International Journal of Communication 16(2022), 1441–1459 1932–8036/20220005

"I'm Not a Robot," or am I?: Micro-Labor and the Immanent Subsumption of the Social in the Human Computation of ReCAPTCHAs

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This article analyzes Google's reCAPTCHA as one instance of what Hardt and Negri have conceptualized as a subsumption of the social as opposed to the extracting taking place under conditions of formal and real subsumption, which occurs in a punctualized production process (e.g., manufacture or fordist factories). Like Hardt and Negri, we see digital networks as having enabled a new commons that capital is trying to subsume. We trace the subsequent development of reCAPTCHA as an ever-evolving form of subsumption of the social that varyingly reconfigures elements of hybrid, formal, and real subsumption. We distinguish between two phases in the subsumption of the social. In a first phase, dispersed micro-labors are captured, aggregated, and put to use to improve the use value of Google's free Web services. In a second phase, we see that reCAPTCHA tools evolve into a tracking technology, allowing for an immanent subsumption of the social. We observe that thus processes of autonomous and cooperative work in the digital commons are brought under capitalist relations.

Keywords: algorithmic governance, audience commodity, CAPTCHA, commons, digital labor, exploitation, Google, Hardt, human computation, Marx, micro-labor, Negri, ReCAPTCHA, rent, subsumption, value

In January 2015, an American citizen filed a lawsuit against Google for not compensating her for her labor: the actions necessary to complete the security test administered to users when they sign up for a Gmail account (Harris, 2015). This test, the so-called reCAPTCHA, asked users to transcribe poorly legible alphanumeric characters to prove that they were not bots (i.e., software written to perform automated tasks such as indexing websites or, more maliciously, guessing passwords). Despite its legal dismissal (Dinzeo, 2016; *Rojas-Lozano vs. Google Inc.*, 2015), the case did manage to publicly foreground a debate within media studies. Namely, whether to interpret online user activity as labor, and hence value-creating activity.

Two camps can be distinguished: those who argue that online users indeed provide unwaged labor that produces surplus value (Fuchs, 2010, 2011; Terranova, 2000), versus those who argue that users are

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not laboring but instead are constituted as an audience, with the website charging rent to advertisers in return for access to this audience (Caraway, 2011; Rigi & Prey, 2015). In political-economic terms, extracting rent differs from deploying labor in a production process in that the former generates an income that does not require any labor to be expended: Once a house or a piece of land is owned, it can be rented out with no or minimal investments and there is no value-generating labor involved. This is the reason why classical political economists like Adam Smith opposed it, since "rent was an expression of the undesirable power of the feudal aristocracy and represented an unearned extraction from the profits of capitalist investment" (Garnham, 2015, p. 298).

In this article we do not confront the *labor versus rent* debate head-on. Instead, we opt to focus on different modes of subsumption of labor under capital. Taking up Michael Hardt and Antonio Negri's (2018) recent engagement with this topic, we posit that as production and exploitation are no longer punctualized in enclosed and controlled spaces, but instead are spread to innumerable places across society (i.e., throughout the social factory), the category of subsumption may provide a way of resolving the strict binary of the *labor versus rent* debate without wholly abandoning either analytical framework. More specifically, the subsumption framework allows the delineation of the historical specificity of contemporary forms of socialized labor, making possible the differentiation between objective socialization and objective individualization of labor.

In what follows, we correspondingly analyze Google's reCAPTCHA as one instance of what Hardt and Negri (2018) have recently conceptualized as a new form of exploitation. Namely, the subsumption of society *itself* to capital: while ostensibly the reCAPTCHA tool is a *human authentication tool*, it is also an apparatus or dispositif, set-up by Google, to track, capture, and deploy computer users' movements and capacity to discern. Its ubiquity across the Internet means that this dispositif effectively envelopes the whole of society.

By focusing on the category of subsumption, this article aims to approach the question of digital labor through a historically and technologically specific understanding of what constitutes labor and the strategies deployed in its exploitation. Like Hardt and Negri (2018), we see digital networks as having enabled a new commons that capital is trying to subsume; reCAPTCHA is one example of such a subsumption device. Through a detailed analysis of the original CAPTCHA and its subsequent mutations like reCAPTCHA, we argue that the widget combines and reconfigures elements of hybrid, formal, and real subsumption, while also introducing a new element, namely the immanent mode of its subsumption.

Theoretical Framework

Formal, Real, and Hybrid Subsumption in Marxist Thought

Unlike value, surplus value, or primitive accumulation, the concept of subsumption is, on the whole, not prominently foregrounded in *Capital Volume 1* (Marx, 1976). Yet, on closer inspection, the notion of subsumption underpins many of the analyses in Marx's *magnus opus*. In volume 1, subsumption presents itself mainly in a twofold form, namely in the distinction between formal and real subsumption. Both forms

of subsumption are essentially historicizing concepts, introduced by Marx for periodizing different phases of the capitalist mode of production.

