AGAINST REMEDIATION

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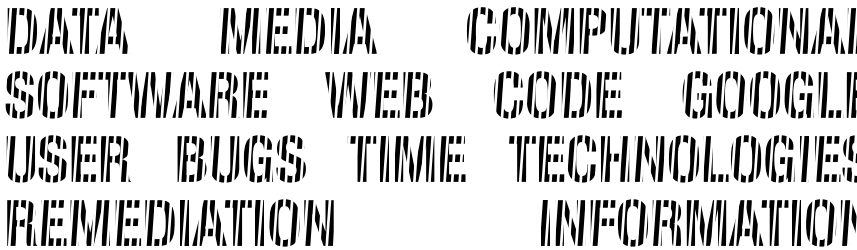

In contemporary life, the social is a site for a particular form of technological focus and intensification. Traditional social experience has, of course, taken part in various forms of technical mediation and formatting, and has been subject to control technologies. Think, for example, of the way in which the telephone structured the conversation, diminishing the value of proximity, whilst simultaneously intensifying certain kinds of bodily response and language use. It is important, then, to trace media genealogies carefully and to be aware of the previous ways in which the technological and social have met – and this includes the missteps, mistakes, dead-ends, and dead media. This understanding of media, however, has increasingly been understood in terms of the notion of *remediation*, which has been considered to helpfully contribute to our thought about media change, whilst sustaining a notion of medium specificity. Bolter and Grusin, who coined its contemporary usage, state,

> [W]e call the representation of one medium in another *remediation,* and we will argue that remediation is a defining characteristic of the new digital media. What might seem at first to be an esoteric practice is so widespread that we can identify a spectrum of different ways in which digital media remediate their predecessors, a spectrum depending on the degree of perceived competition or rivalry between the new media and the old.[1]

However, it seems to me that we now need to move beyond talk of the remediation of previous modes of technological experience and media when we attempt to understand computational media. I think that this is important for a number of reasons, both theoretical and empirical. Firstly, in a theoretical vein, remediation has become a hegemonic concept and as such has lost its theoretical force and value. Remediation traces its intuition from McLuhan's notion that the content of a new media is an old media – McLuhan actually thought of 'retrieval' as a 'law' of media.[2] But it seems to me that beyond a fairly banal point, this move has the effect of both desensitizing us to the specificity and materiality of a 'new' media, and more problematically, resurrecting a form of media hauntology, in as much as the old media concepts 'possess' the new media form. Whilst it might have held some truth for the old 'new' media, although even here I am somewhat skeptical, within the context of digital, and more particularly

1. Jay David Bolter and Richard Grusin, *Remediation: Understanding New Media*, Cambridge, MA: MIT Press, 2000, p. 45.
2. Marshall McLuhan and Eric McLuhan, *Laws of Media: The New Science*, Toronto: University of Toronto Press, 1992.

computational media, I think the notion is increasingly unhelpful. Secondly, remediation gestures toward a depth model of media forms, within which it encourages a kind of originary media, *origo*, to be postulated, or even to remain latent as an a priori. This enables a form of reading of the computational that justifies a disavowal of the digital, through a double movement of simultaneously exclaiming the newness of computational media, whilst hypostatizing a previous media form 'within' the computational. Thirdly, I do not believe that it accurately describes the empirical situation of computational media, and in fact obfuscates the specificity of the computational in relation to its structure and form. This has a secondary effect in as much as analysis of computational media is viewed through a lens, or method, that is legitimated through this prior claim to remediation. Fourthly, I think remediation draws its force through a reliance on an ocularity, that is, remediation is implicitly visual in its conceptualization of media forms, and the way in which one media contains another, relies on a deeply visual metaphor. This is significant in relation to the hegemony of the visual form of media in the 20th century. Lastly, and for this reason, I think it is time for us to *historicize* the concept of remediation. Indeed remediation seems to me to be a concept appropriate to the technologies of media of the 20th century, and shaped by the historical context of thinking about media in relation to the materialities of those prior media forms, and the constellation of concepts that appeared appropriate to them. We need to think of computational media in terms that de-emphasize, or certainly reduce, the background assumptions of remediation as something akin to a looking glass, and think in terms of a medium as an agency or means of doing something – this means thinking beyond the screenic.

In contrast to talk about remediation, and in the context of computational media, I want to think about *de-mediation*, that is, when a media form is no longer dominant, becoming marginal, and later absorbed/reconstructed in a new medium which *en-mediates* it. By enmediate I want to draw attention to the securing of the boundaries related to a format, that is, a representation or mimesis of a previous medium – but it is not the 'same', nor is it 'contained' in the new media. This distinction is important because at the moment of enmediation, computational categories and techniques transform the newly enmediated form – I am thinking here of the examples given by the new aesthetic and related computational aesthetics. I also want to highlight the processual nature of the enmediation; in other words, enmediation requires constant work to stabilize the enmediated media. In this sense, computational media is deeply related to enmediation as a total process of mediation through digital technologies. One way of thinking about enmediation is to understand it as gesturing towards a notion of a paradigmatic shift in the way 'to mediate' should be understood, and which does not relate to the 'passing through' or 'informational transfer' as such. Rather, enmediate, in this discussion, aims to enumerate and uncover the specificity of computational mediation as mechanic processing.

I therefore want to move quickly to thinking about what it means to enmediate the social. By the term 'social' I am particularly thinking in terms of the meditational foundations for sociality that were made available in 20th century media, and which when enmediated become something new. So sociality is not remediated, it is enmediated – that is, the computational mediation of society is not the same as the mediation processes of broadcast media, rather, it has a specificity that is occluded if we rely on the concept of remediation to understand it. Thus, it is not an originary form of social-

ity that is somehow encoded within media, and which is re-presented in the multiple remediations that have occurred historically. Rather, it is the enmediation of specific forms of sociality, which in the process of enmediation are themselves transformed, constructed, and made possible in a number of different modes of existence.

