Article | Modulation Harms and the Google Home

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Abstract

Deleuze's (1992) modulation is frequently invoked to explain power relations in hyper-connected, sensorised environments. However, attempts to articulate the harmful implications of modulation—a critical step in the process of considering the need for legal intervention—have been modest. In this paper, we theorise four harms arising from the exercise of modulatory power: subsumption, amplification, vibration, and alienation. To do so, we outline the core features of Deleuzian modulatory power (Deleuze 1992), illustrated through contrasts with Foucauldian discipline (Foucault 1995, 1988). Then, drawing on Julie Cohen's (2013, 2015, 2018, 2019) modulation as a two-way flow of predicted and prescribed modes of governance and knowledge production, we explore and situate our harms in the sensorised and smart home, employing Google's patented vision as a concrete example (Fadell et al. 2020). We contend that modulation harms arise from the continuous flow and constant agitation of insistent modification (D'Amato 2019) enabled by sensorisation. The core power act that gives rise to modulation harm is the ability to harness, direct, and provide "frequency" to flows of sensor data to achieve continual behavioural modification and shape social norms about the purposes and benefits of such modification. The overarching harm we identify is subsumption, the infrastructural enclosure of all sensorised environments that enables social shaping to take place anywhere, which gives rise to the other modulation harms. Amplification harms regard auto-regulatory norms as an unquestioned facet of an automated human life. Vibration harms arise from the automated ability to prescribe changes in affect. Alienation harms regard subtle denials of access to informational networks. We show that the Google sensorised home both modulates and disciplines occupants concurrently, but more importantly, these concurrent power acts can take place wherever an individual is tethered to the modulation infrastructure and sensor data can be harnessed.

Introduction

In the highly influential "Postscript on Control Societies," Deleuze (1992) conceptualised a new mode of power that he saw unfolding in the emerging technological, organisational, and economic arrangements of the post-Fordist era. Deleuze's theory of power, distinguished by its modulatory quality, has become an important frame for scholarly understandings of the consequences of pervasive data collection enabled by expanding networked surveillance technologies. The notion of modulatory power has, however, largely escaped the attention of the legal academy, apart from the notable exceptions of Cohen's (2013, 2015, 2018, 2019) work on modulation and Rouvroy's (2013) research on algorithmic governance. Attempts to articulate and label the potential harms arising from modulation have thus far been modest. Articulation is important because appropriate forms of legal intervention are more easily targeted to the prevention or mitigation of identifiable harms. Moreover, without a clear idea of what constitutes a modulation harm, proposals for legal intervention generally fall back on the dominant but ill-suited paradigms underpinning information privacy or data protection law.

Our paper seeks to address this gap in the literature by articulating a series of modulation harms. In conceptualising these harms, we build upon the extant literature, which has thus far considered the harms in our paper as the fragmentary effects of modulation. To move from identifying mere effects to understanding

potential harms, considerations of modulatory power need to be embedded in real life (Burroughs 1978: 41), and the consequences of modulatory power need to be examined in a readily identifiable context. In this paper, we utilise the “concrete assemblage” (Bogard 2009: 28) of the sensorised and smart home to explicate how modulatory power is produced and reproduced through data flows and infrastructures (Elmer 2003: 235).

These sites of concentrated smart surveillance seek to modulate the behaviour of home occupants across several targeted trajectories, in each case by harnessing sensor data that enables behavioural prediction and subsequent prescription of outcomes in the form of the eponymous nudge. In the *ideal* smart home, behavioural predictions and prescriptive nudges arise in the course of seemingly quotidian household activities that nonetheless take on an unexpected quality, such as the disruption of dinner table silences, the disciplining of regular brushing of younger teeth, or the enhanced monitoring of unexpected visitors (Fadell et al. 2020).

We begin the process of identifying modulation harms in the sensorised and smart home by exploring the core features of modulatory power, as articulated by Deleuze (1992) and extended by other theorists, and juxtaposing those features with the mechanisms of Foucault’s (1995) discipline. We then employ Cohen’s (2019) concept of modulatory power as two-way flows of predicted and prescribed modes of governance and knowledge production to articulate four types of modulation harm: subsumption, amplification, agitation, and alienation. We then concretize our abstract harms by demonstrating how they could manifest in Google’s vision of the sensorised and smart home, “The Google Home.” In doing so, we examine the relationship between disciplinary and control power modes that suffuse in the smart home environment. We find that smart surveillant activities in the Google Home have both a modulatory and disciplinary quality that centres around Google’s ability to continually reassemble dividualated data and apply its constant segmentations to an individuated context of disciplining home participants. As such, the Google Home modulates and disciplines home occupants concurrently.

Modulation and Discipline

In “Postscript,” Deleuze (1992) briefly sketches out the basic tenets of the control society—a distinct regime of power which he claims will progressively supersede the disciplinary societies expounded by Foucault. Deleuze contends the control society represents a fundamental departure from the disciplinary societies which sought to force individuals into specific moulds. Instead, control operates through continuous modulations that are constantly self-transmuting moldings from one moment to the next (Deleuze 1992: 4). Modulation operates “like a sieve whose mesh varies from one point to another,” akin to an iron cast (Deleuze 1992: 4). Discipline consequently has a defined and visible firmness, whereas modulation has an invisible plasticity that responds to “changing contingencies of production” (Bogard 2012: 33). In this section, we overview the core features of modulatory power, drawn through contrasts with the distinct dimensions, logics, and targets of Foucault’s discipline.

