The text is reading you: teaching language in the age of the algorithm

Jones, R. (accepted); The text is reading you: Teaching language in the age of the algorithm. *Linguistics and Education*.

Author Note

An earlier version of this paper was presented at the 18th World Congress of Applied Linguistics, Rio de Janeiro , July 23-28, 2017.

Abstract

Most accounts of the way digital technologies have changed practices of reading and writing have focused on surface aspects of digital texts (such as hypertextuality, multimodality and the development of new registers). There are, however, less visible aspects of digital communication environments that have had an equally profound effect on reading and writing – namely the *algorithms* that lie behind texts that monitor the actions of readers and writers and alter the form and content of the texts they are exposed to. Algorithms have the potential to affect not just local communication practices, but also broader social practices, as they work to encourage and reinforce patterns of language use, communication and consumption. This paper describes the results of a two-year long participatory project, in which university students in Hong Kong and the United Kingdom explored the communication and inference forming practices they engage in when interacting with algorithms. The participants articulated six primary metaphors through which they and their classmates understand how algorithms work: 1) Algorithm as agent; 2) Algorithm as authority; 3) Algorithm as adversary; 4) Algorithm as communicative resource; 5) Algorithm as audience; and 6) Algorithm as oracle. Engaging learners in articulating the 'folk beliefs' that govern people's interaction with algorithms, it is argued, can contribute to the development of the kinds of digital literacies they will need to better understand the ways algorithms affect the kinds of information they are exposed to, the kinds of inferences they form about this information, and the ways their own acts of reading and writing can be used by algorithms to manipulate them.

Keywords: algorithms; digital literacies; folk linguistics

In his book *What Algorithms Want,* Ed Finn (2017) talks about how the progress bars that we gaze at when waiting for files to download or software to install on our computer systems have very little to do with real 'progress'. The speed of most progress bars, he says, is determined not by the process they are meant to represent but by *algorithms* that are designed in such a way as to make the process itself more psychologically satisfying for users, increasing their feeling of anticipation and holding their attention, often for the purpose of showing them ads.

Progress bars are an excellent example of how digital technologies have changed the way we perceive and engage with digital technologies, illustrating how, in digital environments, even the most mundane text has two sides to it: the *surface* (in this case, the gradual crawling of the bar along the screen), and the *backend processes*, the workings of algorithms which may be pursuing agendas that have very little to do with the meanings we read off of the surface of texts. We believe that progress bars are essentially *performative*, that the blue line *is* the software installing. We think of it like a glass of water filling up, when in reality, it is just a *performance* of a process that usually has little relationship to what is actually going on. This is also true for more sophisticated texts like social media feeds, news aggregators, retail websites, and dating apps. What we read and how we read, and, more importantly, how we are conditioned to think of ourselves as readers (especially the degree of agency we are able to exercise over what and how we read), is increasing determined by algorithms that operate underneath of the surface of texts.

There has been considerable attention in the media lately about how algorithms affect our reading, mostly around the issue of fake news. Much of this discourse, however, gets stuck in rather simplistic models of 'echo chambers' and 'filter bubbles' which discount the agency of users (Davies, 2018; Tagg et al., 2017) or false dichotomies regarding what is 'fake'

and what is 'real'. In this article I am more interested in in is how people *experience* digital texts as both computational processes and textual performances, and how they themselves come to perform with and for algorithms in their day-to-day practices of reading digital texts. I attempt to uncover these experiences and practices though asking users to articulate their own 'folk theories' about how algorithms influence what they see online and how they are able to interact with it. Teaching students to read digital texts, I argue, is not a matter of teaching them how to decipher the complex computer code that constitutes algorithms, but a matter of getting them to reflect upon their own *inferential processes* when they interact with online texts and platforms.