So this work explores the relationship between sociality and enmediation, particularly in relation to code and software. It does so because sociality and enmediation are increasingly intertwined. That is, code and software become the conditions of possibility for human living, crucially becoming computational ecologies, which we inhabit with non-human actors.[3] As such we need to take account of this new computational world and think about how we live today in a highly enmediated code-based condition. Computer code and software are not merely mechanisms, they represent an extremely rich form of media. They differ from previous instantiations of media forms in that they are highly processual. They can also have agency delegated to them, that they can then prescribe back onto other actors, but which also remain within the purview of humans to seek to understand. As Kitchin argues:

> The phenomenal growth in software creation and use is due to its emergent and executable properties: how it codifies the world into rules, routines, algorithms, and databases, and then uses these to do work in the world to render aspects of everyday life programmable. Whilst it is not fully sentient and conscious, software can exhibit some of the characteristics of "being alive" (Thrift and French, 2002). This property is significant because code enables technologies to do work in the world in an autonomous fashion – that is, it can process data, evaluate situations, and make decisions without human oversight or authorization.[4]

This deeply interactive characteristic of code and software, as computational media, makes it highly plastic for use in everyday life, and as such it has inevitably penetrated more and more into the lifeworld – social media is clearly an important example of this. This has created, and continues to create, specific tensions in relation to old media forms, as well as problems for managing and spectacularizing the relations of the public to the entertainment industry and politics. The notion of enmediation carries over the interests of the previous century's critical theorists, particularly their concern with the liquidation of individuality and the homogenization of culture – the digital is a specific and paradigmatic form of this. Nonetheless, there is also considered to be a radical, if not revolutionary, kernel within computational media.[5] This is due to the relative affordance code/software appears to give for individual autonomy within networks of association to share information and communicate.

Nonetheless, here I want to understand enmediation as a broad concept related to the assemblage of both human and non-human actors. The aim is to explore changes

3. Matthew Fuller, *Media Ecologies: Materialist Energies in Art and Technoculture*, Cambridge, MA: MIT Press, 2005.
4. Rob Kitchin, 'The Programmable City', *Environment and Planning B: Planning and Design*, 38.6 (2011): 945.
5. See, David M. Berry, *Copy, Rip, Burn: The Politics of Copyleft and Open Source*, London: Pluto Press, 2008; and Paola Antonelli, 'States of Design 03: Thinkering', *Domus*, 4 July 2011, http://www.domusweb.it/en/design/states-of-design-03-thinkering-/.

that are made possible by the installation of code/software via computational devices, streams, clouds, or networks, what Mitcham calls a 'new ecology of artifice'.[6] The proliferation of contrivances that are computationally based is truly breathtaking, and each year we are given statistics that demonstrate how profound the new computational world is. For example, 427 million Europeans (or 65 percent) use the internet and more than 90% of European internet users read news online.[7] These computational devices, of course, are not static, nor are they mute, and their interconnections, communications, operation, effects, and usage remain to be properly studied. This is made much more difficult by both the staggering rate of change, thanks to the underlying hardware technologies, which are becoming ever smaller, more compact, more powerful, and less power-hungry, and by the increase in complexity, power, range, and intelligence of the software that powers them. Of course, we should also be attentive to the over-sharing or excessive collection of data within these device ecologies that are outside of the control of the user to 'redact themselves', as represented by the recent revelation of Path and Hipster that were automatically harvesting user address book data.[8]

Computational devices and systems also enable the assemblage of new social ontologies and the corresponding social epistemologies that we have increasingly grown to take for granted in computational society, including Wikipedia, Facebook, and Twitter – we might say new social forms *enmediated* by the computational. The extent to which computational devices, and the computational principles on which they are based and from where they draw their power, have permeated the way we use and develop knowledges in everyday life is astounding, if we had not already discounted and backgrounded its importance. For example, David Zax[9] has written about the extent to which computational methods like n-gramming are being utilized to decode everyday life.[10] The ability to call up information instantly from a mobile device, combine it with other data streams, subject it to debate and critique through real-time social networks, and then edit, post, and distribute it worldwide would be incredible if it hadn't already started to become so mundane to us.

In fact, the much heralded 'Age of Context' is being built upon the conditions of possibility made feasible by distributed computing, cloud services, smart devices, sensors, and new programming practices around mobile technologies. This new paradigm in computing stresses the importance of connecting up multiple technologies that provide data from real-time streams and APIs (Application Programming Interfaces) to enable a new kind of intelligence within these technical devices. A good example of this is given

6. Carl Mitcham, 'The Importance of Philosophy to Engineering', *Teorema*, Vol. XVII/3 (Autumn, 1998): 43.
7. Robin Wauters, '427 Million Europeans are Now Online, 37% Uses More than One Device: IAB', *The Next Web*, 31 May 2012, http://thenextweb.com/eu/2012/05/31/427-million-europeans-are-now-online-37-uses-more-than-one-device-iab/.
8. 'iPhone Apps Path and Hipster Offer Address-book Apology', *BBC*, 9 February 2012, http://www.bbc.co.uk/news/technology-16962129.
9. David Zax, 'You Can't Keep Your Secrets From Twitter', *Fast Company*, 26 July 2011, http://www.fastcompany.com/1769217/there-are-no-secrets-from-twitter.
10. An n-gram is a list of 'n' items from a given sequence of textual materials or speech. The basic units can be letters, words, syllables, etc. Google n-gram viewer is a good example of using this technique to search textual corpora: http://books.google.com/ngrams.

