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Author(s):	Jasmine Guffond
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Listening Back

Listening Back is an add-on for the Chrome and Firefox browsers that sonifies Internet cookies in real-time while one browses online. This creative tool is utilised for a practice-based research focused on the commercial online context of extractive algorithmic surveillance technologies. As a critical mode of sonic inquiry it takes place at the convergence of Web surveillance and sensory perception to offer another approach for experiencing how surveillance itself is situated. Enacted across live performance, installation and personal computer usage, cookie data is rendered audible as a sounding strategy for interrupting the visual surface of the browser interface to draw attention to backend data capture and advance experiential engagement with the normalisation of Web surveillance. Seamlessly embedded in to our everyday Web experiences, online surveillance remains largely intangible to the surveilled. Theoretical scholarship from surveillance studies proposes that visual panopticism has been largely superseded by automated technologies of humanly incomprehensible data collection. Scholars such as Mark Andrejevic have observed how the operations of algorithmic surveillance have become post-representational. Through the affecting, time-based, and omni-directional attributes of sound, *Listening Back* proposes it's creative potential to address the post-representational character of contemporary online surveillance by simulating a tangible experience of being continuously monitored while browsing the Web. Functioning as both a creative sounding work and a platform for a critical, reflexive listening, this "material-discursive" (Goh 2017, 288-289) approach engages the materiality of sound to provide an affecting register that connects to ideas about the politics and situated knowledge that cookie data, located within the paradigm of Web surveillance, might convey.

Video Documentation: <https://vimeo.com/jasmineguffond/listeningbackdemo>

Post-Representational Web Surveillance

According to the most extensive online index of “pre-categorised cookies”, in October 2022, 41,868,335 cookies circulated across the World Wide Web and personal computing devices of which one percent were identified as ‘strictly necessary’ (<https://cookiepedia.co.uk/>).

Notwithstanding this extraordinary scale, the cookie is just one of a plethora of online tracking techniques implemented through the technical protocols and infrastructures of the World Wide Web. By way of HTML and Java Script, the Web browser, vast server infrastructures, and data mining technologies, our personal data is collected, aggregated, compiled, and sold. Such information can include data about our IP address, type of computer or mobile phone, operating system, the plugins we have installed, our searches, our likes, the websites we visit, what we buy, watch, and how long our cursor lingers on a page. Some of the lesser-known online surveillance technologies include Web bugs, audio beacons, Web RTC IP discovery, third-party HTTP requests (Libert, 2015), and device fingerprinting (Englehardt and Narayanan, 2016). Even with the passing of the European General Data Privacy Regulation (GDPR) in May 2018 (<https://gdpr-info.eu/>), by which websites are mandated to inform visitors of the tracking technologies embedded in their website, the majority of Web users within the European Union and beyond, remain unaware of the multitude of surveillance technologies monitoring their every online move.

Unlike the majority of online surveillance technologies identified above, media attention given to cookies has raised a general awareness of their existence. This was largely initiated by The Internet Engineering Task Force’s (IETF) cookie standardisation (Kristol, 2001). The invention of the cookie in 1994 provided a practical means to implement the virtual shopping cart and as a key device in the widespread commercialisation of the Web effected not just a technical, but also a cultural, commercial, and surveillant paradigm shift that transformed the Web into a space capable of non-stop, continual monitoring. Functioning as a reference number or ID that travels between Web servers, Web browsers, and personal computers, for the first time the cookie mechanism provided a protocol for online automated data collection. A technique that allows Web servers to identify users without disclosing what and how much information is being collected, making it difficult to examine a cookie’s value or what it represents (Ibid., 5). Inherent to the functioning of a cookie, is an opacity that contributes to a “privacy asymmetry” that aligns knowledge and power with the tech corporations and data broker industry that programme the automated data capture systems and