The first important distinction relates to spatiality. Disciplinary power is highly reliant upon the enclosure of the subject, while under modulation, the location of the subject is inconsequential to the exercise of control (Savat 2009: 53). Disciplinary power operates by organising “an analytical space” where a collective mass can be converted to “separated individualities... that can be numbered and supervised” (Foucault 1995: 143, 201), such as the school, the factory, or most famously, the prison (Andrejevic 2019: 12). While Foucault (1995: 218) downplayed the essentiality of confinement, he did note that the objective of discipline is nonetheless to render the subject fixed; ultimately, “it is an anti-nomadic technique.” Thus, disciplinary power is ultimately reliant on “restrictive spatiality” (Elmer 2012: 25).

By contrast, modulatory power is adapted to environments in which subjects are neither enclosed nor fixed but are mobile and freely dispersed as data segments that flow across digital networks (Castells 2009: 78). The diffusion of digital networks has contributed to the breakdown of distinct disciplinary domains and has provided a new infrastructure for surveillance that enables continuous and unobtrusive observation of

mobile individuals in dispersed settings. In these networked settings, surveillance can be constant so long as the individual is in some way tethered to the network (Savat 2009: 53). Whereas disciplinary enclosures are spatially and architecturally varied to fulfil the observational oversight requirements of each space, in modulated settings, the digital environment is itself the observatory (Savat 2009: 50). Modulations unfold across a vast infrastructural enclosure that is malleable based on how data can be collected, segmented, and reassembled (Iveson and Maalsen 2019: 345).

The divergent logics of hierarchical observation in disciplinary settings and unobtrusive, continuous monitoring in modulated environments have distinct implications. Surveillance in the disciplinary society targets the internal state of the individual (Savat 2013: 23). For instance, in the panopticon, the archetypal disciplinary enclosure captured in Bentham's (1787) architectural designs, prisoners are classified and separated into single cells that are "constantly visible" from a central observation tower (Foucault 1995). The observation tower and the suggestion of continuous surveillance operates as a mechanism of power by inducing the inmates to modify and order their behaviour as if watched, thus internalising discipline (Elmer 2012: 27). Externally, discipline manifests in the individual as compliance and docility (Foucault 1995; Galič, Timan, and Koops 2017: 17). Disciplinary power operates by making its surveillant presence known—the disciplined individual is conscious that they are being observed and subject to disciplinary power.

Modulatory power, on the other hand, is primarily concerned with observing and detecting patterns with the aim of "predicting... specific forms of behaviour" (Savat 2009: 54). Behavioural modifications induced by fear of surveillance would likely undermine the modulation goal of detecting patterns in authentic, unself-conscious behaviour. Disciplinary modes of power are therefore distinctly visible, while modulatory modes are ideally invisible or at the very least unobtrusive (Bogard 2009: 19). Disciplinary oversight requires constant visibility and awareness to mould. Modulation requires continued unawareness or indifference to generate conditions of incessant malleability.

Foucauldian discipline thus regards the exercise of normalising judgement, that is, the enforcement of standard norms of behaviour through gratification or punishment. Normalised judgement aims to produce "model" behaviour. Modulation, by contrast, is an essentially non-judgemental mode of power that is concerned with the detection of patterns and trends and the prediction of behaviour rather than seeking to enforce compliance with established norms (Bogard 2012). It is this process of continual adjustment that is at the heart of Julie Cohen's (2013: 1918) notion of modulation as "a set of processes in which the quality and content of surveillant attention is continually modified according to the subject's own behavior, sometimes in response to inputs from the subject but according to logics that ultimately are outside the subject's control." Cohen (2015: 71) provides a useful explanation of the effects and aims of this behavioural prediction, contending that modulation involves a constant two-way flow of data that fosters systems of prescriptive governance and knowledge production. Both elements are interlinked. As a system of prescriptive governance, modulatory power operates using continuous collections of sensorised data as a means of predicting patterns of occupant behaviour. Those predictions found the basis for prescriptive governance, generally in the form of nudges that seek to align predicted behaviours with modelled outcomes. More insidiously, the expansion of data collection for prediction and prescription becomes a modulated form of knowledge production because acceptance of continual surveillance becomes the norm (Burdon 2020: 238–241).

The temporal dimensions of modulatory and disciplinary power are also distinct. Discipline operates through rigid partitioning of space and time. Bodies are disciplined using timetables to control time and activities that prevent idleness and maximise productivity (Foucault 1995: 154). Segmenting time is part of the long-term process of casting or moulding the individual. Gradually, the individual is shaped through the performance of exercises, "tasks of increasing complexity that marked the gradual acquisition of knowledge and good behaviour" (Foucault 1995: 161). Disciplinary processes are long-term and time bound. The successive confinements of disciplinary societies thus have an endpoint, a graduation, an "apparent acquittal" (Deleuze 1992: 5).

A different approach prevails in modulated settings. The linear organisation of time is incompatible with membership of digital networks, which are conducive to multi-tasking (Bogard 2012: 22). A task is “never quite finished” (Deleuze 1992: 5) and the compartmentalised spaces of discipline fold into a continuous segment of modulation (Savat 2009: 52). Modulation does not operate through segmenting time and activities that maximise efficiency and utility of the individual. Instead “[C]ontrol is short-term... of rapid rates of turnover, but also continuous” (Deleuze 1992: 6). Modulation is concerned with short-term adjustments rather than long-term moulding that result in a state of “limitless postponements” (Deleuze 1992: 5). The corporation is the beneficiary of this endless state of short-termism as it has the flexibility to determine its position and role in constantly changing and ever-expanding international markets (Davies 2015: 43).