The advent of the algorithm

Over the past few years, there has been an explosion of concern over the role that algorithms play in the production of knowledge and in the life opportunities made available to different kinds of people. Books with titles such as *Algorithms of Oppression* (Noble, 2018), *Automating Inequality* (Eubanks, 2017) and *Weapons of Math Destruction* (O'Neil, 2017) tell stories of people denied loans, having health insurance claims refused, or being suspected of crimes or terrorists acts because of the workings of algorithms which, in many areas of social life, have taken over decision making power from humans. We learn, for example, how facial recognition software 'discriminates' against people of color, and how algorithmically powered 'predictive policing' leads law enforcement officers to focus attention on certain neighborhoods and certain kinds of people rather than others. Even institutions are beginning to blame their own bad behavior on algorithms, as United Airlines did after a passenger was forcefully ejected from a flight after an algorithm had singled him out as someone who could 'reasonably' be removed to make room for other passengers (Kaplan, 2017). In his book *World without Mind,* Franklin Foer (2017) imagines a world in which all decision-making is

relegated to the pattern seeking prowess of algorithms. He writes: ‘the essence of the attempts to train algorithms to become adept at finding patterns, teaching them to discern images and understand language’ is a desire to ‘transform life on the planet…The laws of man are a mere nuisance that can only slow down such work. Institutions and traditions are rusty scrap for the heap.’

It should be clear from these examples that just as algorithms have come to dominate the way we interpret information and experience social interactions online, so have our *ideas* about algorithms come to dominate the way we *think* about interacting with digital technologies. The word ‘algorithm’ has gone from being a niche term used mainly by computer programmers to a popular topic of daily discourse. As David Beer (2017, para. 6) puts it:

> The notion of the algorithm is becoming really quite powerful in its own right. The very notion of the algorithm has taken on a life of its own, especially in the popular media. Algorithms are becoming the shadowy figures that in some way embody our wider fears and concerns. The visions we have of algorithms chime with broader feelings of a loss of control, of accelerated lives that are speeding away from us, of our inability to cope with the unmanageable information that we are exposed to, or the feeling that our lives are governed for us and that we have less discretion, autonomy or voice.

Representations of algorithms in public discourse, however, are not always negative. Far from it. Apart from discriminating against poor people and spreading disinformation, algorithms are also credited with helping us to find good books to read and good people to marry, with filtering out unnecessary ‘noise’ and making the information overload of digital media manageable, with solving traffic gridlock, with being able to teach us how to perfectly

apply our makeup, and with saving the lives of children (see for example Alexander, 2018; Brownstone, 2013; Hart-Davis, 2018).

Whether or not one gets the impression that algorithms are good or bad, however, may itself depend upon the kinds of information one is exposed to online, something that is also increasingly determined by algorithms (Jolly, 2014). In a comparison of the kinds of coverage algorithms get in different British newspapers, for example, Williamson (2016) found that readers of *The Guardian* tend to be served stories about how algorithms spread fake news and spy on us at work, while readers of *The Telegraph* are more likely to learn how algorithms can help them to spot liars on online dating sites or generate cool filters for their Instagram posts.

There is also no dearth of information for internet users on how various algorithms 'work'. For instance, on its support page Facebook explains its EdgeRank algorithm, which decides what posts users see on their news feeds, as follows:

> Posts that you see first are influenced by your connections and activity on Facebook. The number of comments, likes and reactions a post receives and what kind of story it is (example: photo, video, status update) can also make it more likely to appear higher up in your News Feed. (Facebook, 2018)

Other sites, such as *Wikipedia* ('Edge rank', 2018), give slightly more technical explanations of this algorithm, including the equation:

$$\sum_{\text{edges } e} u_e w_e d_e$$

Where:

u_e = user affinity

w_e = how the content is weighted

d_e = time based decay

While such explanations might influence the strategies some people use when they interact with Facebook Newsfeeds and other algorithmically driven texts, most users would have difficulty understanding these formulae, and, in the end of the day, such equations represent gross oversimplifications of how algorithms really work. The problem with a 'transparency' model for digital literacies, which calls for text producers to open up the 'black box' (Pasquale, 2015) of their algorithms so that people can 'read' what is underneath the text, is not just that it underestimates the complexity of algorithms, which are invariably made up of strings of code much more complicated than the simple formulae reproduced above (code that is usually proprietary and often changes to adapt to different people's behavior) (Ananny & Crawford, 2018), but also that it underestimates the complexity of human beings and the context-specific communicative practices that they develop as they interact with and through technologies.

Most people's understanding of algorithmic reading comes not from deciphering mathematical equations but from their own moment by moment *experiences* with algorithms as they engage in situated acts of reading and writing, and the way they interpret and respond to them is a matter of strategies that build up over time based on these experiences.