maintain the vast data mining infrastructures (Crain, 2018). This critical power dynamic is intrinsic to the Web surveillance context in which users are mostly unaware of how or what data is collected. These outwardly benign yet intrusive protocols, initially introduced by the cookie mechanism, have prospered into cultures of continual connectivity and users are frequently by default opted-in to automated data capture. Increasingly effecting our daily experience, the extraction of personal data is correlated and used to curate news feeds, influence cultural consumption, academic research (Goldenfein, 2020), consumer purchases and behaviour. Derived from online purchasing, link clicks, and browsing activities, automated techniques of data collection render human activity machine readable with the aim of escalating sales and increasing knowledge. This commercial, extractive industry, dubbed “surveillance capitalism” by Shoshana Zuboff is shrouded in a culture of proprietary secrecy, aided by the complexity and intangibility of its extraction machines (2018, 8).

Within the Web surveillance context, human sensory modes of surveillance such as eavesdropping or being watched over, have been largely superseded by the non-sensory, extractive capacities of automated algorithmic surveillance, largely implemented by major businesses such as Facebook and Google. However, while holding a majority of the market share in the extraction and commodification of personal information, they are but two players within the expanding online data broker industry (Thakur and Mann, 2014). Projected for substantial growth from 2020 to 2026 (SB Wire, 2020), the two hundred billion US dollar industry is comprised of over four thousand data broker companies worldwide, with one of the largest brokers Acxiom, owning twenty-three thousand servers to process data for five hundred million consumers (WebFX Team, 2020). The magnitude of Acxiom’s server infrastructure exemplifies how the extraction of data accumulates at scales that exceed human comprehension.

A significant framework for understanding surveillance practices was famously contributed by Michel Foucault’s theorisation of the Panopticon (1995, 195-228). However, theoretical scholarship from surveillance studies proposes that visual panopticism is an ill-fitting metaphor for automated technologies of humanly incomprehensible data collection (Haggerty, 2006, 23). Contemporary theorists such as Mark Andrejevic argue that the gaze mechanism of the Panopticon, highly dependent on a visible symbol for surveillance, has been largely superseded by post-panoptic cultures of invisible, automated data capture (Andrejevic, 2019). Andrejevic depicts how the operations of algorithmic surveillance which privilege

backend data extraction processes bypass a symbolic representation for the surveillance apparatus, thus becoming post-representational (ibid., 7 – 8, 10). Listening Back aims to address the post-representational character of Web surveillance by asking: how can artists critically simulate an online experience of continuous and ubiquitous surveillance within the very context in which its operations have, as Andrejevic notes, displaced symbolic communication (Andrejevic, 2020). *Listening Back* as a creative tool and sonic practice proposes to creatively address the operational logics of automated data capture in which human semantic interpretation and meaning making has been dislodged by the efficacy of the operation (ibid., 12). By rendering an intangible post-panoptic surveillance technique sensible through auditory means I explore the potential of sound to reinstate sense-making in the online surveillance context and thereby spaces in which the politics inherent to the activity of online surveillance operations register.

Pragmatic Aesthetics

Listening Back is a proposition for investigating algorithmic surveillance by providing a new creative approach to experiencing surveillance playing out within real-time Web browsing. Following creative data sonification practices such as those of artist Andrea Polli and her work *Atmospherics/Weather Works* (2002), it explores the use of sound as an affecting register for signaling data with political, social, and cultural consequences. *Listening Back* aims to strike a balance between interrupting an otherwise seamless browsing experience and allowing that routine activity to continue. What appears on screen demands attention, which leaves room for sound to simultaneously provide a space to simulate the presence of more opaque data capture processes. Sara Bly first hypothesised the value of sound in presenting digital information in 1982. By identifying the limits of graphical modes of representation, Bly demonstrated how sound can also be used to communicate information from a computer to a human. Recognised as a keystone proposition for sonification, subsequent research has been conducted into which contexts sound is effective for communicating information (Bergman 1990; Gaver 1993; Walker and Kramer 2004; Tuuri and Eerola 2012; Vickers 2012). Paramount for the practice of *Listening Back* is the human auditory ability to monitor peripherally (Brown et al. 1989; Fitch and Kramer 1994; Vickers 2011), as it is critical to listen to the cookie continuum while simultaneously browsing the Web. This enables the user

to engage and experience online tracking during routine Web browsing, thereby situating listening within the ontological, social, and political nexus of Web surveillance.