by Google's new 'Google Now' product, which attempts to think 'ahead' of the user by providing algorithmic prediction based on past user behavior, preferences, Google search result history, smart device sensors, geolocation, and so forth. As they explain,

> Google Now gets you just the right information at just the right time. It tells you today's weather before you start your day, how much traffic to expect before you leave for work, when the next train will arrive as you're standing on the platform, or your favorite team's score while they're playing. And the best part? All of this happens automatically. Cards appear throughout the day at the moment you need them.[11]

These new technologies form a constellation that creates new products and services, new tastes and desires, and the ability to make an intervention into forethought – what Google calls 'Augmented Humanity'.[12] In some senses this follows from the idea that after 'human consciousness has been put under the microscope, [it has been] exposed mercilessly for the poor thing it is: a transitory and fleeting phenomenon'.[13] The idea of augmented humanity and contextual computing are intended to remedy this 'problem' in human cognitive ability. Here the technologies are aware that they need to tread carefully as Eric Schmidt, Google's ex-CEO, revealed 'Google policy is to get right up to the creepy line and not cross it'.[14] The 'creepy line' is the point at which the public and politicians think a line has been crossed into surveillance, control, and manipulation, by capitalist corporations – of course, internally Google's experimentation with these technologies is potentially much more radical and invasive. These new technologies need not be as dangerous as they might seem at first glance, and there is no doubt that the contextual computing paradigm can be extremely useful for users in their busy lives – acting more like a personal assistant than a secret policeman. Shel Israel argues that this new 'Age of Context' is made possible by the confluence of a number of competing technologies. He writes that contextual computing is built on,

> [1] social media, [2] really smart mobile devices, [3] sensors, [4] Big Data and [5] mapping. We argue that the confluence of these five forces creates a perfect storm whose sum is far greater than any one of the parts.[15]

Today it should, therefore, hardly come as a surprise that code/software lies as the key mediator between ourselves and the world we encounter, disconnecting the physical world from a direct coupling with our physicality, whilst managing a looser softwarized transmission system. Called 'fly-by-wire' in aircraft design, in reality, fly-by-wire is the condition of the computational environment we increasingly experience, and I

11. 'Google Now', Google, 2012, http://www.google.com/landing/now/.
12. See, Kit Eaton, 'The Future According to Schmidt: "Augmented Humanity," Integrated into Google', *Fast Company*, 25 January 2011, http://www.fastcompany.com/1720703/future-according-schmidt-augmented-humanity-integrated-google.
13. Donald, quoted in Nigel Thrift, 'Re-inventing Invention: New Tendencies in Capitalist Commodification', *Economy and Society* 35.2 (May, 2006): 284.
14. Shane Richmond, 'Eric Schmidt: Google Gets Close to "the Creepy Line"', *The Telegraph*, 5 October 2010, http://blogs.telegraph.co.uk/technology/shanerichmond/100005766/eric-schmidt-getting-close-to-the-creepy-line/.
15. Shel Israel, 'Age of Context: Really Smart Mobile Devices', *Forbes*, 5 September 2012, http://www.forbes.com/sites/shelisrael/2012/09/05/age-of-context-really-smart-mobile-devices/.

elsewhere term *computationality*.[16] This is a highly enmediated existence and has been a growing feature of the (post)modern world. Whilst many objects remain firmly material and within our grasp, it is easy to see how a more softwarized simulacra lies just beyond the horizon. Not that software isn't material, of course, certainly it is embedded in physical objects and the physical environment, and requires a material carrier to function at all, such as the massive data centers that currently power our computational societies. Nonetheless, the materiality of software is without a doubt, *differently* material, more *tenuously* material, almost less *materially material*. This is partly due to software's increasing tendency to hide its depths behind glass rectangular squares, which yield only to certain prescribed forms of interactions. Here I am thinking both of physical keyboards and trackpads, as much as haptic touch interfaces like those found in the iPad and other tablet computers, and new anticipatory interfaces, such as represented by Google Now and Apple Siri.

Web Bugs, Beacons, and Trackers

Some examples will help to demonstrate how this code-based world is increasingly enmediating the world around us. Firstly, we might consider the growing phenomena of what are called 'web bugs' (also known as 'web beacons'), that is, computer programming code that is embedded in seemingly benign surfaces but is actively and covertly collecting data and information about us.[17] As Madrigal explains:

> This morning, if you opened your browser and went to NYTimes.com, an amazing thing happened in the milliseconds between your click and when the news about North Korea and James Murdoch appeared on your screen. Data from this single visit was sent to 10 different companies, including Microsoft and Google subsidiaries, a gaggle of traffic-logging sites, and other, smaller ad firms. Nearly instantaneously, these companies can log your visit, place ads tailored for your eyes specifically, and add to the ever-growing online file about you […] the list of companies that tracked my movements on the Internet in one recent 36-hour period of standard web surfing: Acerno. Adara Media. Adblade. Adbrite. ADC Onion. Adchemy. ADiFY. AdMeld. Adtech. Aggregate Knowledge. AlmondNet. Aperture. AppNexus. Atlas. Audience Science […] And that's just the As. My complete list includes 105 companies, and there are dozens more than that in existence.[18]

Web bugs are automated data collection agents that are secretly included in the online pages that we browse. Often held within a tiny one pixel frame or image, which is therefore far too small for the naked eye to see, they execute code to secrete cookies onto your computer so that they can track user behavior, and also send various information about the user back to their servers.

16. David M. Berry, *The Philosophy of Software: Code and Mediation in the Digital Age*, London: Palgrave, 2011.
17. These include HTTP cookies, and Locally Stored Objects (LSOs) and document object model storage (DOM Storage).
18. Alexis C. Madrigal, 'I'm Being Followed: How Google – and 104 Other Companies – Are Tracking Me on the Web', *The Atlantic*, 29 February 2012, http://theatlantic.com/technology/archive/2012/02/im-being-followed-how-google-and-104-other-companies-are-tracking-me-on-the-web/253758/.