The fact is, algorithms are not just the mathematical formulae by which they are represented: they are, in the words of Finn (2017, p. 7): 'sprawling assemblages involving many forms of human labor, material resources, and ideological choices.' How algorithms 'work', is inseparable from how people 'work' with algorithms, what they imagine algorithms are doing with/to/for them and how they feel about it. As Bucher (2017, p. 30), argues, while algorithms operate to 'configure users' (Hutchby, 2001; Noble, 2018), users also actively contribute to configuring algorithms. She writes:

> the algorithmic imaginary – ways of thinking about what algorithms are, what they should be and how they function – is not just productive of different moods and

> sensations but plays a generative role in moulding the … algorithm itself. Examining how algorithms make people feel, then, seems crucial if we want to understand their social power.

Bucher's notion of the algorithmic imaginary, informed primarily by 'affect studies' (see for example Gregg & Seigworth, 2010; Stewart, 2007) focuses on 'the moods, affects and sensations that the algorithm helps to generate' (Bucher, 2017, p. 32) . What is missing from this approach is an explanation of the *concrete processes of inferencing* people develop through their 'conversations' with algorithms (Jain, 2014), based partly on what kind of 'conversational partners' they take them to be.

One branch of linguistics useful for understanding such processes of inferencing is *pragmatics*, and while the way algorithms make inferences and create implicature is in some ways very different from the way humans do (Jones, in press), the same general principles of sense-making remain in play: meaning is a matter not just of what is 'said' or 'written', but of how the visible aspects of the text interact with the *context* in which it is produced/consumed and *who* the producers/consumers are (including what their relationship is and what their respective goals and intentions are). We try to figure out what people are 'doing with their words' (Austin, 1976), not by opening up the 'black box' of their brains, but by engaging in protocols of guesswork that we have developed since childhood – our own 'cognitive algorithms', so to speak (Suchow, Bourgin, & Griffiths, 2017).

The point of this argument is that the key to teaching people how to interact with algorithmic texts is getting them to understand how *they are part of the process*, and that the ways algorithms enlighten them, manipulate them, confuse them or 'configure' them as readers depends upon the inferential processes that they bring to them. The motivation for such a strategy is partially linguistic (to help students understand more about the co-constructed nature of all reading and the discursive processes that underpin this co-

constructedness), partially political (to help students begin to formulate was to reclaim agency in their interaction with algorithmic texts), and partly social (to help students understand how their social relations with other text producers and text consumers can be affected by algorithmic processes).

Participants and data

The data for the discussion below come from a long-term project on digital surveillance and privacy, part of which involved engaging university students in Hong Kong and the UK as 'participant researchers', tasked with exploring their own everyday experiences of digital reading and writing and those of their friends and classmates. They did this through in person and online interviews with others, keeping personal blogs, in which they engaged others in discussions about various topics related to digital literacies, searching the internet for relevant information, and meeting regularly with one another to share their findings. One of the tasks they set for themselves was 'algorithmic inventories', a technique in which they picked out algorithms that affected their daily lives and tried to figure out how they and their friends interacted with them, focusing on the following questions:

- How do people think the algorithm works?
- What kind of guesswork goes in to figuring out the algorithm?
- What kind of 'conversational partner' do people take the algorithm to be?
- How does the algorithm try to 'configure users' as certain kinds of 'conversational partners'?
- How do people try to 'work' ('adapt to', 'game' or 'trick') the algorithm?

The idea was not to try to reverse engineer algorithms. It was more to reflect upon their own *inferential processes* as they interacted with algorithms so they could develop more

agentive relationships with the text and platforms that they regularly read and communicated with.