Through use of the *Listening Back* add-on in my sounding art practice I adopt Stephen Barrass' notion of a "pragmatic aesthetics" evident in creative sonification strategies that strive for a co-habitation of aesthetics and functionality to provide listening enjoyment as well useful information about the world (2012). This is facilitated by communicating information through the experience of sound as both signifier and affecting medium (ibid). Drawing from Patricia Clough, affect refers broadly to a relationship between bodies, organic and inorganic, and the immediacy of fluctuations of feeling that shape the experiential yet may pre-empt or evade conscious knowing (Clough 2008). As Paul Jasen reasons, "affect is never reducible to language and something of it always escapes us" (2016), yet for the practice of *Listening Back* affect refers to an experiential appreciation of sound in embodied and sensing terms. It provides a framework for evoking the arguably immeasurable "material-energetic tendencies" of sonic experience (Clough 2018). Through an interplay of aesthetics and functionality, the *Listening Back* project explores ways to engage listening with a sonic simulation of patterns and flows of algorithmic surveillance. This is enacted through personal use of the *Listening Back* browser add-on and by performatively deploying the add-on in live performance for audiences.

Listening Back live performance, Black Box, Sydney, 2017

In May 2017 at the Black Box venue at UNSW's School of Art & Design in Sydney I performed as a duo with Emily Morandini utilising the *Listening Back* Chrome browser add-on. We projected our laptop screens, greatly enlarged, directly behind us to explore the effect of magnifying the Web browser's screen display. As we browsed, a sonic rendering of cookie activity unfolded within the audio-visual dynamics of mundane Web browsing. We scrolled through our Facebook streams, clicked the Like button and conversed with each other via the messaging function. I checked my Gmail account, read articles in the Sydney Morning Herald, the Guardian, and Vogue. Meanwhile, Morandini researched Criteo (<https://www.criteo.com/>), one of the data brokers inserting numerous third-party cookies onto our laptops, read articles by the ABC's news website, searched for plane tickets, and looked up recipes. In addition, we both went shopping on Amazon. As we performed

everyday browsing routines each cookie that was inserted, updated, or deleted from our laptops triggered a sound, which gave a tangible sense of the hidden, extractive relationships intrinsic to navigation of the Web. Within the parameters of a real-time composition, we occasionally accessed the *Listening Back* interface to change the musical key of the cookies. At one point Richard Keys, one of the event organisers, began messaging me on Facebook and sent a photo he had just taken of our performance. This interaction provided a playful exchange with the audience, while a compositional structure unfolded as each website introduced its own sound signature, and its projection provided a visual context for the sound. As subsequent tabs were opened and additional websites retrieved, the soundtrack gradually became increasingly layered, evolving into a generally noisier soundscape. As the sounds became denser the contrast between the banal visuals of news websites, the smooth aesthetics of corporation home pages, and the growing cacophony of sound contributed to a palpable paradox. The extraordinary amount of cookie activity generating sound, created a stark contrast to our mundane browsing of the Web. The familiarity of the visual design of Gmail, Facebook, or Amazon's Web interfaces was interrupted by an atypical soundtrack, at once exposing and repurposing hidden processes of data extraction and situating the audience's listening within the real-time dynamics of contemporary Web surveillance.