Originally designed as 'HTTP state management mechanisms' in the early 1990s, these data storage processes were designed to enable web pages and sites to store the current collection of data about a user, or what is called 'State' in computer science, known as 'web bugs for web 1.0'.[19] They were aimed at allowing website designers to implement some element of memory about a user, such as a current shopping basket, preferences, or username. It was a small step for companies to see the potential of monitoring user behavior by leaving tracking information about browsing, purchasing, and clicking behavior through the use of these early 'cookies'.[20] The ability of algorithms to track behavior, and collect data and information about users raises important privacy implications but also facilitates the rise of so-called behavior marketing and nudges.[21] These technologies have become much more sophisticated in light of Web 2.0 technologies and developments in hardware and software; in effect, web bugs for web 2.0.[22]

Fortunately, we are seeing the creation of a number of useful software projects to allow us to track the trackers: Collusion, Foxtracks, and Ghostery, for example.[23] If we look at the Ghostery log for the ChartBeat company[24] it is described as:

> Provid[ing] real-time analytics to web sites and blogs. The interface tracks visitors, load times, and referring sites on a minute-by-minute basis. This allows real-time engagement with users giving publishers an opportunity to respond to social media events as they happen. ChartBeat also supports mobile technology through APIs.[25]

Web bugs perform these analytics by running code in the browser without the knowledge of the user, which if it should be observed, looks extremely complicated.[26] Newer web bugs (Web 2.0) are much larger in size than their previous incarnation as tiny snippets of code or one pixel image files.[27] They are also much less screenic, relying

19. Jaromir Dobias, 'Privacy Effects of Web Bugs Amplified by Web 2.0', in S. Fischer-Hübner et al. (eds) *Privacy and Identity Management for Life*, London: Springer, 2010, p. 245.
20. 'Cookies are small pieces of text that servers can set and read from a client computer in order to register its "state." They have strictly specified structures and can contain no more than 4 KB of data each. When a user navigates to a particular domain, the domain may call a script to set a cookie on the user's machine. The browser will send this cookie in all subsequent communication between the client and the server until the cookie expires or is reset by the server'. (Sonal Mittal, 'User Privacy and the Evolution of Third-party Tracking Mechanisms on the World Wide Web', thesis, Department of Computer Science, Stanford University, May 2010, http://www.stanford.edu/~sonalm/Mittal_Thesis.pdf, p. 10).
21. For a behaviourist approach see, Nir Eyal, 'How To Manufacture Desire', *TechCrunch*, 4 March 2012, http://techcrunch.com/2012/03/04/how-to-manufacture-desire/.
22. Dobias, 'Privacy Effects of Web Bugs Amplified by Web 2.0', p. 245.
23. Ghostery describes itself on its 'about' page: 'Be a web detective. Ghostery is your window into the invisible web – tags, web bugs, pixels and beacons that are included on web pages in order to get an idea of your online behavior. Ghostery tracks the trackers and gives you a roll-call of the ad networks, behavioral data providers, web publishers, and other companies interested in your activity' ('About Ghostery', Ghostery, 2012, http://www.ghostery.com/about). Also see, https://disconnect.me/.
24. See, http://chartbeat.com.
25. 'About ChartBeat', Ghostery, 2012, http://www.ghostery.com/apps/chartbeat.
26. For an example see, http://static.chartbeat.com/js/chartbeat.js.
27. Also see examples at: Chartbeat, http://static.chartbeat.com/js/chartbeat.js; Google Analytics, http://www.google-analytics.com/ga.js; Omniture, http://o.aolcdn.com/omniunih.js; Advertising.com, http://o.aolcdn.com/ads/adsWrapper.js.

not as greatly on requests for specific image files to count usage, than processual and agentic, often containing complex software functionality that runs within the browser (or app) on the user's device. It is noticeable that this code is also extremely opaque and difficult to understand, even for experienced computer programmers. Indeed, one suspects an element of obfuscation, a programming technique to reduce the readability of the code and that is used to essentially shield the company from observation. In checking a number of web bugs on a variety of sites so far, I have been unable to find a web bug that supplies any commentary on what exactly the code is doing, beyond a short privacy policy statement. Again Ghostery can be useful in providing some general information on a particular bug (of the thousands that are now thought to be available).[28] As Madrigal reports:

> In essence, [the Network Advertising Initiative] argued that users do not have the right to *not* be tracked. "We've long recognized that consumers should be provided a choice about whether data about their likely interests can be used to make their ads more relevant," [they] wrote. "But the NAI code also recognizes that companies sometimes need to continue to collect data for operational reasons that are separate from ad targeting based on a user's online behavior." Companies "need to continue to collect data," but that contrasts directly with users desire "not to be tracked".[29]

These web bugs, beacons, pixels, and tags, as they are variously called, form part of the dark-net surveillance network that users rarely see, even though it is profoundly changing their experience of the internet in real-time by attempting to second guess, tempt, direct, and nudge behavior in particular directions.[30] Ghostery ranked the web bugs in 2010 and identified these as the most frequently encountered (above average): Revenue Science (250x), OpenX (254x), AddThis (523.6x), Facebook Connect (529.8x), Omniture (605.7x), Comscore Beacon (659.5x), DoubleClick (924.4x), Quant-Cast (1042x), Google Adsense (1452x), Google Analytics (3904.5x).[31] As can be seen in terms of relative size of encounter, Google is clearly the biggest player in the area of the collection of user statistics by a long distance. This data is important because, as JP Morgan's Imran Khan explained, a unique visitor to each website at Amazon (e-commerce) is generating $189 per user, at Google (search) it is $24 per user, and although Facebook (social networking) is only generating $4 per user, this is a rapidly growing number.[32] Keeping and holding these visitors, through real-time analytics, customer history, and behavioral targeting, etc. is increasingly extremely profitable. In-