Communicating with algorithms

In meetings with one another, participants compared their own ideas about algorithms and those they had gathered from friends and classmates and tried to isolate the main 'themes' that recurred in their responses. Initial themes were shared between the Hong Kong and the UK group though a dedicated WhatsApp group, and a consensus was reached on six main ways that students thought about algorithms as conversational partners, summarized in Table 1

Table 1: 'How we see algorithms'

- **Algorithm as agent**
  - 'We sometimes believe the algorithm has a mind of its own'
- **Algorithm as authority**
  - 'We sometimes believe that the algorithm is smarter than us'
- **Algorithm as adversary**
  - 'We believe the algorithm is something we can 'cheat' or 'hack'
- **Algorithm as conversational resource**
  - 'We think we can use algorithms to talk to others'
- **Algorithm as audience**
  - 'We believe that algorithms are watching or judging us.'
- **Algorithm as oracle**

- 'We sometimes believe algorithms are magic'

Algorithm as agent. The idea of algorithmic agency – that algorithms have intentions– hearkens back to the sentient robots of science fiction stories written long before the invention of the internet, and to more recent predictions of the coming 'age of intelligent machines' (Kurzweil, 1990). How ascriptions of agency affect people's inferencing processes, however, depends on what is meant by agency. In pragmatics, rather than speaking of 'agency', people usually talk about 'intentionality'; much of Grician pragmatics is based on the assumptions that 1) speakers have intentions, 2) those intentions are communicated through their utterances and other actions in particular contexts; and 3) it is the job of the hearer to attempt to somehow discern the intentions of the speaker (thus, we are less interested in what people say and more concerned with what they *want* us to understand) (Haugh, 2008). This version of intentionality is typical of how people talk about algorithms, hence the title of Finn's (2017) book: *What algorithms **want***. Participants in this study also talked about what they thought algorithms wanted, but often viewed these wants as responses to their own wants, things about algorithms that they could change by wanting or pretending to want something different. One participant in an online interview said:

> 'So I used to like to listen to Ed Sheeran, but now I've stopped because all the Discover Weekly algorithm (in Spotify) wanted to give me was all white guys with acoustic guitars. So I figured out that the only way to lower the WGWAG[1] percentage was to listen to Jay Z.'

So when it came to ascribing intentionality to algorithms, there was often a sense of a distributed intentionality (Mazzone & Campisi, 2013), where intentions followed from

[1] White guys with acoustic guitars

actions, rather than the other way around, and what was ‘wanted’ was something that had to be *negotiated* between algorithm and user. It is also an example of how algorithms can actually lead to changes of behavior by users designed to influence what the algorithms ‘want’ to do.

Another way of thinking about agency is in terms of having a set of motives or an ‘agenda’. For participants, this sometimes involved attributing to algorithms an ‘ulterior motives’, accusing them of ‘pretending’ to be motived by one set of principles while actually being motivated by another. One user, for example, believed that Spotify’s shuffle algorithm favored some artists over others:

> I absolutely don’t trust (Spotify’s) shuffle algorithm. There’s no way that’s random. I think the artists must pay them to play their songs more than others. How else do you explain three Taylor Swift songs in a row, right?

Interestingly, this participant was not the only user to have this suspicion. In fact, complaints that Spotify’s shuffle algorithm was not really ‘random’ led to the company adopting a new algorithm that is designed not to play songs by the same artist in proximity to each other, finding that a non-random process is actually better at *performing* randomness that real randomness. This highlights an important aspect of how we build inferences about the intentions of algorithms (and people, for that matter): the fact that our observations of their behavior are always filtered through our own cognitive capacity to find patterns (even when none exist) (Zolfagharifard, 2015).

The pattern seeking capacity of humans is a kind of double-edged sword: it promotes cognitive efficiency by allowing us to make generalizations based on few examples, but these generalizations can also be the basis of rigid misconceptions and stereotypes. As it turns out, pattern recognition is also a feature of algorithms, and sometimes the generalizations algorithms seem to come to based on the patterns they discern in data can be taken as

evidence that they (or their authors) are promoting a particular ideological agenda, as can be seen in the following conversation that took place in a focus group with students in the UK:

A: So I read that the Google algorithm is like racist because searches on Google Images kept mixing up pictures of black people with pictures of gorillas.

B: Can an algorithm even be racist?

A: Maybe it's the people who designed the algorithm.

C: It's not like the designers put that in on purpose.

D: Algorithms can definitely be racist. They're just like us because we made them.

B: Can an algorithm be homophobic then?

A; Can an algorithm be gay?

D: It's about the result. If the result is racist, then it's racist.