Formal subsumption refers to the earlier phase of capitalism, that of manufacture (cf. Mandel, 1976, p. 944). In the *Economic Manuscripts 1861–63*, Marx and Engels (2010a) describe the formal subsumption of labor by capital as follows:

> Historically, in fact, at the start of its formation, we see capital take under its control (subsume under itself) not only the labour process in general but the specific actual labour processes as it finds them available in the existing technology, and in the form in which they have developed on the basis of non-capitalist relations of production. It finds in existence the actual production process—the particular mode of production—and at the beginning it only subsumes it formally, without making any changes in its specific technological character. (p. 92)

During this first stage, the existing labor processes are not fundamentally changed but are brought under the command of capital through two processes: first, the gathering and centralizations of the workers into one single space (the manufacture), and second, the installment of the wage relationship (i.e., workers sell their labor power for a salary). Whether the latter takes the form of an hourly or a piece rate is irrelevant: what matters is that the workers' capacity to work is bought, used, and brought under the control of the owner of capital. This is dependent on a prior separation of workers from the means of production, which are in the hands of capital owners. But the production process is still conducted in the same way as during the precapitalist era, hence the name "formal" subsumption: Capital attaches itself onto the existing (i.e., precapitalist) labor processes without reorganizing them. This also means that the worker retains some level of autonomy over the work process, albeit in a diminished form in comparison to independent commodity producers.

Because capitalists required higher control over labor productivity, more intense forms of control were needed. The mechanized factory is the prime example of such a centralized, controlled workplace. In it, we find a second form of subsumption that is fundamentally different from its predecessor:

> Formal subsumption means that wage-labor relations are imposed on particular forms of labor without transforming the mode of production. Real subsumption in contrast means a qualitative change of the mode of production so that more radical organizational and technological changes take place. (Fuchs, 2018, p. 458)

Under real subsumption capital no longer has an external relationship with the work processes but directly intervenes in them, thus transforming them. In the process, the workers are subsumed by capital, no longer in the formal sense of being hired and brought together by capital, but by becoming a function in a sequence of production events that the workers no longer control, reducing them to cogs in a whole. But—and this needs to be stressed—real subsumption simultaneously *increases* cooperation among workers, while emptying the term of its voluntary and mutually beneficent connotations. As with formal subsumption, the

workers do not own the means of production, but neither do they control the speed of work, which is now set by the factory owner. All of this implies a significant loss of labor autonomy.

> For Marx, real subsumption has not only negative consequences:
>
> With the real subsumption of labour under capital [. . .] the development of the productive power of labour takes place, in that *the productive forces of social labour* are developed, and only at that point does the application of natural forces on a large scale, of science and of machinery, to direct production become possible. (Marx & Engels, 2010b, p. 106; emphasis added)

That Marx mentions the effect of real subsumption on the development of "the productive forces of social labor" is important. By this he means the "heightening of the productivity of labor and the scale of production" (Marx & Engels, 2010b, p. 106), thus creating the material conditions for a future communist society. Real subsumption as such contributes to what Marx (1976) regarded as the *objective socialization of labor* (i.e., the tendency of the capitalist system to increasingly depend on intra- and international work processes; pp. 1052–1055). And, as the remainder of this theoretical framework aims to clarify, it is with the historical specificity of contemporary forms of this socialization that the analytical purchase of subsumption becomes most obvious.

Real and formal subsumption are the two forms that have received the most scholarly attention, for the good reason that these are the only two forms that receive sustained attention in Marx's writings. There is, however, a growing body of literature that points to the existence of other forms of subsumption in Marx's writings. Scholars like Nicholas Vrousalis (2017) and Gilbert Skillman (2007) have successfully teased out these other forms of subsumption of labor by capital. The one that interests us here is what Vrousalis, echoing Marx, dubs *hybrid* forms of subsumption (Skillman prefers the term primitive subsumption, but it describes the same phenomenon). Hybrid subsumption designates those forms of capitalist relations *before* the installment of the wage relationship, that is, before formal subsumption is fully established. Marx describes this period as antediluvian because it does not belong to capitalism proper but is a transitional form. These early capitalisms are usury and mercantile capitalism. The usurer and merchant do not directly buy labor power from the direct producer. Instead, they either advance money with which the direct producer buys raw materials and pays the lender interest after having sold the completed goods (usury); or, in the case of mercantile capitalism, the merchant buys and distributes raw materials among a number of direct producers, who transform them into finished commodities for a piece price, and the merchant in turn sells the finished commodities (for a higher price) on the market, pocketing the difference. An example of the latter is the putting-out system.