28. 'About Chartbeat'.
29. Alexis C. Madrigal, 'I'm Being Followed: How Google – and 104 Other Companies – Are Tracking Me on the Web'.
30. For example the page scraping of data from open access web pages using 'robots' or 'spiders' in order to create user repositories of data through aggregation and data analysis. Interestingly this is the way Google collects the majority of the index data it uses for its search results. This is also becoming a digital method in the social sciences and raises particular digital research ethics that have still to be resolved. See, https://www.issuecrawler.net/; http://socscibot.wlv.ac.uk/; and http://webatlas.fr/wp/navicrawler/.
31. Andy Kahl, 'Ghostrank Planetary System', *Ghostery*, 5 April 2011, http://purplebox.ghostery.com/?p=1016021670.
32. Jay Yarrow, 'Chart of the Day: Here's How Much A Unique Visitor Is Worth', *Business Insider*, 5 January 2011, http://www.businessinsider.com/chart-of-the-day-revenue-per-unique-visitor-2011-1.

deed, Amazon has calculated that knowing and responding to customer needs is very important for profitability and 'that a page load slowdown of just one second could cost it $1.6 billion in sales each year'.[33] Correspondingly, 'Google has calculated that by slowing its search results by just four tenths of a second they could lose 8 million searches per day – meaning they'd serve up many millions fewer online adverts', and hence make less money.[34]

Companies that are more explicitly collecting data and information often have data collection and privacy policies in place, for example Facebook[35] or Google.[36] An analysis by Cranor and McDonald found that it would take on average 201 hours per year to read privacy policies that users find in their everyday use of the internet, and which are extremely complicated legal documents.[37] Unsurprisingly, few read them. Users are therefore often agreeing to certain data usage, collection, reselling, and aggregation without explicitly being aware of it. For example, whilst you are logged in Facebook collects,

> […] a timestamped list of the URLs you visit and pair it with your name, list of friends, Facebook preferences, email address, IP address, screen resolution, operating system, and browser. When you're logged out, it captures everything except your name, list of friends, and Facebook preferences. Instead, it uses a unique alphanumeric identifier to track you.[38]

Of course, web bugs are a form of surveillance, and indeed it is no surprise that web bugs perform part of the tracking technologies used by companies to monitor staff. For example, in 2006 Hewlett Packard used web bugs from readnotify.com to trace insider leaks to the journalist Dawn Kawamoto and later confirmed in testimony to a U.S. House of Representatives subcommittee that it's 'still company practice to use e-mail bugs in certain cases'.[39]

As can be seen, this is an extremely textured environment that currently offers little in terms of diagnosis or even warnings to the user. The industry, which prefers the term 'clear GIF' to web bug, certainly is keen to avoid regulation and keeps very much to itself in order to avoid raising too much unwarranted attention. Some of the current discussions over the direction of regulation on this issue have focused on the 'do not track' flag, which would signal a user's opt-out preference within an HTTP header. Unfortunately very few companies respect the do not track header and there is currently no legal requirement that they do so in the U.S., or elsewhere.[40] There have been some

33. Kit Eaton, 'How One Second Could Cost Amazon $1.6 Billion In Sales', *Fast Company*, 14 March 2012, http://www.fastcompany.com/1825005/impatient-america-needs-faster-intertubes.
34. Eaton, 'How One Second Could Cost Amazon $1.6 Billion In Sales'.
35. See, for example, Facebook's 'Data Use Policy', http://www.facebook.com/about/privacy/.
36. See, for example, Google's 'Privacy Policy', http://www.google.com/policies/privacy/.
37. Aleecia M. McDonald and Lorrie Faith Cranor. 'The Cost of Reading Privacy Policies', *I/S: A Journal of Law and Policy for the Information Society* (2008 Privacy Year in Review issue), http://lorrie.cranor.org/pubs/readingPolicyCost-authorDraft.pdf.
38. Dylan Love, 'Here's the Information Facebook Gathers on You as You Browse the Web', *Business Insider*, 18 November 2011, http://www.businessinsider.com/facebook-tracking-2011-11.
39. Joris Evers, 'How HP Bugged E-mail', *CNET*, 28 September 2006, http://news.cnet.com/How-HP-bugged-e-mail/2100-1029_3-6121048.html.
40. 'Tracking Protection Working Group', W3C, 2012, http://www.w3.org/2011/tracking-protection/.

moves towards self-regulation in the technology industry with a recent report from the U.S. Federal Trade Commission.[41] However, in the current debate over the EU ePrivacy Directive, the Article 29 Working Party (A29 WP) has stated that 'voluntary plans drawn up by Europe's digital advertising industry representatives, the European Advertising Standards Alliance (EASA) and IAB Europe, do not meet the consent and information requirements of the recently revised ePrivacy Directive'.[42] As such, legislation may be introduced into the EU before elsewhere.