Apart from their idea that algorithms might have 'agendas', another important theme this conversation highlights is that of accountability: who is accountable for the consequences of algorithmic operations: the algorithms, their authors, or the users with whom they are interacting? The important thing about this theme was not so much who participants really held responsible as it is how they used ascriptions of responsibility to position themselves and others as social actors. As Kenneth Burke (Burke, 1969) famously argued, the ascription of agency is chiefly a *rhetorical strategy* with which speakers position themselves as more or less responsible for the actions they are involved in. I mentioned above, for example, United Airline's strategy of blaming an algorithm for bumping a passenger. Similarly, participants in this study blamed algorithms for making it difficult for them to stay off Facebook, for leading them into unfulfilling romantic relationships, and for making them buy things that they didn't need. One participant said:

> They have control over us. They make us feel emotional or pressured and so we make impulse purchases because we don't have time to think through the decision. Sure, it could be argued that they are simply making you aware of how many tickets, seats, clothes –whatever—is a good thing. But is this information really accurate, or is it just another form of mind control?

While algorithms are certainly not responsible for the actions of humans, they do construct what Agre (1994) calls 'grammars of action'; systems of choices which enable and constrain certain ways of acting and of interacting and so work to *structure* human activity. In this regard, perhaps Google's CEO Eric Schmidt was not far off when he once said to a reporter: 'I actually don't think most people want Google to answer their questions. They want Google to tell them what they should be doing next' (Wardrop, 2010).

Algorithmic Authority. Related to the idea that algorithms have agency is the tendency to grant them a certain amount of authority, to, as my participants put it, 'think they're smarter than us.' The term 'algorithmic authority' comes from Clay Shirkey (2009), who defines it as our propensity to trust algorithms more than people, to believe that algorithms are 'objective', 'scientific', and 'reliable'. For some participants, this meant trusting algorithms more than they trusted themselves. One of them, for example, told us about a friend who trusted the judgement of a dating site algorithm more than her own judgement:

> So she said she likes OK Cupid much more than Tinder. She says it's more objective because it's like all done by an algorithm. Untouched by human hands. She's like, I can't trust my own judgement to swipe. I always swipe right on Mr. Wrong.

Of course, part of what makes sites like OK Cupid so 'smart' is a kind of self-fulfilling prophecy. The higher the match score profiles are given, the more likely users are to try to start a conversation with the people who own those profiles, and the more likely they are to

find that they have something in common with them. As OK Cupid founder Chris Rudder admitted, ‘when we tell people they are good matches, they act as if they are’ (Ensor, 2014).

Trust, of course, is an important factor in guiding our inferential processes when we communicate with humans. Although, as Grice (1989) points out, a certain amount of trust, at least that our interlocuters will try to cooperate in communicating with us, is the default setting for most communication, we also evaluate what others say based on how ‘credible’ we take them to be, which is a function of who they are, our past interactions with them, and what kind of knowledge we beleive they have about us and the situation. We employ similar ‘credibility heuristics’ (Metzger & Flanagin, 2013) when interacting with digital texts. When evaluating how much they should trust algorithims, participants referenced the reputation of the institutions (corporations) behind the algoritms and the vast amounts of ‘big data’ that they believed algorithms had access to. One participant, for example, talked about her belief that sites like OK Cupid and Match.com have the ability to evaluate whether or not users are lying on their profiles by cross-refernecing their claims with other information they found online (see also Baugh, 2015):

> A: So if you say you like a certain kind of music, then they can crosscheck that with Spotify to make sure so they really make the right match.
>
> I: And that doesn’t bother you?
>
> A: Not really, maybe they are like better judges of what you really like.

Of course, there was a counter-narrative as well, one that constructed algorithms as flawed, unreliable, or sometimes ‘out of whack’. One participant, for example, expressed skepticism about the validity of the algorithm behind the plagiarism detection service Turnitin, explaining, ‘It gives you a number, based on the amount of similar text that it's seen, which it mis-labels as "probability of plagiarism", and some gullible people believe it because it came from a computer.’