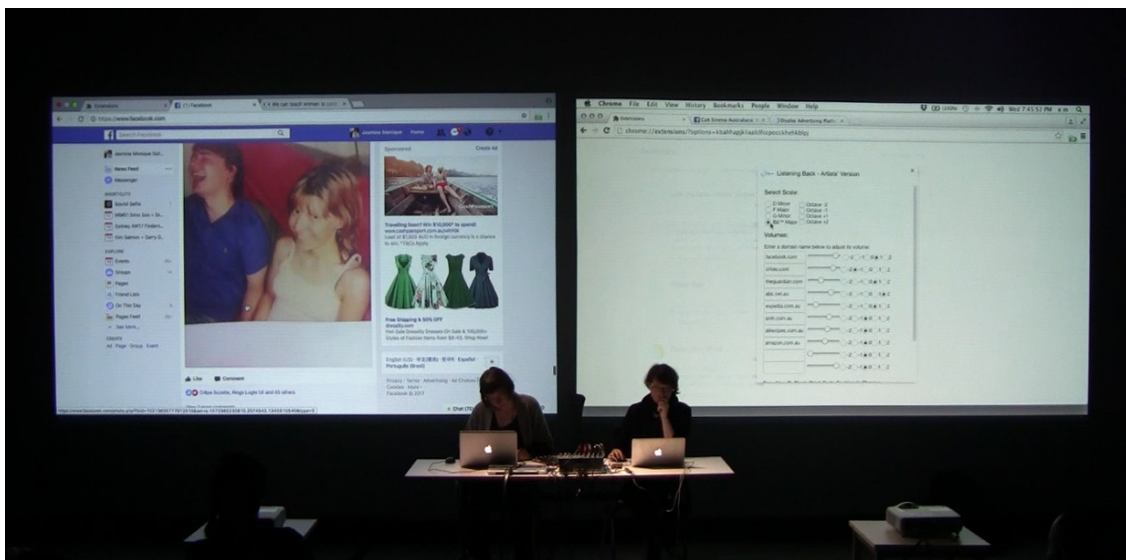


Figure 1: Browser Duo: Jasmine Guffond and Emily Morandini performing *Listening Back* at Black Box, UNSW School of Art & Design, Sydney, 10th May, 2017.

Video documentation: <https://vimeo.com/jasmineguffond/browserduo>

By rendering cookie activity audible the performance sonically highlighted how the Web browser, as interface and gateway to the Web, functions to conceal pervasive, ubiquitous, and omnipresent surveillance infrastructures. Sound provides a tangible presence for automated data capture to challenge what is ordinarily made apparent through screen displays and sonically resists the post-representational character of Web surveillance. By providing a means to experience hidden socio-political, extractive infrastructures implicit to Web browsing, a situated listening is engaged as a reflective practice. Implemented by a browser add-on, intangible data capture processes are audibly manifest and the potential of sound in providing an aesthetic space for Web surveillance to sensibly register in real-time and in situ, is explored through a live performance of Web browsing.

Sonic Skills & Listening for Knowledge

Through live performance and personal usage, listening is engaged within the audio-visual and tactile dynamics of Web browsing and its underlying surveillance, and thereby appreciates listening as one sensory mode of perception amongst many that contribute to knowledge production. By undertaking inquiry through listening, the aim is not to privilege listening and the auditory but to consider what the ear returns to the eye. By bringing intangible, backend data capture processes into the affective foreground a space is provided to re-consider the graphical display of the browser interface as a site of concealment. Through an engagement with the multi-sensory dynamics of Web browsing, the potential for sound and listening to question presumptions and re-examine the nature of Web browsing is explored. That is, the potential of a “sonic sensibility” (Voegelin 2013) to reorient the politics of visibility is investigated. Sounding strategies for simulating real-time data activities reintroduce symbolic, poetic, and sense making spaces to contribute to comprehensions of the effects of post-panoptic online surveillance.