Each modality of power also has a different target. In disciplinary societies, the project of power is to individualise and distribute subjects—to mark, analyse, and rank each body in a designated space (Foucault 1995: 198). Discipline is directed toward individuals to shape them into a specific mould. Modulation targets what Deleuze (1992: 5) calls *dividuals*, which are data fragments of the individual. Rather than disciplining actual bodies, modulation is directed at “data-bodies” which, in a control society, are more important than real bodies (Galič, Timan, and Koops 2017: 20). Modulation is applied to oscillations, specifically, to “trends” or “tendential movements” (Bogard 2012: 32), a process Savat (2009: 53) calls “the programming of flows.” Discipline’s prime concern is with whole individuals, while modulation’s is the motions and rhythms or behaviourable patterns that are constructable as dividuals across dispersed data networks (D’Amato 2019: 310). It is the constant recycling of data and code that enables modulation’s pre-emptive qualities of prediction and prescription. Discipline is reactive and physical. Modulation is proactive and immaterial (Bogard 2012: 36).

Deleuze predicted that the modulatory mode of control would supersede discipline. The degree that one has or has not replaced the other has become a significant bone of contention that has led to critical questioning about the basis of Deleuze’s (1992) account of modulation in “Postscript” (Hui 2015). Our position, like others’ (Iveson and Maalsen 2019; Savat 2013; Andrejevic 2019), is that the two modalities of power are contemporaneous and often overlap. At their heart, discipline and modulation are concerned with “the continual movement between multiple modes of personhood” (Iveson and Maalsen 2019: 334) in the fundamentally different ways highlighted above. However, these fundamentally different ways are still closely related and can be exerted simultaneously, as in the smart home.

The Smart Home

Before exploring the manifestation and consequences of exercises of modulatory power in the sensorised and smart home, it is useful to delineate some of the relevant components and features of contemporary smart home environments. The term “smart home” may be used to denote a wide range of environments with varying levels of sensorisation, automation, and smart functionality (Aldrich 2003). We use the term to refer to a site, typically a home, *densely* populated by sensors embodied in internet-connected, multi-functional smart devices, such as smart refrigerators, wall switches, or doorbells. Such sites share several common core components (Burdon 2020: 50).

In the smart home, sensorised devices, such as smart refrigerators, wall switches, and doorbells, collect an enormous array of data including video, audio, and event data about device usage. In the “digital nervous system” (Lewis 2011) that is the smart home, the sensors function as interchangeable nerve endings that send data to the brain, which for the smart home is the “protocol hub” (Burdon 2020: 54). The protocol hub collects data from the range of different home sensors and facilitates integration between devices using the same communications protocol (Wilson, Hargreaves, and Hauxwell-Baldwin 2017). The smart home can also include an “external platform” that processes sensor data: indexes it, analyses it, and derives statistical data about device use, use patterns, and sensor readings (Fadell et al. 2020; Doty 2020). The processed data, constantly refreshed by a continuous stream of sensor data, can then be used to identify the fine-grained behaviours of occupants, which in turn inform analytical predictions about future behaviours and provide

the basis for the application of policies and rules regarding smart home functions (Wilson, Hargreaves, and Hauxwell-Baldwin 2015: 468–469). It is the combination of contiguous data and code that provides “more intelligent governance of the home experience” (Fadell et al. 2020: 52).

We noted earlier that location is unimportant to the exercise of modulatory power so long as the subject is in some way tethered to the digital network. On that basis, the value of examining the operation of modulatory power in a fixed site or disciplinary enclosure such as the home may seem questionable. We contend that the smart home is not the type of disciplinary enclosure envisaged by Foucault, but instead perfects the integration of the home into the broader digital surveillance infrastructure, completing the progressive breakdown of the distinction between the home and other disciplinary domains, as envisaged by Deleuze (1992: 4). Nevertheless, the smart home retains both disciplinary and modulatory characteristics. It is a spatial enclosure in which disciplinary power can be exercised over occupants. Disciplinary targeting is, however, derived as part of a dividualised enclosure enabled by the spread of sensor networks that permit a range of activities traditionally performed in distinct physical domains to be practised via a myriad of different data infrastructures (Elmer 2012: 32). Theoretically, membership of digital networks enables individuals to perform diverse activities, such as work, education, consumerism, and political participation, in a variety of physical spaces. It is the essence of being more mobile. Conversely, membership also facilitates the convergence of these diverse activities into a single physical space, such as the home.

While in certain cultures the home has historically been a site for the concentration of personal activities, intimacy, and emotional behaviour (Burdon 2020), digital and sensorised technologies have brought a new range of activities, traditionally reserved for outside the home, within its bounds. This trend has seemingly intensified in the wake of widespread lockdown orders implemented in response to the COVID-19 pandemic. The intense clustering of different activities into the home makes it a fecund source of data for behavioural pattern detection (Maalsen and Dowling 2020) and a potential site for amplified modulation. If the operation of modulatory power is not reliant upon the restriction of subjects to an enclosure, so long as they are tethered to the broader digital surveillance infrastructure, it would seem to follow that modulatory power may be strengthened or weakened commensurately with the strength of the tether.

Smart homes strengthen and multiply the surveillance tethers, integrating the home into the broader surveillance infrastructure. For example, a smart home system described in a 2020 patent filed by Google (referred to from here on in as “the Google Home”) can collect and integrate a vast range of data about seemingly innocuous home activities previously beyond the purview of surveillance technologies, such as vapour detection to confirm the “presence of food” and audio signals to record “utensil movements” that signify dinner is served and is being consumed (Fadell et al. 2020: 45). Consequently, the smart home has the potential to serve as an important node in the broader surveillance network (Maalsen and Sadowski 2019: 120). In the smart home, and other smart surveillant environments, the strength of the tether increases with the density of sensorisation in that space. The denser the sensorisation, the greater the amount of data that can be collected and used to continually identify changing behavioural patterns relating to use of sensorised devices.