Often narratives of the unreliability of algorithms also came out of the 'credibility heuristics' participants used when interacting with them, in particular, the use of what Metzger and his colleagues (2010) call the 'self-confirmation heuristic', referring to the widely observed tendency for people to believe things that conform to their pre-existing beliefs (Klayman & Ha, 1987), and the 'expectancy violation heuristic', the tendency for people to disbelieve information that is contrary to what they have come to expect. These two heuristics can be seen in the exchange below:

> A: Usually quickmatches matches me with attractive people. But I was visiting relatives during the break so I switched my location from Hong Kong to Canada. Suddenly all those quickmatches are unattractive people. Their algorithm seems out-of-whack.
>
> B: Maybe you're just more attractive to unattractive Canadians.

What these exchanges highlight is that, like the ascription of agency, the ascription of authority to algorithms may be less a matter what we 'believe' and more a situated pragmatic strategy that we employ differently in different situations.

Algorithm as Audience Another common theme constructed algorithms as audiences for performances that participants more or less self-consciously put on for them. Discussions around the theme of 'algorithms as audience' touched on how 'exposed' participants felt when they were interacting with digital media and also how this sense of 'being watched' actually resulted in their changing their online behavior.

Many participants told stories of the 'experience' of being monitored by algorithms. One, for example, wrote in a blog comment:

> I turned vegan almost a year ago. (cue the "we get it, you're vegan" comments). This change meant that online information being presented to me about vegans and the

> lifestyle became more interesting. I had to know every nutritional, ethical and environmental fact of veganism. The algorithms of my social medias quickly clocked on and before I knew it, posts about veganism were unavoidable. The platforms I was on suddenly knew that content surrounding "being vegan" was linked to my new "goal or desire."

Some participants found these experiences disturbing. One noted that, 'with the way algorithms predict what I want to read, I feel like the internet is watching my every move, which it is.' Another said, 'although it might be good to get personalized ads, being watched all the time by the algorithm personally makes me feel extremely vulnerable.' There was also the sense, among some, that algorithms also controlled the extent to which they were visible to other people: 'Algorithms Watch all of your small actions like likes,' said one, 'which means that if two people start tagging each other in memes or GIFs, all their mutual friends can see it. So it becomes a joke at their expense, for all to see.'

Others, however, talked about adapting to the algorithm's constant gaze and making changes to their behavior as a result. 'I never skip though songs on Spotify anymore,' one participant confessed, 'because I heard that skipping a song within the first thirty seconds is viewed negatively by the algorithm. I'm not sure how that might affect me, but to be on the safe side I always listen for at least thirty seconds before I switch.' The consciousness of being watched was particularly relevant to the kinds of algorithms participants encountered in academic contexts, like that governing the plagiarism detection service, Turnitin. 'I feel like the most important audience for my essay is Turnitin,' one participant said. 'After all, that's the one that tells my teacher whether I cheated or not, so that's the one I need to pay attention to.' Another noted, ''I think I'm much more likely to paraphrase than to use direct quotes. Turnitin likes paraphrases better.'

Among the pieces of data participants collected from the internet was a Reddit post from an OK Cupid user who had managed to change the perception the algorithm had of him by performing differently for it. In the post, entitled 'I improved my "personality" with one simple trick, the writer relates how he was 'bothered by the fact that OK Cupid has [him] pegged as unambitions.' And so he retook the 'dating persona test' 'hoping to influence the almighty algorithm's bleak perception of [him]':

> I really thought about my answers carefully. I won't say that I lied in order to make myself seem one way or another, but when I truly could've answered something either way, I thought about the implications. And guess what. That did the trick. According to OK Cupid, I used to be 'The Playboy'. Now I'm 'The Bachelor'. Much better. And much more authentic. Take a look at the before and after versions of my personality:

Fig 1.From: https://www.reddit.com/r/OK Cupid/comments/3urme2/i_improved_my_personality_with_one_simple_trick/

Posts like these, as well as stories of participants' own experiences, highlight the fact that, while, as I said in the beginning of this paper, algorithms often *perform* processes for us,

we also perform ‘personalities’ for algorithms, in the hopes of receiving some reward. The surveillant gaze of the algorithm is both a threat and an opportunity: it exposes me to the risk of having my privacy violated, but it also gives me the chance to perform a ‘more actuate’ me.

