Post, Mine, Repeat' – the key word here is *repeat*. Once the data are mined and utilized the process is repeated over and over and over again. This might be seen, in John Urry's (2003: 34) words, as 'a dynamic pattern of escalating feedback loops'. It would seem, as van Doorn (2014: 368) has pointed out, that 'such devices proliferate dynamic feedback loops in which their users get to know themselves and others'. There is a reinforcement of categories, Cheney-Lippold (2011: 168) has argued, 'in this constant feedback loop'. This is the context from which a recursive society has emerged.

There are certain formations that occur within a recursive society. A recursive society is not defined by single or isolated loops but by a kind of *data coiling*. This is not just about data being extracted and then folding back into our lives, it is about the way this folding back is repeated again and again on lots of different fronts, moving from single loops and forming into coils. One coil leading into the next. Once this occurs, the data being produced are not just a product of actions, practices or behaviours, they are a product of how previous feedback loops have shaped those actions, practices and behaviours, which then produces more data, which then fold back again into social life and so on.

The recursive society emerges when data gathering is so integrated that there is no point of origin – everything is already implicated by loop upon loop of data processing. Contemporary analytic processes are working with data that is at least partly a product of previous analytic steps. What we think of as 'our data' are really an amalgamation of previous data processes. Imagine extrapolating this outwards to include all data-led systems and all forms of algorithmic social ordering.

The power and depth of looping and data coiling are implied by Shoshana Zuboff's (2019) influential book *The Age of Surveillance Capitalism*. Focusing in upon one instance, Figure 1 of that book turns the so-called 'behavioural reinvestment cycle' into a sketched diagram. The diagram illustrates a cyclical process in which 'analytics' feed into services, which are then experienced by the 'user' which then turns into 'rendered behaviour' which then is turned into 'behavioural data', which then feeds

again into 'analytics' and the cycle continues. Here, as Katherine Hayles (2012: 105) has observed, 'the feedback loops between the individual user and networked and programmable machines are cycles of technical innovation'. There is no beginning or end, just a loop. The diagram is, of course, a snapshot and simplification used to develop the point Zuboff is making, yet it is a useful illustration of just one loop. In practice, the cogs and conveyor belts used in Zuboff's diagram would be spinning so fast that this cycle would be a blur, with each stage rapidly implicating the next – and, of course, there would be a variety of versions of this cycle acting on that one 'user'. We could explore this further, but that particular diagram is illustrative of the type of circulatory data processes that are in place and that are implied by many accounts of the interplay of data and algorithms. With data gathering then feeding-back as part of, in Zuboff's argument, an attempt to modify behaviour. We should now also be explicit about how the ongoing nature of these cycles creates further questions.

The issue this raises is how this works in the long term and what happens when such cyclical data processes lead to a looping or coiling effect. What happens when these processes repeat and repeat and repeat? How do data-informed and algorithmic-led analysis and intervention impact upon the world when we see them not as instances or isolated moments but as series or coils of feedback loops? Looking into these coils of data raises questions about what happens when data analytics and algorithmic interventions are layered upon many previous moments of analysis and intervention. Given the scope and depth of algorithmic circulations, we may wonder if the theories and methods that are used to make sense of the social world can cope with this level and density of recursivity. They may be adapted, but this is still a problem that needs to be faced if we are to understand contemporary social formations and ordering. Indeed, in a recursive society, the problem is not just one of knowing what algorithmic systems are doing or how data are harvested, the problem for social research is in understanding the multiplication of loops and how these loops are implicated by previous loops, on repeat. Perhaps the key question facing critical data studies and social research more broadly is how to deal with recursivity on this scale and how to analyse a social world that is itself so analytic.

The analysis of a society that is itself rich in analytics requires an understanding of how those analytics feed off the data that they themselves have already intervened within. The starting place, as Yuk Hui has already identified, might even be the concept of recursivity itself. I turn to Hui's work in particular in this short commentary because, apart from providing a direct exploration of the concept of recursivity, it poses wider conceptual questions that are useful when thinking through the issues that are posed to researchers by, as I am arguing, the emergence of a recursive society. Hui's book *Recursivity and Contingency*, described as 'primarily a treatise on cybernetics' (Hui, 2019: 1), aims to reintroduce a notion of the

'organic' into the study of technical systems. The focus is upon the way that the organic evolves. Hui writes that the book 'aims to understand the evolution of systems in general, and the emergence of technical systems in particular, by interrogating the concept of the organic, a concept that marks a rupture with the dominating mechanical world-view of early modernity' (Hui, 2019: 1). This has parallels with some of the work on historical data systems by Colin Koopman (2019), in which the way that data processes are 'fastened' into place over time are important for seeing how such systems have evolved (a point that is also developed in relation to the history of biometrics by Chun, 2021). Hui's use of the organic enables the evolutionary aspects of these systems to be explored and it also allows the more important step of bringing their recursive nature into view. Hui claims that 'both conceptually and materially' the concepts of contingency and recursivity 'lead to the emergence and constant improvement of technical systems' (Hui, 2019: 1). This examination of the iterative evolution of systems over time takes the combination of recursivity and contingency as being important in how and in what direction that evolution occurs. Hui places the interaction of the contingent and recursive as being central to the way that systems evolve organically. Within the analysis that Hui provides it is recursivity, I would suggest, that is the lead and most important of these two concepts.