At this point, it is useful to survey some of the main uses to which sensors and pattern detection are put in the smart home. The smart home has two key functions. First, to adjust and adapt the home environment to optimise the comfort and safety of its occupants by, for example, moderating temperatures, locking doors while minor occupants are home alone, ordering groceries that are running low, playing media upon request, or switching on lights in occupied rooms (Aldrich 2003). Environmental adjustments may be programmed by the smart home occupant. Apple’s HomeKit allows occupants to program “scenes,” such that multiple devices activate or adjust at certain times or in response to certain events: for example, the occupant leaving the home (Warren 2015). In some smart homes, environmental adjustments may be tailored to occupants based on behavioural patterns and preferences inferred from the sensor data: for example, when Amazon’s Alexa complies with an ambiguous music request by playing a genre or song that the occupant is most likely to enjoy (Xiao 2018) or when the Google Home’s smart thermostat “learns occupants’ preferred temperature set-points for mornings and evenings,” adjusting accordingly (Fadell et al. 2020: 37).

Second, sensors and sensor data are deployed for the purpose of adjusting occupant behaviour (Maalsen and Sadowski 2019). These adjustments may take several forms. For example, the Google Home may seek to caution against or deter “undesirable behaviour.” The system records and reports undesirable behaviour by occupants, such as “mischief” amongst children (inferred from whispering), the use of foul language, non-completion of household tasks, or “interaction with undesirable substances” (Fadell et al. 2020: 48). In some cases, these “cautionary inferences” trigger an immediate intervention by the system, such as activations of an alarm, or a punishment, such as limited screen time for children (Fadell et al. 2020: 49).

Another way in which smart home occupants are encouraged to modify various habits or aspects of their behaviour is through the setting of rules or challenges for themselves. The Apple HomeKit can be programmed to adjust lighting when an occupant sleeps past a specified time (Burdon 2020: 44). In the Google Home, although rules or challenges are also ostensibly chosen by the occupant, the system may nudge occupants toward programmes for self-improvement by suggesting goals or rules based on demographics or observed behaviour. For example, after detecting a pattern of tardiness, the system may suggest a rule to facilitate punctuality such as a prompt or reminder to leave on time (Fadell et al. 2020: 42). In some cases, the system may seek to gradually induce a change in occupant behaviour through “virtually imperceptible” progressions (Fadell et al. 2020: 52). For instance, where an occupant sets a challenge to decrease internet usage, the system may restrict usage by one-minute daily allotments (Fadell et al. 2020: 52). The system monitors progress toward the achievement of goals for self-improvement, sending reminders in the absence of progress and rewards when sufficient progress is made. Certain smart home components may also encourage behavioural modification and action through overt quantification and, in some cases, diagnosis. For example, a patent filed by Amazon describes smart speaker technology that would, using voice data, detect physical ailments and moods of occupants in real-time (Huafeng and Wang 2017). Upon attributing a particular physical or emotional characteristic to an occupant, Amazon’s Alexa would then present that occupant with relevant content and suggestions: for example, offering to order cough drops for an occupant (Huafeng and Wang 2017).

Finally, the smart home may operate to shape the consumer behaviour of occupants through targeted advertising (Pierce 2019). Given the intense concentration and diversity of activity in the home, and the conversion of the home into an observatory through dense sensorisation of the physical space, smart home systems not only have the potential to tailor advertisements in an extraordinarily hyper-granular manner but also to anticipate desires based on patterns of behaviour, trends, and predicted events. For instance, when Alexa plays a song from a particular genre or artist, based on the inferred preferences of an occupant, it is prescriptively anticipated from predictions from prior data recordings about musical uses. Similarly, when the smart refrigerator, in tandem with the home’s virtual assistant, orders groceries to replace dwindling supplies, or when the smart washing machine orders detergent in time for the impending wash cycle (Burdon 2020: 45; LG Smart ThinQ 2019), the occupant is relieved not only of the burden of monitoring and refreshing household items but also of making various choices about the purchase of such items.

We contend that these seemingly innocuous automated outputs are reflections of modulation harms.

Modulation Harms

We now turn to the task of articulating the possible harms arising from this important node in a vastly encompassing modulatory network. The sensor, and its use in smart homes, is vital to understanding how modulation harms can manifest both in a control and a disciplinary context. Control of the sensor means control of the home, both in the sense of it being a physical, disciplinary enclosure and as a dividualised flow of broader modulatory infrastructure. The dualistic power of Deleuze’s corporation thus starts to emerge (Davies 2015: 56) in the data harvester’s dual ability to enclose the disciplined home as part of a vaster modulatory enclosure.

The sensorised frame of the smart home generates continuous two-way flows of data that support modulated forms of prescriptive governance and knowledge production. The continuous collection of sensorised data

in the home enables the prediction of patterns of occupant behaviour that provide the basis for prescriptive governance. The expansion of sensorised data collection for prediction and prescription becomes a modulated form of knowledge production because acceptance of this dividualised environment becomes the norm. In the smart home, the normalisation of sensorised based nudging is enhanced by the fact that sensorised devices are so deliberately embedded in their physical environments. The embeddedness of the sensors means that their data collection capabilities are overlooked, ill-considered, or ignored completely by occupants. Instead of asserting the types of visible authority employed in a disciplinary context, the unobtrusive sensorised frame supports the subtler, more flexible, exercise of modulatory forms of power.