With the greater use of computational networked devices, from mobile phones to GPS systems, these forms of tracking systems will only become more invasive and more aggressive in collecting data from our everyday life. Indeed, it is unsurprising to find that Americans, for example, are not comfortable with the growth in use of these tracker technologies. Pew found that,

> 73 percent of Americans said they would "not be okay" with being tracked (because it would be an invasion of privacy); only 23 percent said they'd be "okay" with tracking (because it would lead to better and more personalized search results) […] Despite all those high-percentage objections to the idea of being tracked, *less than half of the people surveyed* – 38 percent – said they knew of ways to control the data collected about them.[43]

This contradiction between the ability of these computational systems and surfaces to supply a commodity to the user, and the need to raise income through the harvesting of data which is in turn sold to advertisers and marketing companies, shows that this is an unstable situation. It also serves to demonstrate the extent to which users are just not aware of the subterranean depths of their computational devices and the ability for these general computing platforms to disconnect the user interface from the actual intentions or functioning of the device, whilst giving the impression to the user that they remain fully in control of the computer. Indeed, this disconnect between the enmediation of software, and previous attempts to think in terms of the concept of remediation, are important in highlighting how software is different from previous media. As Garber observes,

> underground network, surface illusion […] How much do we actually want to know about this stuff? Do we truly want to understand the intricacies of data-collection and personalization and all the behind-the-screen work that creates the easy, breezy experience of search [...] or would we, on some level, prefer that it remain as magic?[44]

41. Hayley Tsukayama, 'FTC Releases Final Privacy Report, Says "Do Not Track" Mechanism May be Available by End of Year', *Washington Post*, 26 March 2012, http://www.washingtonpost.com/business/technology/ftc-releases-final-privacy-report-says-do-not-track-mechanism-may-be-available-by-end-of-year/2012/03/26/gIQAzi23bS_story.html.
42. Jennifer Baker, 'European Watchdog Pushes for Do Not Track Protocol', *PCWorld*, 6 March 6 2012, http://www.pcworld.com/businesscenter/article/251373/european_watchdog_pushes_for_do_not_track_protocol.html.
43. Megan Garber, 'Americans Love Google! Americans Hate Google!', *The Atlantic*, 9 March 2012, http://theatlantic.com/technology/archive/2012/03/americans-love-google-americans-hate-google/254253/. For more information on the Pew study on 'Search Engine Use 2012' see, http://pewinternet.org/Reports/2012/Search-Engine-Use-2012/Summary-of-findings.aspx.
44. Garber, 'Americans Love Google! Americans Hate Google!'

Indeed, as Aron reports, 'up to 75 per cent of the energy used by free versions of Android apps is spent serving up ads or tracking and uploading user data'.[45] That is, on free versions of popular apps most of the processing work in the app is spent monitoring user activities and sending it back home to servers.[46] This ability for code/software to monitor the user covertly and even obscure its processing activities will undoubtedly become a growing political and economic as well as technical issue.[47]

Lifestreams

Lastly, I want to turn to connect these developments in web bugs to the use of self-monitoring technologies called lifestreaming, or the notion of the quantified self.[48] These have expanded in recent years as the 'real-time stream' platforms, like Twitter and Facebook, have grown. Indeed, some argue that 'we're finally in a position where people volunteer information about their specific activities, often their location, who they're with, what they're doing, how they feel about what they're doing, what they're talking about […] We've never had data like that before, at least not at that level of granularity'.[49] This has been usefully described by the *Economist*, who argue that the

> idea of measuring things to chart progress towards a goal is commonplace in large organisations. Governments tot up trade figures, hospital waiting times and exam results; companies measure their turnover, profits and inventory. But the use of metrics by individuals is rather less widespread, with the notable exceptions of people who are trying to lose weight or improve their fitness [...] But some people are doing just these things. They are an eclectic mix of early adopters, fitness freaks, technology evangelists, personal-development junkies, hackers and patients suffering from a wide variety of health problems. What they share is a belief that gathering and analysing data about their everyday activities can help them improve their lives – an approach known as "self-tracking", "body hacking" or "self-quantifying".[50]

This phenomenon of using computational devices to monitor health signals and feed them back into calculative interfaces, data visualizations, and real-time streams, etc. is the next step in social media. This closes the loop of personal information online, which, although it remains notionally private, is stored and accessed by corporations who wish to use this biodata for data mining and innovation surfacing.

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45. Jacob Aron, 'Free Apps Eat up Your Phone Battery Just Sending Ads', *New Scientist*, 18 March 2012, http://www.newscientist.com/article/mg21328566.400-free-apps-eat-up-your-phone-battery-just-sending-ads.html.
46. Abhinav Pathak, Y. Charlie Hu and Ming Zhang, 'Where is the Energy Spent Inside My App? Fine Grained Energy Accounting on Smartphones with Eprof', Eurosys 2012, 2012, http://research.microsoft.com/en-us/people/mzh/eurosys-2012.pdf.
47. See the following commercial examples of user control software for governing public exposure to trackers, web bugs, and compactants, although the question is, why you would choose to trust them?: https://cloudcapture.org/register/ and http://www.abine.com.
48. See, http://quantifiedself.com/.
49. Randy Rieland, 'So What Do We Do With All This Data?', *Smithsonian*, 23 January 2012, http://blogs.smithsonianmag.com/ideas/2012/01/so-what-do-we-do-with-all-this-data/.
50. 'Counting Every Moment', *The Economist,* 3 March 2012, http://www.economist.com/node/21548493.

Lifestreams were originally an idea from David Gelernter and Eric Freeman in the 1990s,[51] which they described as:

> […] a time-ordered stream of documents that functions as a diary of your electronic life; every document you create and every document other people send you is stored in your lifestream. The tail of your stream contains documents from the past (starting with your electronic birth certificate). Moving away from the tail and toward the present, your stream contains more recent documents – papers in progress or new electronic mail; other documents (pictures, correspondence, bills, movies, voice mail, software) are stored in between. Moving beyond the present and into the future, the stream contains documents you *will* need: reminders, calendar items, to-do lists. You manage your lifestream through a small number of powerful operators that allow you to transparently store information, organize information on demand, filter and monitor incoming information, create reminders and calendar items in an integrated fashion, and "compress" large numbers of documents into overviews or executive summaries.[52]