In contrast to initial impressions, Hui argues that 'recursivity is not mere mechanical repetition; it is characterized by the looping movement of returning to itself in order to determine itself, whilst every movement is open to contingency, which in turn determines its singularity' (Hui, 2019: 4). Recursivity alone would lock things into place, what Hui suggests is that contingent factors also shape the way that loops form and adapt. What this then means in the context of the points being made in this article is that data coiling is not necessarily predictable even if it feeds off previous interventions. The paths the coils take may not be obvious and may not simply be set in a particular motion or repeat in predefined ways over time. Looping through recursivity is open to the contingency of the circumstances of the loop, and so it isn't simply a form of repetition that Hui is referring to but a looping that is impacted by the circumstances. The inclusion of contingency means that the established loop can potentially spiral in different directions depending on those contingent conditions. Here the presence of the loop is recursive in that it is looping but is not simply a fixed replication of earlier loops. The way that loops are impacted by contingent arrangements varies in form and context. Recursion, Hui writes, 'is both structural and operational, through which the opposition between being and becoming is sublated' (Hui, 2019: 4). The loops break down notions of becoming, with the loop constantly performing both. Hui's argument, it would seem, is that looping filters through structures and infrastructures whilst also being open to the actions, practices and operations of those who are active within that looping.

Data coils, we might conclude from this, may not necessarily take the form of springs.

With the breakdown of being and becoming, the loops also challenge the notion of an ending or endpoint – the looping continues, and so we are always at a point within a loop. We are also then, I'd suggest, always at a point within the coiling of those loops. Where, we might ask Hui, are the ends? Hui thinks here of the finite and infinite in dealing with this question. Recursion, Hui (2019: 6) argues, 'presents a form in which the infinite is inscribed in the finite; such an infinite is always an approximation, since in the world of the infinite there is no longer difference in quantity but only in quality' (Hui, 2019: 6). The continuous aspect of looping creates a problem for the finite and cessation, instead the ongoing loop captures the sense of an unending and therefore seemingly infinite set of processes within those finite processes. There appears no end to the loops, even if, ultimately, there is one. In the case of algorithmically implicated data coiling, we may similarly wonder where it is possible to find an endpoint. This is to acknowledge that the moment that is being studied is unlikely to be the end of a coil. Rather it is to accept that such things would be hard to identify, particularly as we move further into the context of a recursive society and the coils extend further backwards.

As well as beginnings and endings, thinking in terms of recursivity is to acknowledge the problem of trying to understand a 'singularity'. As I have already argued, the point of thinking in terms of data coils is that it pushes us to question the sense that an event, moment or phenomenon occurs in isolation without the relationalities of algorithmic processes. Isolating things within loops is to extract them from the recursion that is defining them. That singularity is always exposed to loops. Hui's (2019: 7) point here is that 'the singularity of every being is constituted by the play of recursivity and contingency'. A singularity can only be understood in the context of the recursive processes that have come to shape it. The singularity only exists within the loop and within those loops' combined recursion and contingency. Isolating a singularity is to imagine that this is not the case. Hui's contention is that recursion gives form to that singularity. Exploring data coils rather than single loops might also offer such form to seeming singularities. This is the problem of recursion I've outlined above. Each thing that might be studied is in a loop, or multiple repeated loops, and making sense of them requires an understanding that they have emerged from the previous loop upon loop.

As well as posing problems for notions of the finite, singularities and endpoints this recursive looping may also pose problems for causes and beginnings. As Hui (2019: 7) explains further: 'the search for the beginning is a search for the first cause. While in a circular loop, the beginning is only temporal, but not necessarily a cause. The cause is the totality of the loop'. The beginning of a loop, or its seeming beginning, if such a thing can be located, could be mistaken for the cause of a chosen outcome. It is not

just how processes or systems start that is needed then to understand what causes things to take the shape that they do, rather Hui's argument is that we need to see the full process of recursivity to understand cause, and that is if cause can even be derived from such an analysis, which is something that is left in question. If we think in terms of algorithmic processes, then it is unlikely that whole data coils can be comprehended or that they might then be used to discern causes. Another problem with the idea of the first cause is that 'the beginning already includes the end' (Hui, 2019: 7). The loop is not a path. There is a problem with thinking in terms of mechanisms here and how these define systems and outputs. Hui points out that 'mechanisms presupposes a linear causality' (Hui, 2019: 7), and so they miss the looping of recursivity and misunderstand what they mean for causes and outcomes. By undermining notions of first causes, mechanisms and then linearity, Hui is seeking to reconfigure how systems and processes are understood in the context of data, algorithms and processing. Clearly, the problem of what constitutes a cause is a problem for anyone seeking to understand the social world. As are beginnings.