The sensorised infrastructure provides increasingly more data to enable the production of more sophisticated dividualised outputs (Andrejevic 2019: 11). In turn, these outputs can be used for more predictive segmentations that can be utilised for a greater range of commercial modelling purposes. In other words, more sensors mean more dividualised segments, which in turn mean more prescriptive outcomes and, consequently, more opportunities for the commercial exploitation of behavioural patterns (Andrejevic and Burdon 2015; Maalsen and Sadowski 2019). The transfer from sensorised data collections to prescriptive norms as a mode of knowledge production is thus seamless (Cohen 2019: 24). It is a project of vast social shaping, as warned by Julie Cohen (2015: 74). As sensorised data collection spreads, so too does modulatory power, pervading the environmental gaps and spaces that sensors can now reach (Burdon 2020: 210).

The ability of the sensorised infrastructure to unobtrusively collect data that flows into endless cycles of normalised prescriptive analysis and outcome means that modulation harms are different in nature to the harms traditionally contemplated by information privacy law (Cohen 2019). Modulation harms directly involve power actions regarding the ability of sensor data collectors to prescribe (e.g., collect, segment, and predict) and to shape (e.g., design, influence, and normalise). Information privacy law protections are built into processes of visible and intentional personal information exchange. Modulation harms arise in the gaps and spaces of process (Cohen 2015: 77) and reach into the environmental shadows of behavioural capture through sensorised data collections.

Modulation harms thus have an informational and environmental capacity representing the concurrence of modulatory and disciplinary intentions. Harms emerge from the dividualised double, but they are also about the environmental circumstances in which sensor data is generated, collected, and operated. Future legal focus must therefore regard the gaps and spaces between informational processes and not just the process points of personal information handling.

Modulation harms arise from the continuous flow and constant agitation of insistent modification (D'Amato 2019: 309). The core power act that gives rise to harm is the ability to harness, direct, and provide frequency to flows of sensor data that achieve continual behaviour modification and shape social norms regarding the purposes and benefits of such modification. Modulation harms flow from the process of prescriptive governance and the ability of data collectors to harness and reassemble continuous sensor data flows. Harms also arise from the knowledge production element of modulation that seeks to produce acquiescent individuals who do not comprehend and thus do not object to the creation of their endless segmentations in the dividualised context.

The frequency of data flows is key to the operation of modulation harms. In this context, frequency is used to denote the incessant or constant flow of data, as well as the bandwidth, which refers to the granularity of data usage and the ability to harness it across infrastructure. When combined, constancy and bandwidth can be used to shape individual and societal understanding by broadening and narrowing cognitive capacities. For example, some types of modulation harms, mostly of infrastructural context, will involve wide frequencies of incessance that can result in both broadening and narrowing cognitive capacities. Regarding frequency, to use Deleuze's (1992: 4) corporation analogy, a data harvester has the capacity to harness and open sensor data flow across infrastructural plains so that the harnessed data is like a river torrent or gas leak. The data flow seeps throughout the data infrastructure and thus saturates through environmental spaces permeated by sensors. With regards to bandwidth, the seepage can be used to shape positively—for example,

to educate—or can be used negatively—to misinform. The power act therefore involves the ability to harness and direct data torrents across vast infrastructural plains and to use those torrents for knowledge production purposes. It is the harnessing of sensor data at the device level and the control of infoglut (Andrejevic 2013) at the infrastructural level.

Some types of modulation harms will involve narrower frequencies of incessance and highly targeted bandwidth outcomes. These are the types of behavioural modification pertinent to the smart home, where predictions are personalised and prescriptions are aimed at individual behaviour modification with the potential for broader societal effects (Cheney-Lippold 2011: 177). The difference between harms, therefore, hinges on the target of behavioural modification. Harms entailing broader infrastructural frequencies harness and aim the flow at a larger corpus to modulate and modify that population together. Harms entailing narrower frequencies aim to harness and direct flow to a targeted, singular audience, at specific environmental locations through devices. In that sense, the first type of harm is purely modulatory and reflects Deleuze's (1992) argument in "Postscript," whereas the second is more aligned to the concurrent applications of disciplinary and modulatory effect, as noted above. These different types of modulated harm will also have different degrees of application and effect in the smart home, as outlined by the different application of subsumption as an infrastructural harm and the others that are targeted at individualised audiences.

Hence, the importance of our use of the smart home as a means of concretizing our concept of harm. The smart home encapsulates the ability to harness, direct, and provide frequency to sensor data flows that have individual, population, and societal applications. It is a concrete exemplification of prescriptive governance and knowledge production in operation. It also provides a prime example of the seepage of data harnessers into all spaces and aspects of life—in this case, the "home." Through smart home technologies, data harnessers can simultaneously enclose the smart home in a disciplinary sense and utilise it as a data harnessing node in a vast modulatory infrastructure. The smart home is an enclosure to facilitate data collection for disciplinary purposes, and it is a modulatory faucet or conduit that enables the harnessing, directing, and providing of frequency to all smart home sensorised data collections. The ultimate power act is, therefore, the conjoined harnessing of data from the infinitesimal sensors that pervade social and physical environments with the ability to shape understanding about the nature, purpose, and outcome of that harnessing. The operation of modulated harms thus stretches from the micro-positioning of individual sensors to the macro-harnessing of directed flows of sensor data that involve different degrees of frequency and bandwidth. These principles are at the heart of our concept of modulation harms in the smart home, starting with subsumption.