As a sonic means of imparting information relating to cookie data processes, my sonification practices provide auditory environments for critical and reflexive listening, a mode of inquiry that listens for knowledge. As Julian Henriques notes; “thinking through sound also calls for a practical methodology of listening” (2011). Both the sound design and interface for the *Listening Back* add-on aim to encourage the development of a set of listening skills so that one may either listen to cookies in the background while browsing the Web or

engage with a direct focus on cookie data subsets via its interface. The interface, initially developed for playing cookies during live performance, allows for the signaling, silencing, tuning, and volume adjustment of particular cookies. In conjunction with the sound design the interface aims to encourage skillful approaches to listening that might be harnessed for interpreting the sonified cookie data in a more detailed and in-depth manner.

The notion of “sonic skills” has been developed by Karin Bijsterveld in her analysis of historical cases of listening for knowledge, and refers to a range of listening skills and techniques developed in pursuit of specialised study (2019). Bijsterveld’s descriptions of embodied and encultured techniques, such as the positioning of the stethoscope on the patient’s body or the handling of magnetic tape recorders, continues from Jonathan Sterne’s notion of “audile techniques”. Here, listening as a set of historically and culturally informed practices, develops as specialised skills toward instrumental outcomes (2003). Sterne’s conception of audile techniques investigated the professionalisation, industrialisation, and capitalisation of listening during modernity (ibid., 93). As a twenty-first century audile technique, *Listening Back* navigates a post-representational, surveillance (late) capitalisation of listening. That is, to *listen back* implies that someone or something is already listening and thereby addresses the context in which users are by default opted in to being continuously ‘listened in’ on in the online context. To *listen back* is to investigate what it means to be listened in on by automated algorithmic data capture, an automated, operational, and algorithmic listening.

Drawing on the concept of sonic skills, I have developed a set of ideas and practices to formulate a critical engagement with cookie activity through listening. The *Listening Back* interface was initially designed to allow performers to change the key, the octave, and the volume of individual cookies. The intention was to create an instrument for live performance that provided for musical manipulations and a means to impart information inherent to the sonic unfolding of real-time cookie activity. Previous experience with earlier sonification projects has indicated that dissonance can have the effect of disrupting in a way that makes audiences disengage or users simply turn the sound off (<http://jasmineguffond.com/art/Anywhere+All+The+Time>). Moreover, when working with real-time data the results tend to occur unpredictably, a phenomenon that is particularly evident with cookie data as the online surveillance ecosphere is perpetually expanding, transforming, and mutating beyond one’s capacity to fully monitor and adapt. As an

indeterminate composition, Listening Back is driven by real-time post-panoptic surveillance processes, and it thus benefits from a simple harmonic structure that aids listeners in deciphering the complexity of simultaneous and unpredictable layers of sonic information.