Algorithm as Adversary. Many of the stories participants told about their experiences with algorithms positioned them in an adversarial relationship with them. We have already seen examples of people assigning to algorithms ulterior motives and of trying to influence them by changing their behavior. In the ‘algorithm as adversary’ theme, these two notions are taken to their logical extreme, with algorithms depicted as actively trying to cheat users (or of being used as instruments of deception), and with users seeing it as their job to formulate ways to cheat or ‘hack’ algorithms. ‘As far as I’m concerned,’ said one participant, ‘algorithms are put into place in order to frustrate consumers, trying to cheat them out of as much money as possible. So why not try to beat them at their own game?’

Attempts to ‘hack’ algorithms included posting to social media sites only at certain times of the day, using particular key words or hashtags in posts, banding together with friends to engage with or like certain posts, generating random searches to confuse Google, and creating false identities/profiles. This belief that algorithms can be ‘hacked’ is reinforced by the hundreds of websites and news articles participants found, with headlines like: ‘How the Tinder algorithm is PUNISHING you, and how to hack your way to the top’ (Calabrese, 2017) and ‘Instagram made me feel bad about myself—until I hacked its algorithms to improve my body image’ (Russo, 2017).

The idea that algorithms can be ‘hacked’ was especially evident when participants talked about Turnitin. Participants and their friends were fonts of knowledge on ways to confuse Turnitin’s algorithm, such as converting their assignments to pdf documents and then changing the character map to one that uses ligature characters making the text Turnitin

extracts from the document gibberish, or using Microsoft Word's Thesaurus to change keywords in plagiarized passages.

Sometimes these attempts at 'hacking' involved using different algorithms at the same time, and balancing out the perceived constraints of one with the perceived affordances of another (Jones and Hafner, 2012). Just as algorithms were thought to 'cross-check users' information across platforms, users also spoke of ways of strategically engaging with more than one platform or app at a time. One participant put it this way.

> Most people I know use more that one dating app, and they keep them all open at the same time. It's not that they're different people. Everyone uses the same three or four apps. But they're different algorithms, so you get different matches, you get to see the same people differently. It's like a strategy, you play one algorithm against another.

Algorithm as conversational resource. Related to notions that algorithms could be 'hacked' were ideas that algorithms could themselves be used as 'conversational resources', that one could use algorithms to talk to other people for them. The most dramatic example of this was a story from a participant in Hong Kong who fancied a classmate who liked 'Indie' music. The problem was, she didn't really like Indie music all that much or know a lot about it. She liked Cantopop. So in order to attract this boy's attention she followed him on Spotify and, whenever she left home, she would set the Spotify program on her desktop computer to play indie playlists while she was gone. In this way he would get a stream of alerts on his newsfeed that she was listening to this or that cool indie song, and since she was listening to the same songs he was, Spotify's algorithm started to make her activity appear more prominently on his feed.

One thing this example reminds us of is that algorithms never act alone. They are used by and make use of *people* in concrete relationships and situated, goal-based interactions. Like many other algorithms, for example, in order to recommend songs to a user, Spolitfy's

algorithm depends not just on data from that user, but also depends on other people, both those who interact with the user and those that do not, to figure out what the user might like. As Pasick (2015) puts it: 'The main ingredient in [Spotify's algorithm] is other people [...] human selections and groupings of songs form the core of Discover Weekly's recommendations.'

Algorithm as Oracle. Perhaps the most potent and pervasive construction my participants uncovered in their own behavior and that of their friends was the notion of 'algorithm as oracle', their willingness to think about algorithms as having magical powers, able to predict the future or reveal some kind of hidden truth about them. In speaking of Spotify's algorithm, for example, one participant said:

> I'm always fascinated with what the (Spotify) algorithm will come up with, because it's like reflecting back to me my true self. What can I learn from it this week? Like, I have no idea what synthpop is, but apparently, I'm a big fan.

Another called OK Cupid her 'personal fortune teller.' 'It knows before I do,' she said, 'what totally inappropriate guy is going to be in my future.'

Throughout the project participants continually returned to the idea that such and such an algorithm 'knows me better than I know myself.' This idea, though sometimes perceived by participants as 'creepy' or, as above, tempered by irony, also gave them an odd sense of comfort or validation. Finn (2017) suggests that what we most desire from algorithms is that they truly know us and that they tell our stories back to us. Which is also exactly what algorithm want too – to know us completely in order to make us better targets for advertising.