Gelernter originally described these as 'chronicle streams',[53] highlighting their narrative and temporal dimensions related to the storage of documentation and texts. Today we are more likely to think of them as 'real-time streams' and the timeline functions offered by systems like Twitter, Facebook, and Google+. These are increasingly the model of interface design that is driving the innovation in computation, especially in mobile and locative technologies. However, in contrast to the document-centric model that Gelernter and Freeman described, there are also the micro-streams of short updates, epitomized by Twitter, which has short text-message sized 140 character updates. Nonetheless this is still enough text space to incorporate a surprising amount of data, particularly when geo, image, weblinks, and so forth are factored in. Starting in 1989, Stephen Wolfram was certainly one of the first people to systematically collect their data. He explains,

> So email is one kind of data I've systematically archived. And there's a huge amount that can be learned from that. Another kind of data that I've been collecting is keystrokes. For many years, I've captured every keystroke I've typed—now more than 100 million of them.[54]

This kind of self-collection is certainly becoming more prevalent, and in the context of reflexivity and self-knowledge, it raises interesting questions. The scale of data that is collected can also be relatively large and unstructured. Nonetheless, better data

51. Eric Thomas Freeman, 'The Lifestreams Software Architecture', PhD diss., Department of Computer Science, Yale University, May 1997, http://www.cs.yale.edu/homes/freeman/dissertation/etf.pdf; and David Gelernter, 'Time To Start Taking The Internet Seriously', *The Edge*, 3 March 2010, http://www.edge.org/3rd_culture/gelernter10/gelernter10_index.html.
52. Eric Thomas Freeman, 'Welcome to the Yale Lifestreams Homepage!', 2000, http://cs-www.cs.yale.edu/homes/freeman/lifestreams.html.
53. David Gelernter, 'The Cyber-road Not Taken'. *The Washington Post*, April 1994.
54. Stephen Wolfram, 'The Personal Analytics of My Life', Stephan Wolfram blog, 8 March 2012, http://blog.stephenwolfram.com/2012/03/the-personal-analytics-of-my-life/.

management and techniques for searching and surfacing information from unstructured or semi-structured data will no doubt be revealing about our everyday patterns in the future.[55]

This way of collecting and sending data has been accelerated by the use of mobile apps, which are small relatively contained applications that usually perform a single specific function. For example, the Twitter app on the iPhone allows the user to send updates to their timeline, but also search other timelines, check out profiles, streams, and so on. When created as apps, however, they are also able to use the power of the local device, especially if it contains the kinds of sophisticated sensory circuitry that is common in smartphones, to log GPS geographic location, direction, etc. This is when lifestreaming becomes increasingly similar to the activity of web bugs in monitoring and collecting data on users that are active on the network. Indeed, activity streams have become a standard that is increasingly being incorporated into, and across, a number of media and software. An activity stream essentially encodes a user event or activity into a form that can be computationally transmitted and later aggregated, searched, and processed:

> In its simplest form, an activity consists of an *actor*, a *verb*, an *object*, and a *target*. It tells the story of a person performing an action on or with an object – "Geraldine posted a photo to her album" or "John shared a video". In most cases these components will be explicit, but they may also be implied.[56]

This data and activity collection is only part of the picture, however. In order to become reflexive data it must be computationally processed from its raw state, which may be structured, unstructured, or a combination of the two. At this point it is common for the data to be visualized, usually through a graph or timeline, but there are also techniques such as heat-maps, graph theory, and so forth that enable the data to be processed and reprocessed to tease out patterns in the underlying data set. In both the individual and aggregative use case, in other words for the individual user (or lifestreamer) or organization (such as Facebook), the key is to pattern match and compare details of the data, such as against a norm, a historical data set, or against a population, group, or class of others.

The patterned usage is therefore a dynamic real-time feedback mechanism in terms of providing steers for behavior, norms, and so forth, but also offering a documentary narcissism that appears to give the user an existential confirmation and status. Even in its so-called gamification forms, the awarding of competitive points, badges, honors, and positional goods, can more generally be seen as the construction of a hierarchical social structure within the group of users. It also encourages users to think of themselves as a set of partial objects, fragmented 'dividuals', or loosely connected proper-

55. Wolfram further writes: 'It's amazing how much it's possible to figure out by analyzing the various kinds of data I've kept. And in fact, there are many additional kinds of data I haven't even touched on in this post. I've also got years of curated medical test data (as well as my not-yet-very-useful complete genome), GPS location tracks, room-by-room motion sensor data, endless corporate records – and much much more […] And as I think about it all, I suppose my greatest regret is that I did not start collecting more data earlier'. (Wolfram, 'The Personal Analytics of My Life').
56. ActivityStreamsWG, 'JSON Activity Streams 1.0'.

ties, collected as a time-series of data-points and subject to intervention and control. This can be thought of as a computational care of the self, facilitated by an army of oligopticons[57] in the wider computational environment that observe and store behavioral and affective data. However, this self is reconciled through the code and software that makes the data make sense. The code and software are therefore responsible for creating and maintaining the significance and narratives through a stabilization and web of meaning for the actor.[58]

How might we draw these case studies together to think about living in code and software, and the implications for wider study in terms of research and the theorization of computational society?