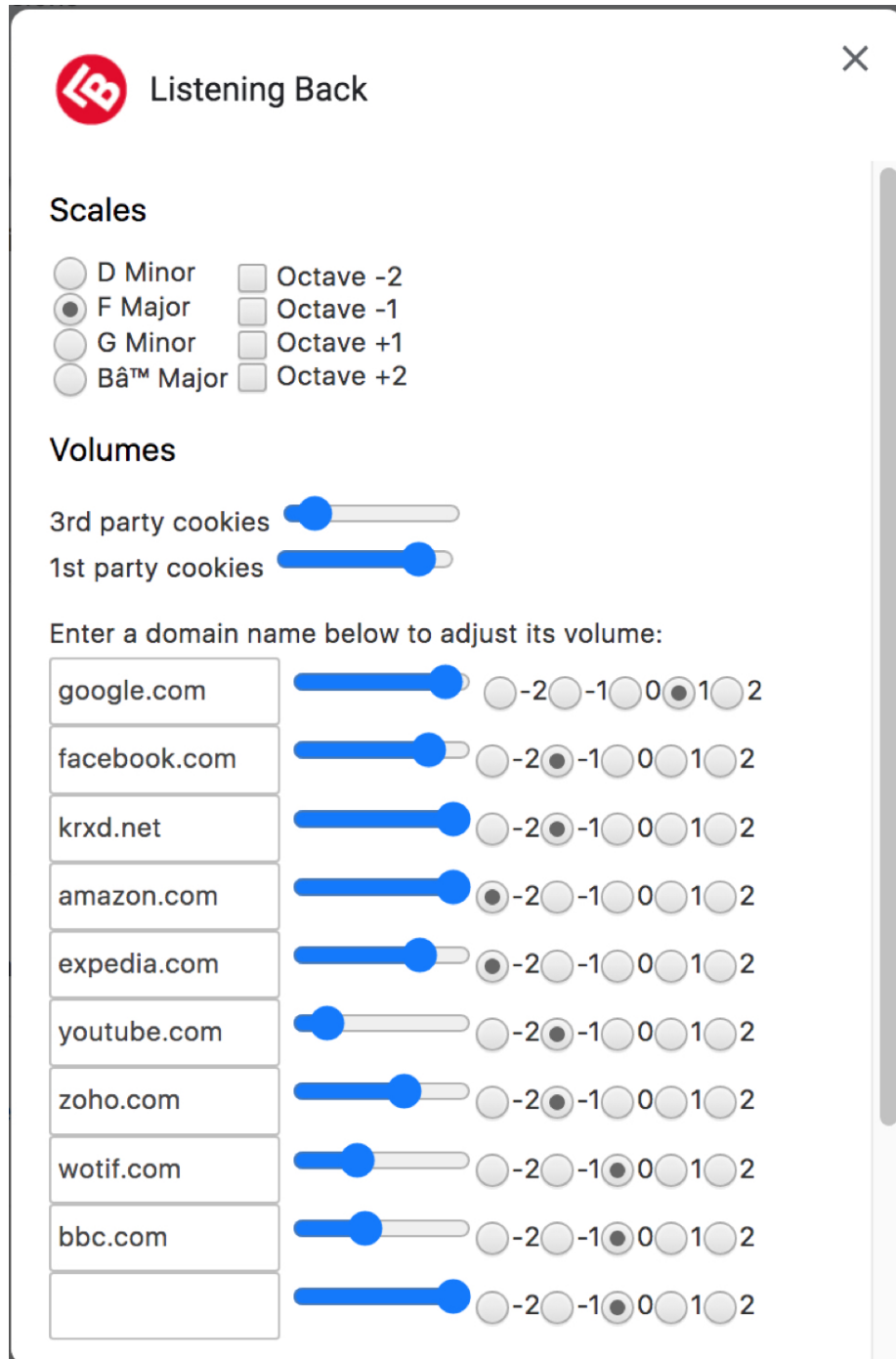


Figure 2: *Listening Back* interface, Chrome browser.

In addition to changing musical keys, the interface enables users to decipher between first and third-party cookies as well as between cookies specific to particular Web domains. This functionality is activated through volume sliders that allow for the turning up or silencing of individual data sets. First and third-party cookies are predominant data subsets that carry particular privacy implications. The primary operational difference is identified by their host, which is the domain name of the site that, via the browser, inserts cookies onto computers. A first-party cookie is a cookie with the same domain name as the website one is currently visiting, and a third-party cookie is any cookie with a domain name other than the website one has currently loaded. First-party cookies are only inserted or read by the website while one is visiting it and normally are not employed to monitor activity across different websites. Third-party cookies, on the other hand, are implemented by numerous, divergent websites and function as an effective method for tracking users across the Web. Typically inserted onto personal computers via advertising banners, scripts, or tags added to a web page, they enable data brokers to track users across different sites, gather information, and aggregate behavioural profiles to sell on to strategic partners such as advertisers. My aim was to encourage users to develop the listening ability to decipher between first and third-party cookies by providing a timbral based sounding difference and, furthermore, through the interface guide a diagnostic listening.