Hui's exploration of the recursive properties of the social world are helpful in beginning to think through what might be thought of as the problems of researching a recursive society. The problems of understanding seeming singularities, of identifying endings and beginnings, of finding causes within looped structures and, finally, the problem of grasping the role and influence of contingency in the direction of recursive processes, these are all apparent if we turn our attention to algorithmic processes and data coiling. If this is a kind of recursive society, as I have suggested, then the concept of recursivity should itself be a focal point. A detailed exploration of the concept of recursivity across different literatures would certainly be needed for the concept of a recursive society to be fully realized. Understanding recursivity itself is a way of thinking through the problems that looping creates for social research. As we observe the loops upon loops it is time to reflect on what it is to be recursive and how data processes are multiple and not singular. Understanding such looping is one means to not only to understand the recursive society, but also to think about the coils that have been set in place, and if there is actually much possibility for alteration or adjustment (or for the contingent to shape the direction of the loops). This would be to push towards an examination that considers moments of judgment, decision and practice but that also thinks in terms of the existing recursion that is playing out behind and beyond that moment.

Within a recursive society, the question is how outcomes are already implicated by the looping of prior decisions and the data that those decisions have recursively produced. This is not to say that the recursive society has emerged from nowhere. Clearly the social world has always been recursive, it has always fed back off itself and off its knowledges and practices (this is described in terms of a 'second-order feedback loop' by Airoldi, 2022: 23). It has been argued that we have

long been made up through numbers and that measuring the social world changes behaviours and practices (see Hacking 1990: 2). However, the increase in the presence of data-informed analytics along with the layering of feedback has accelerated and heightened that recursivity, as well as producing new forms and opportunities for recursion to be implemented. Beyond this, the recursive society I'm attempting to define here occurs where this recursivity comes to be coded into the very infrastructures in which social life is lived. There is a genealogy to this recursivity, yet it now takes distinct forms (as discussed in Beer, 2016: 77–126). The advantage of thinking in terms of a recursive society is not that it highlights a moment of complete rupture, but that it brings to the fore the implications of data coils and the looping of the social that has built up over time. In other words, it requires us to think of how to handle this looping and what the methodological and conceptual issues are that it presents. In this sense, the notion of a recursive society brings an attentiveness to the shifting fabric of the social world, whilst also, crucially I would suggest, preventing us from seeing that social world without the depths of loops that lead to its form and ordering. By illuminating the coiling and looping that is occurring it highlights something that, if missed, might lead to misinterpretations of the circumstances in which the social world is performed. The concept acts to prevent the world from being seen without that particular dimension. The value of the concept of a recursive society is in the questions it poses to a researcher about the depths of the interventions that are occurring in their object of study and how they might be handled.

We might wonder how a society based on so many recursive processes can be understood, this is the problem I'm posing in this short article. It is not just a question of pulling apart individual loops to see what they do, rather we need to find theories and methods that factor in the coiling of data processes and the loop-upon-loop of data interventions and algorithmic sorting that may have led to that point. I would suggest that the problem of recursivity is perhaps the biggest issue now facing any attempt to grasp the structures, experiences and connections of the social world. This is not so much a problem for critical data studies or algorithm studies, much of which is probing implicitly at the problem. The problem of researching a recursive society that I'm highlighting here is revealed or suggested by this collective endeavour. As has been implicitly revealed by that literature, a recursive society is one that is not new to data looping but, as we already now see, is to be found where such looping and coiling are long established within its very fabric. As Louise Amoore (2020: 64) has argued, 'in every singular action of an apparently autonomous system, then, resides a multiplicity of human and algorithmic judgements, assumptions, thresholds, and probabilities'. Even something that looks like a singularity is actually a product of multiple circulations. This is not just about data and algorithms being active in shaping the social world, it is that these processes

have been repeated many times to the point at which these processes implicate themselves. Seeing the social world as anything other than being shaped by the repeated 'fastening' (Koopman, 2019: 12) of data processes would be to misunderstand that world and the relations that make it up. As Hui has indicated, this is not just about repetition it is about looping, I go further to say that it is about data coiling. This coiling then poses a problem for the notion of a singularity or a cause whilst creating further questions about where things begin, where they might end and how we might think of their becoming. The problem of researching a recursive society is that algorithmically defined data loops are already layered into a deep pile, they have already formed into extended data coils – there is no space outside from which to pull at the threads.

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