Subsumption

Subsumption is a macro-level harm as it provides the ultimate theoretical position and basis for the other modulated harms presented below. It is the essence for understanding our basis for modulation and the harms that emanate. Subsumption is modulation in a hyper knowledge production mode. It is the ability to subsume space into data and to harness those data so they can be used for predictive outcomes that permeate every point of the infrastructure through continuous data flows and corresponding analytical outcomes. Seamless data flow enables connection to everything, primarily for the benefit of the data harnesser, and can be used infrastructurally to connect or disconnect, to amplify or to alienate, dividual and individual components from the broader network or society.

Subsumption is the ultimate modulatory power act because it means the vibratory impulses of modulation's vast network of enclosure can be used to pacify or to alarm, individually or collectively, and is therefore a vast social shaping mechanism regarding the normalisation of modulated flows by data harnessers. Subsumption is the realisation of absolute frequency and absolute bandwidth. It is Deleuze's (1992: 4) flowing corporate gas that we argue could reach into every space, crevice, and crack of socially constituted life. It is Cohen's (2018) warning about the fulfilment of the biopolitical domain. It is Bogard's (2009: 27) "network control of the common, of the production of life itself."

Key to understanding the harm of subsumption is the notion of tethering. Subsumption regards the tethering of all infrastructural, device, and sensor tethers. The billions of sensors that perpetuate the multitude of smart surveillance infrastructures are the power access points. The sensors are the point of entry for modulation's gaseous reach. They are the generators of data for segmented and automated futures (Elmer 2003: 237). Sensor data fuels the production of fluid codes that enables modulation's continuous re-engineering of social codes and the concomitant *socius* (Bogard 2009: 19). It is the subsumptive sensorisation that creates modulation's infrastructure and enables the constant adjustment of everything "all in the name of power and money" (Bogard 2009: 21). Subsumption then regards the deconstruction of "every desire, every social relation, percept, affect and concept, indeed the entirety of life on the planet" (Bogard 2009: 21).

Subsumption is data harnessing at such a vast scale that it transcends the morass of separate enclosures to reassemble an enclosure, an infrastructural colossus that can be harnessed and from which social shaping can take place anywhere. Consequently, the harnessing capabilities of major smart home data collectors, as represented by subsumption, mean that they have the capacity to be both panopticon and (data harnessing) corporation that can mould and modulate concurrently at will. We believe this is most clear in a specific instance of the smart home, the Google Home, which we use to outline the modulation harms that flow from subsumptive acts of data harnessing. The infrastructural scale of Google means that it already has the capacity to convert the home into an observatory that is integrated into the broader surveillance environment. The Google Home already provides unbroken monitoring of occupant activities with their ostensible consent. It assembles individuals by continuous data collection and nudging toward behavioural modification. If the panopticon represents the archetypal disciplinary technology, then the Google Home might represent the ideal realisation of modulation—the control home.

These points become apparent when we outline the three situated modulation harms that flow from subsumptive enclosure. As noted above, subsumption, as a macro harm, provides the infrastructural underpinning for the use of different bandwidth and frequency actions by data harnessers that manifest in the predicted and prescriptive nudges of the smart home. The three harms thus have a common intersection as they arise from the infrastructural context of subsumption in the form of automated nudges for the smart home. However, how those nudges unfold, and what those nudges seek to do, varies across each harm and manifests in different automated outcomes.

Amplification

Our first harm, amplification, has been most clearly articulated in the extant literature. Hui (2015) argues, based on Gilbert Simondon's (2005) work, that amplification needs to be considered as part of understanding the impact of modulation on identity formation. Here, amplification operates in three ways. First, it is transductive as it can involve a "transfer of information from one phase-state to another" (Hui 2015: 80). Second, it is modulative as informational effects can be "amplified by certain determined information or patterns of conduct" (Hui 2015: 81). Third, as a synthesis of the first two effects, amplification organises in an auto-regulatory sense. Hui (2015) further argues that amplification has three modes in a modulatory setting. It has a "crowd effect" that is characterised by the seamless and transductive speed of turning a sensor reading into a prescriptive nudge. The second mode regards the ripple effect of repeating behavioural patterns that can be transduced to "units of information" for broader purposes, such as targeted advertising or marketing. Finally, amplification acts as a mode of self-regulation of social systems. Put together, the end point of amplification in modulatory settings is to effect "auto-regulation" (Hui 2015: 82), that is the self-perpetuating shaping of individual and collective identity through automated processes of prediction and prescription.

Hui (2015) considers issues of amplification from a purely modulatory perspective, albeit one that seeks to redefine Deleuze's (1992) obliquely defined anti-capitalist base of modulation in "Postscript." Savat (2013) also considers amplification arising from modulatory and disciplinary power. The amplification of discipline that can arise from modulatory power relates to the ability to collect and aggregate data across

networks that can amplify “a disciplinary gaze in a specific space” (Savat 2013: 19-20). However, this disciplinary gaze is not panoptic but is instead aimed at “simply content or risk analysis” (Savat 2013: 25).