During the process of mapping sound to cookie data I came to understand not only the significance of the difference between first and third-party cookies but also the prevalence of major trackers such as, though not exclusively, Google and Facebook. To highlight predominant networks of surveillance, I designed specific signature sounds for the major online platforms: Google, Facebook, Amazon, YouTube, Expedia and some of the third-party advertising cookies that are prevalent across many websites, such as [krx.net](https://cookiepedia.co.uk/host/.krx.net) (<https://cookiepedia.co.uk/host/.krx.net>). Max Breedon is the programmer I collaborated with during the development stage of this project, and he suggested using the [timbre.js](http://mohayonao.github.io/timbre.js/) library because at the time it was a practical method for generating Web audio (<http://mohayonao.github.io/timbre.js/>). Hence, sounds were designed using digital waveform synthesis: sine, saw, or triangle waves, white noise, alongside a range of sound effects such as equalisation, delay, phasor, flanger, and reverb that can all be employed together in various combinations. The humanly incomprehensible scale of post-panoptic online surveillance can only be rendered sensible in part. Considering the extraordinary amount of individual cookies

circulating the Web and personal computing devices it was impossible to design a sound for each one. Hence, a sound called ‘pluck’ from the `timbre.js` library was selected as the generic cookie sound. The goal was to provide a sense that something else is taking place beneath the visual surface of the browser interface through a creative and pragmatic sound design that is both communicative and listenable over time. Pluck’s sound, reminiscent to that of a single guitar string being plucked, was suitable as a sound that is played continuously by numerous cookies. The note of each generic cookie is generated from a number produced by a hash of the cookie’s domain name. In this way, the pluck sound is subtly varied to provide an impression of a complex ecosphere of millions of cookies.

Throughout this research-led practice I have received varied feedback regarding *Listening Back*’s sonic aesthetic, including from peers who have asked “why did you make the cookies so beautiful?” or “I found them fun, but then I’m a tech cynic”. Then there were others who while enjoying a Web browsing performance found the sounds too annoying to have running for long durations on their own computers. Perhaps it is the relentlessness of the cookie’s activity in itself that is annoying when sonified. There were also reviews from differing sources such as a data security magazine which proclaimed “listening to Web cookies can be very interesting, even though they are not particularly musical” (Perekalin 2020), and an art blog which found that, “the plug-on [sic] for chrome and firefox translates data generated from cookies into (rather unpleasant) sound” (Regine 2018). A degree of surprise or disquiet regarding the disclosure of ubiquitous hidden cookie surveillance may also play into the aesthetic response to a performance, installation, or personal usage. As an article in *The Irish Times* states, “if you enjoy the wobbly psychedelic synth of Boards of Canada you might like listening to the onslaught of cookies but if, like me, you have both Adblock and Privacy Badger installed on your browser then you will begin to worry about how many of these third-party cookies they are managing to catch and block.” (Boran 2021)

The Browser API

The sound design and development of the add-on was also determined by certain technical protocols, practical considerations, and cultural factors particular to the political and commercial context of post-panoptic Web surveillance. These include the parameters of the cookie data, Browser API’s, online power asymmetries, limited access to data, Web browser

opacity, proprietary secrecy, computing and processing power, the size of speakers on computers, and the humanly incomprehensible and ever evolving scale of online data capture infrastructures. As previously discussed, regarding the magnitude of networked data collection it is only possible to sonify a portion of its vast infrastructures. This is largely determined by the Browser API (application programming interface), a Web protocol critical to the *Listening Back* add-on and its deployment across artistic and personal listening contexts.

A Browser API is a programming interface for a Web server or browser that predetermines the objects, actions, data, or protocol third-party developers may access in order to execute the development of a third-party application. Functioning as a gateway the browser API determines what cookie data the *Listening Back* add-on can access. As Polli states regarding her own sonification work, as a translation process data sonification is a reductive procedure that necessitates a simplification of the data (2020). The representational form of the data sets used is not a simple analog, but rather a process of translation techniques that are inherently reductional, indexical, and symbolic topologies. For *Listening Back*, this is first determined by the browser API and therefore the data Google or Mozilla allow third-party developers access to. This includes each time a cookie is inserted onto the user's computer, deleted from the user's computer, or overwritten, but other information such as when a cookie is read by the Web browser and the Web server are excluded. The limited cookie data set accessible for sonification is indicative of the proprietary control inherent to the political, technical, and commercial online surveillance context. It makes apparent privacy asymmetries intrinsic to the situation in which Web developers are provided with limited access to data in contrast with the capture-all logic of data extraction practiced by the data broker industry and Big Tech. From the outset it became clear that the data I have access to is determined by major tech corporations and furthermore that there is a monopoly on distribution infrastructure, such as the Web stores for add-ons or Web browsers themselves.