At the same time, they acknowledged that there is a fine line between 'knowing us' and 'creating us'. 'Maybe it's just one version of me that it knows,' one participant admitted, 'maybe just based on what I'm showing it.' What algorithms are becoming better and better at

is *performing* a kind of recognition of their users, while at the same time nudging users into being the kinds of people (customers) they want them to be. 'There is a dangerous discursive slippage at play,' says Dumitrica (2016, para. 6), in constructions of algorithms as oracles. He writes:

> Their role is not to 'know' us, but to mould us into receptive customers... When conflating this representation with popular understandings of 'knowledge' of the individual, with its connotations of objectivity and certainty, the reductive and reifying drive producing these representations becomes invisible… algorithms do not 'know' us better than we know ourselves. They merely record our actions, black boxing our very (messy) nature as meaning-making subjects.

It is in understanding the 'magical thinking' associated with algorithms where Bucher's (2017) appeal to 'affect' becomes most useful. One thing that came out strongly in participants' discussions was that despite their 'creepiness', what attracted them to algorithms was that mystery that lay in the gap between what they could observe them doing, and what they understood about it. So, even after admitting the 'reductive' nature of algorithmic knowledge, they still held on to the hope that the algorithm could really tell them who they were.

Discussion and conclusion

Of course, magical thinking comes with a cost, and in this case, the cost of indulging in magical thinking is accepting the 'terms of service' of the online platforms that we use, which inevitably means surrendering more and more of our personal information to the algorithm. And this was something that my participants acknowledged. This acknowledgment, however, was not enough to get them to stop using Instagram or Tinder or Spotify, or to stop delighting in the feeling of being 'recognized'. And maybe they don't need to. Perhaps the most important insight both participants and I got from these 'algorithmic

inventories' was that students are able to explicitly reflect on their interactions with algorithms, articulating both their own inferential processes and those that they assigned to algorithms. Another insight was that this did not necessarily have to involve 'opening up the black box' or denying them the pleasure they sometimes associated with interacting with algorithms.

What was often most pleasurable for my participants about interacting with algorithms in their daily lives was the fun of trying to figure them out, the imagination involved in getting the OK Cupid algorithm to give them just the right matches or figuring out how to cheat Turnitin. What is lacking in attempts to get students to 'think critically' when it comes to things like social media, algorithms, and 'fake news' is an appreciation of the role of imagination, a recognition of the space of play and performance that algorithms make possible.

Perhaps the best hope in generating truly critical attitudes towards algorithms is to engage with our students' own emergent 'algorithmic pragmatics' (Jones, in press), the vernacular literacies people are developing around playing information games with machines. As Ananny and Crawford (2018, p. 9) put it:

> Learning about complex systems means not simply being able to look inside systems or take them apart. Rather, it means dynamically interacting with them in order to understand how they behave in relation to their environments (Resnick, Berg, & Eisenberg, 2000). This kind of complex learning intertwines epistemological claim-making with material design, social contexts, and self-reflexivity—making sure that a system is not only *visible* but also debated and changeable by observers who are able to consider how they know what they know about it.

The kind of work described in this paper represents an attempt to begin to build a foundation for such learning not by telling students what *we* know about algorithms, but by engaging

them in representing their own theories about them, and in considering 'how they know what they know.' In other words, what this study shows is that it is possible to facilitate learning environments that engage students in critically evaluating how technologies 'work' though getting them to reflect on their *subjective* experiences of 'working with' and being 'worked on by' technologies.

It is widely held that we are currently experiencing a crisis of objectivity, an era of post-truth and fake news in which automated systems are gradually robbing us of the ability to make really informed judgements, and that is certainly true, to a point. But we are also experiencing a crisis in what Felix Guattari (1995, p. 4) calls 'the production of subjectivity,' which, as he points out is always already mixed with 'archaic attachments to cultural traditions that nonetheless aspire to the technological and scientific modernity". We need to come to terms with the different forms of subjectivity that algorithms do not just 'force' us into, but also make possible, as well as the kinds of subjectivity we bring to our interaction with them.

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