The amplification process outlined by Hui (2015) has similar characteristics to our notion of modulation harm above. Its transductive element relays the underlying purposes of prescriptive governance to seamlessly turn sensor data into operative nudges. The modulative element reflects the harnessing harms that arise from frequency and bandwidth capabilities. Finally, the auto-regulatory element regards the normalisation of knowledge production and the accepted auto-regulation of individuality through ongoing automated processes of dividualisation. Similarly, Savat’s (2013) considerations align with the smart home and the always-on, ever-collecting sensor data collections that flow as a normalised aspect of smart surveillance. With regards to the harnessing capability of frequency and bandwidth, our amplification harm relates to the ability to switch up signal strengths in the form of prescriptive outcomes, based on ongoing behavioural predictions, that seek to continually draw attention to, or distract from, critical realisations of increasingly normalised conditions. Amplification in a modulatory sense produces incessant short-termism, but continual short-termism can have a disciplinary effect by denying the fulfilment of long-term and critical viewpoints. It is the equivalent of docility by distraction achieved through high frequency incessancy and narrow bandwidth targeting of data harnessing.

In the Google Home, the “cautionary inferences” function (Fadell et al. 2020: 49) provides an example of amplification. Certain cautionary inferences, such as interaction with inappropriate content, can lead to automated monitoring strategies that are able to be heightened based on real-time situational analysis. For example, sensor monitor activity will increase if a babysat child is illicitly watching a “scary movie” or a child is alone in the home (Fadell et al. 2020: 45). The Google Home increases the signal that means more sensor data are collected for more instantaneous pattern recognition analysis. Equally, these signal strength enhancements can be used for fine-grained prescriptive outcomes. An alarm notification is sent to a parent who is monitoring their child after detection of five foul language uses, which can be reset to two foul language uses if the errant child is being babysat (Fadell et al. 2020: 54).

One could argue that such intense surveillance of young souls is a harm itself, but our amplification harms point to something else. It is the normalisation of Hui’s (2015) auto-regulation as an unquestioned part of an automated human life. The “cautionary inferences” are so repeatedly and deeply embedded in the infrastructural fabric of the home that incessant modification leads to a reduction of the cognitive space for critical self-reflection about fundamental human questions, such as the relationship of parent and child and the development of selfhood in conjunction to environmental surroundings. Attention is thus continually drawn to the automated output and continually distracts from the broader societal context in amplificatory forms of auto-regulation.

Vibration

Our second harm, vibration, relates to the generation of physical or affective sensations in smart home occupants through prescriptive nudges, informed by sensorised data collection. The sensorised devices of the smart home are thus sensation generators as well as data collection devices (Nemorin 2017: 13). As Nemorin (2017: 13) notes, “[s]ensation is a two-way process.” We argue that the Google Home utilises this two-way process to connect the vibrations of object movements with affective intent on individuals and spaces. These outputs in turn affect the development of selfhood that is implicated by dividualised based nudges and is predicated on environmental and cultural conditions that encourage or negate individual becoming (Nemorin 2017: 13).

A vibration harm, therefore, relates to both the prescriptive governance and knowledge production aspect of modulation. In the former mode, it is about disciplinary governance through sensation of bodies and in the latter, it is about social shaping through material changes to physical environments and the affective impact on occupants. Also key is Deleuze’s (2003: 45) observation that repeated sensation has a modulatory impact as constant vibratory sensations eventually lead to desensitisation and “nothing other than the action offerees upon the body.”

A vibration harm in the smart home setting involves the ability to settle and unsettle the affective position of occupants through sensorised device or environmental adjustments. For example, a calming vibration in the Google Home may be generated through environmental adjustments meant to optimise the comfort of occupants, such as the use of smart lights to soothe or the automated locking of doors to secure. The Google Home can also agitate occupants by, for example, brightening or flashing the same smart lights or using the smart home speakers as a warning system. In that sense, some sensor vibrations are intended to calm and settle whereas others are intended to disturb and agitate. Vibrations that soothe are anxiety reducing while vibratory agitations are anxiety enhancing. The smart home infrastructure is thus capable of oscillating between soothing and agitating vibrations. For example, the Google Home's smart doorbell is at any given time a doorbell, a security camera, a social media neighbourhood watch scheme, and a pre-emptive recorder of data and visual evidence. This shape-shifting device provides security certainty to reduce occupant anxiety while, at the same time, heightening anxiety through the constancy of presupposed security needs to the extent that an unexpected ring of the bell is a threat that requires examination of video footage before opening the door (Fadell et al. 2020: 5). Smart home vibration harms, therefore, have narrow bandwidth applications as vibrations are targeted to individual devices and homes.

It is the continual formation and reformation of sensorised devices that perpetuates and provides for the different vibratory outcomes. As Bogard (2012: 33) notes “an enclosure that modulates can vary its structure and the product it produces in response to changing contingencies of production.” Vibration harms arise from the automated ability to prescribe changes in affect, which means the facility to comfort and discomfort is displaced as a human activity and becomes a machine consequence of the predicted and prescriptive modes of modulation. The nature of human soothing and agitation is therefore shifted to the profit-driven motives of the data harnessers.

Alienation

Finally, our third harm, alienation, results from the separation of the dividual from the individual self, where “human totality is alienated from self-consciousness, and the digital self becomes a commodity” (Nygren and Gidlund 2012: 514). The individual becomes a screen on which to project the requirements of data corporatisation (Nygren and Gidlund 2012: 514). Andrejevic (2020: 10) takes this argument further and contends that alienation in the context of ongoing monitoring of consumer behaviour has an “estranged” dimension, more recently articulated as “hermetic isolation.” The complexity of predictive structures means that users cannot be aware of the ultimate purposes of data collection, and when data are reformulated into a prescriptive nudge, they do so in an “unrecognisable form as a means of fulfilling the imperatives of others” (Andrejevic 2011: 286). Alienation, or estrangement, in this context “occurs when our own activity appears as something turned back against us as “an alien power”” (Andrejevic 2011: 286; Marx 2009). D'Amato (2019: 312) also notes how alienation is reinforced by the embedded invisibility of modulation's machine environment and the opacity of its “blackbox mechanisms” which help to ensure the relationship between the controlled and the controller is imperceptible to the former. The controlled, “whose domination is not perceived as constrictive,” appears to enjoy a degree of freedom that is ultimately illusory (D'Amato 2019: 312).