CONCLUSION - Post Third-Party Cookies

Google announced its intention to block third-party cookies in the Chrome browser by January 2022 (Cyphers 2021). Through AI-driven technology such as the Federated Learning of Cohorts (FLoC), the proposed aim is to develop alternatives to third-party cookies so that

advertisers can track consumers in a way that Google argues would be more private. As a new online tracking technique, FLoC employs machine learning to group people with similar interests and demographics by enabling the browser to collect data which is then purposed to assign individuals to a cohort (Kaye 2021). Instead of personal data typically provided by the third-party cookie to advertisers, Google's cookieless method categorises groups of at least one thousand people, an obfuscation tactic that proposes to hide users within a crowd of similar interests. However, FLoC is deeply flawed – aside from the third-party cookie, it does not remove other forms of tracking and analysis but rather adds to them, rendering users potentially easier to identify (Doffman 2021). The question is not whether to track user activity, but rather how to present an automated tracking technology as being somehow more private. Rolled out with Chrome 89 in March 2021 (Lardinois 2021), the FLoC initiative is an indicator that the Web surveillance context is continually evolving and that Google's parent company Alphabet is focused on moving from advertising based revenues to becoming major players in the development of A.I. technologies (Elliot and Marakami Wood 2022).

Driven by the commercial imperatives of Big Tech the Web tracking ecosphere is complex, largely controlled by proprietary protocols, and subject to ongoing change. The operational logics of post-representational Web surveillance renders its ever-changing infrastructure difficult to engage and comprehend, as these algorithmic processes often bypass human, semantic modes of comprehension. *Listening Back* has addressed the post-representational character of Web surveillance through the development of creative sounding strategies for rendering the continual and ubiquitous flux of the ever evolving cookiesphere, sensible for human experience. Sound's durational and omni-directional functioning registers online surveillance as occurring spatially, temporally, and ubiquitously. Considering the ever evolving online tracking ecosphere, the artistic practice of *listening back* to cookies is an open-ended proposal that could be further developed to include the sonification of other and newer tracking technologies. To this end I plan to make the source code available in the tradition of open source coding practices. To make the source code open invites anyone with the inclination and programming skills to develop their own adaptations for the add-on as well as build upon and evolve its artistic and functional potential for other contexts and usage.

As a sounding strategy I have focused on a pragmatic aesthetics that aims to impart information about the sonified data as well as produce experimental audio works within the multi-sensory dynamics of browsing the Web. The *Listening Back* plug-in has been developed

in particular for Web browsing performances, an installation and personal use (<http://jasmineguffond.com/art/Listening+Back>). I am currently embarking (thanks to a research stipend from the Berlin Senat 2022) on a second developmental phase for this project that focuses on working collaboratively with musicians to explore *Listening Back*'s potential as a musical instrument for live improvisation with other players of musical instruments as well as recording composed musical work. Through musical improvisation I aim to investigate particular tensions inherent to the normalisation of online surveillance and how collaborative music practices can playfully intersect these current situations. Deeply entrenched in everyday communication and thereby daily life, surveillant participants often assume creative, active, and performative roles in offering personal information to online platforms. The idea of playing cookies with an instrumentalist provides a subsequent position to a critical listening back to data capture. Through musical improvisation our relationship to mundane, everyday surveillance, becomes one that intersects a critical engagement with a positive playfulness and thereby particular tensions inherent to contemporary surveillance lifestyles.

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