Conclusions: Code, Compactants, and Contexts

It seems that a thread runs through web bugs and lifestreaming: data collection, monitoring, and real-time feedback, whether overt or covert. Whilst we can continue to study these phenomena in isolation and think about them in terms of remediation, and indeed there can be very productive knowledge generated from this kind of research, it seems to me that we need to attend to the computationality represented in code and software to better understand such software enmediation.[59]

One of the most interesting aspects of these systems is that humans in many cases become the vectors that enable data transfers, thereby fuelling the computational economy. The concept of enmediation tried to take into account this assemblage quality of computational technology. Users are actively downloading apps that advertise the fact that they collect data and perhaps genuinely find an existential relief or recognition in their movements being watched, recorded, and available for later playback or analysis by 'little brothers'. Web bugs, then, are in many ways lifestreams. Albeit lifestreams that have not been authorized by the user whom they are monitoring. This collection takes place by what we might call *compactants*, which are designed to *passive-aggressively* record data.[60] With the notion of *compactants* (computational actants) I want to draw particular attention to the passive-aggressive feature of computational agents that are collecting information, both in terms of their passive quality – under the surface, relatively benign and silent – but also the fact that they are aggressive in their hoarding of data – monitoring behavioral signals, streams of affectivity, and so forth.[61] The word *compact* also emits useful overtones of having all the necessary components or functions neatly fitted into a small package, and compact as in conciseness in expression. The etymology from the Latin *compact* for closely put together, or joined

57. Bruno Latour, *Reassembling the Social: An Introduction to Actor-Network-Theory*, Oxford: Oxford University Press, 2005.
58. See, http://open.sen.se/ for a particularly good example of this: 'Make your data history meaningful. Privately store your flows of information and use rich visualizations and mashup tools to understand what's going on'. (Sense, Feel. Act. Make sense, 2012, http://open.sen.se/).
59. Berry, *The Philosophy of Software.*
60. Computational actants, drawing the notion of actant from actor-network theory.
61. Of course compactants are not just 'internal' data collection agents. They may also be outside of your data resources and networks probing to get in. This kind of unauthorized access to personal data is on the rise and has been termed the industrialization of data theft. See, Scott M. Fulton,'The Industrialization of Data Theft: Verizon's Staggering New Data', *ReadWrite*, 22 March 2012, http://readwrite.com/2012/03/22/the-industrialization-of-data.

together, also nearly expresses the sense of what web bugs and their related technologies are. The name compactants is also useful in terms of the notion of *companion actants*.[62] Thus 'compactant' is an important middle-range concept in understanding how software enmediates.

Interestingly, compactants are composed in such a way that they can be understood as having a dichotomous structure of data-collection/visualization, each of which is a specific mode of operation. Naturally, due to the huge quantities of data that is often generated, the computational processing and aggregation is often offloaded to the 'cloud', or server computers designed specifically for the task and accessed via networks. Indeed, many viruses, for example, often seek to 'call home' to report their status, upload data, or offer the chance of being updated, perhaps to a more aggressive version of themselves or to correct bugs.

We might also think about the addressee of these wider computational systems made up of arrays or networks of compactants, which in many cases is a future actor. Within the quantified-self movement there is an explicit recognition that the 'future self' will be required to undo bad habits and behaviors of the present self. Or putting it another way, there is a dimension to computational devices that seems to require that software is not just mediation of the past and present, but enmediation of the probabilistic future. That is, there is an explicit normative context to a *future* self, who you, as the *present* self, may be treating unfairly, immorally, or without due regard to what has been described as 'future self continuity'.[63] This inbuilt tendency toward the *futural* is a fascinating reflection of the internal temporal representation of time within computational systems, which is enmediated as time-series structured streams of real-time data, often organized as lists. Therefore, the past (as stored data), present (as current data collection, or processed archival data), and future (as both the ethical addressee of the system and potential provider of data and usage), are often deeply embedded in the code that runs these systems. In some cases the future also has an objective existence as a probabilistic projection presented through contextual computing, literally a *code-object*, which is updated in real-time and which contains the major features of the future state represented as a model; computational weather prediction systems and climate change models are both examples of this.

There are many examples of how attending to the code and software that enmediates many of the life, memory, and biopolitical systems and industries of contemporary society could yield similarly revealing insights into both our usage of code and software, and also the structuring assumptions, conditions, and affordances that are generated. Our use of computational models is growing, and our tendency is to confuse the screenic representation visualized by code/software with what we might call the real – not to mention our failure to appreciate the ways in which code's enmediation is co-constructive of, and deeply involved in, the stabilization of everyday life today. Even so, within institutional contexts, code/software has not been fully incorporated

62. Donna Haraway, *The Companion Species Manifesto: Dogs, People, and Significant Otherness*, Chicago: Prickly Paradigm Press, 2003.
63. Alina Tugend, 'Bad Habits? My Future Self Will Deal With That', *New York Times*, 24 February 2012, http://www.nytimes.com/2012/02/25/business/another-theory-on-why-bad-habits-are-hard-to-break-shortcuts.html?_r=3&pagewanted=all.

into the specific logics of these social systems, and in many ways undermines these structural and institutional forms.[64] We must remain attentive to the fact that software engineering itself is a relatively recent discipline and its efforts at systematization and rationalization are piecemeal and incomplete, as the many hugely expensive software system failures attest. Of course, this code/software research is not easy, the techniques needed are still in their infancy, and whilst drawing on a wide range of scholarly work from the sciences, social sciences, and the arts and humanities, we are still developing our understanding. But this should give hope and direction to the critical theorists, both of the present looking to provide critique and counterfactuals, but also *of* the future, as code/software is a particularly rich site for intervention, contestation, and the *unbuilding* of code/software systems.[65]

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64. What we might call 'outsider code' or 'critical code' is an interesting development in relation to this. A number of websites offer code that data scrapes or screen scrapes information to re-present and analyze it for the user. Some examples include the Parltrack software, which is designed to improve the transparency of the EU parliamentary legislative process, http://parltrack.euwiki.org/; and TheyWorkForYou, which screen scrapes the UK Parliamentary minutes, http://www.theyworkforyou.com/.
65. Here I tentatively raise the suggestion that a future critical theory of code and software is committed to *un*building, *dis*assembling, and *de*formation of existing code/software systems, together with a necessary intervention in terms of a positive moment in the formation and composition of future and alternative systems.

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