These alienating effects derive from the knowledge production aspect of modulation. Our alienation harm builds on the scholarship above, and on the work of Andrejevic (2020: 107) in particular, to warn against the isolationist tendencies of predictive and prescriptive structures that seek to shape social understanding solely from the perspective of individualised cells and defined by the dividualised activities of data harnessing. The constant delivery of automated service provision, as exemplified in the Google Home, has the effect of estranging individual occupants from the cognitive negotiation of individual and collective considerations that underpin consumptive decision-making mechanisms. Key to smart home operations is the fundamentally “moral decisions” (Lewis 2011) about consumer and consumption practices that were undertaken by individual occupants in conjunction with their own socio-political ideologies and moralities. However, in the Google Home, these decisions are undertaken in a dividualised capacity through the prescriptive outcomes of incessant automation and persuasion. Consequently, these decisions are now formulated and implemented via modelled automated outcomes based on sensor-driven predictions about

desired occupant behaviours. Estrangement thus occurs because consumptive decision making is relocated outside of the home and the socio-political scope of individuals. Instead, decision making may be contracted to correlations of similar segmented populations that are unrecognisable to occupants affected by the automated outcome and are therefore morally unquestioned and dutifully accepted. In other words, modulated control is so subtle that it presents itself in the form of “choice” (Savat 2009: 57).

The harnessing activity in an alienation harm therefore results from the ability of the smart home to restrict or block data flows as well as direct them. The harm is consequently based on the ability to subtly deny or discourage access to informational networks that could extend cognitive capabilities about the societal role of selfhood development. Elmer (2003: 239) eloquently articulates the basis of this alienation harm as the “subtle form of limiting access to difference.”

The clearest example of alienation in the Google Home is the targeting of advertising based on patterns of behaviour, trends, and predicted events in the household. Alienation may also occur while nudging occupants toward programmes for self-improvement. In the Google Home, “household goals” can be constructed in several ways: by surveying occupants, inferring behaviours, or by inputs from “remote vendors” (Fadell et al. 2020: 8). While goals are selected by occupants, the Google Home may nudge occupants toward goals or rules through suggestion. The fulfilment of a household goal, such as efforts to conserve energy, may result in coupon or virtual currency rewards. In this case, a moral decision about consumptive home practices becomes consumed by the profit-driven motives of targeted ads and placements. The model’s only recourse to the outside setting is other dividualised families that have “common demographics” (Fadell et al. 2020: 51) that form the basis of household goal nudges. Such decisions are thus estranged from their own moral foundation and are conducted in a fundamentally individualistic setting that is determined solely by an automated model, isolating occupant decision making from broader socio-political choices.

Conclusion

Our article provides a first attempt at articulating different types of modulation harm that may manifest in a highly sensorised environment, the smart home. By highlighting the sensorised operation of the smart home, we identify a new way of thinking about acts of power that arise concurrently from disciplinary and modulatory modes of action. A key insight arises through the articulation of our subsumption harm. The ability of data harnessers to subsume through sensorisation potentially means that large-scale harnessers can find a means to discipline and modulate anywhere. Subsumption highlights that the multiple codes of the disciplinary society—its abstracted rules, morals, and punishments—can be attenuated by the singular coda of modulation—its incessance, circularity, and reach. Once the combination of disciplinary code and modulative coda is achieved, discipline is no longer confined to structured space. Disciplinary targeting can now reach wherever there is a modulatory tether. Consequently, for powerful data harnessers like Google, everything has the capacity to be dividualised and individualised; made visible from the invisible; fixed and yet malleable; definitive and never-ending; linear and circular; and part of both hierarchy and continuum.

The ability of powerful data harnessers to seemingly reach anywhere in the smart home gives rise to our other harms that manifest through different types of automated nudges. All three harms warn of the danger of an automated life where individuality and core social relations are predicted and prescribed through automated data processes. Amplification’s auto-regulatory considerations, vibration’s focus on affect, and alienation’s socio-political estrangement point towards a vast project of social shaping that becomes more achievable through the combination of disciplinary and modulation modes. Hence the clarion call that comes with the articulation of our modulation harms.

As a fledgling conceptual framework, our article gives rise to new questions and possibilities. One aspect is important. We believe that our concretized focus on the smart home was justified as a means of first articulating our modulation harms. However, it is unclear whether our harms are unique to the smart home context. Further examination is required about whether, and in what context, our harms would arise in other

sensorised environments, such as a workplace or an educational setting. Doing so would assist to demonstrate the macro-basis of subsumption and would indicate whether the most powerful data harnessers can discipline and modulate wherever there is a sensorised tether. This point is crucial in a legal environment that seems increasingly intent on regulating “big tech.”

Our modulation harms suggest that new forms of law and regulation may be required to properly consider the new power consequences that arise when data harnessers can discipline and modulate anywhere through tethering. Whether and how the conceptual building blocks of our harm framework can apply within existing legal frameworks, most notably information privacy law, also needs critical examination. We believe a new way of thinking about legal harm generation that goes beyond the process scope of information privacy law is required. Otherwise, modulation’s continually subsumptive effect will simply seep through the legal gateways of compartmentalised data collections and the boundaries of subsequent purposeful uses.

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