Hybrid subsumption differs from formal and real subsumption in some crucial aspects. First, it is a mode of production characterized by the geographical dispersion of production. Unlike with the manufacture or the factory, usury and mercantile capitalism do not concentrate workers in a single workplace. Instead, production typically takes place in the worker's home—a synonym for putting-out is domestic production—and since the direct producers live across the territory, production is not punctualized but dispersed. Second, and related to this: Under hybrid subsumption, the worker has a large degree of autonomy over the work

process. In fact, Skillman (2007) defines hybrid subsumption as "a condition in which capitalists hire labour power as a commodity yet don't exercise any direct control over the labour processes set in motion by the workers they hire" (p. 223). If there is any control by the capitalist, it is indirectly, at a distance, through the rewarding of contracts and through manipulation of the piece price by the putter-out (in usury, there is no control over the production process whatsoever). Finally, hybrid subsumption does not separate the direct producers from the means of production, to the contrary: Both usury and putting-out leave at least some of the means of production in the hands of the direct producers (actually, usury presupposes it, because without means of production, even in the minimal form of a set of tools, the direct producer would not be able to transform the raw materials bought with the credit).

Table 1. Differences Between Forms of Subsumption.

Form of subsumption	Spatial organization of work	Workers' autonomy over work processes	Type of control by capital	Remuneration
Hybrid	Geographically dispersed	High autonomy	No direct control; at a distance	Unwaged
Formal	Centralized; punctualized in the manufacture	Relative autonomy	Direct but external: grafts on existing work processes	Waged
Real	Centralized; punctualized in the factory	No autonomy	Direct and internal: reorganizes production processes	Waged

Subsumption of the Social

In recent Marxist work, we have seen the introduction of yet another form of subsumption, namely "the subsumption of *society itself* to capital" (Hardt & Negri, 2018, p. 416; emphasis added) for which we will use the shorthand "subsumption of the social." It differs from hybrid, formal, and real subsumption first in the object of subsumption: Whereas in the latter three, the focus was on the labor *process* being subsumed, with social subsumption, society itself is subsumed. To understand what is meant by this, we use Hardt and Negri's (2018) *The Powers of the Exploited and the Social Ontology of Praxis*. In line with their previous arguments (and of Italian autonomism in general) Hardt and Negri (2018) argue that in the postfordist era, roughly from the 1970s onward, the capitalist mode of production changed irrevocably:

> We have left the era in which capital organized exploitation primarily via the norms and discipline of large-scale industry and we are entering a phase in which capital tends to develop in large part through forms of the extraction of value from "common goods" and from the ever vaster social organization of the common in the form of the expanded cooperation of living labour. (p. 415).

In response to a period of social struggle as well as because of increasing automation, Hardt and Negri (2018) argue, workers were forced out of the fordist factories and were compelled out of material necessity to rely on social networks outside of the factory. One can think here of workers' collectives operating outside

of the control of capital, or forms of cooperation like tool-sharing platforms, but also of open-source software that is free to use but nevertheless produces use values ("services"). In fact, Hardt and Negri (2018) stress the role of digitalization and informatization in these social networks, which consists of a complex of "integrated productive services that connected in social labor complex technologies and fundamental sciences, industrial services and welfare" (p. 417). Capital, deprived of its source of value, subsequently tried to "extract[. . .]—for its own valorization—the social wealth produced in common and, in this sense, tends to subsume the entire social field" (Hardt & Negri, 2018, p. 417), leading to a new kind of composition of labor power.

Although this shift to postfordist extraction techniques is on a path to ascendancy in primarily the global North (and even there, it is not yet as ubiquitous as claimed), the observation made by Hardt and Negri remains a valid one. As the capital relation nestled itself everywhere, the forms of subsumption coevolved. Unlike the real subsumption of the fordist factory, where capital directly commanded and reconfigured living labor in an enclosed space, we now have a return to the control at a distance that we witnessed during the era of hybrid subsumption. In fact, as Hardt and Negri (2018) continue, "Today [. . .] the connection between exploitation and its organization are defined by an ever increasing distance" (pp. 417–419). Unlike with formal and real subsumption, this extraction is executed through a nonwage form, for example, through finances (Hardt & Negri, 2018, pp. 418–419). Additionally, if during the era of real subsumption the exploited consisted of a number of finite workers (the employees of the factory), in the era of subsumption of the social, it is *society itself* that is exploited, with the innumerability that the latter suggests. This is precisely what the term subsumption of the social captures: that production and exploitation are no longer punctualized in enclosed and controlled spaces but are spread to innumerable places across society—in short, throughout the social factory.

In *The Powers of the Exploited and the Social Ontology of Praxis*, Hardt and Negri's (2018) focus is on finance as a form of subsumption of the social, but in an important remark, they reframe finance, namely, as one instance of a wider phenomenon of "the capture of the common"—which is just another term for subsumption of the social: "The hegemony of finance must still be understood in terms of the mode of production: finance functions as an apparatus of capture of natural and social values [following] the traces of the common" (p. 419). This equation of the social with the commons is not new in their work (see Hardt & Negri, 2009), and it is particularly relevant for the analysis of the reCAPTCHA tool.

Here, we can already make a preliminary comparison between subsumption of the social and the three preceding forms. If the historical movement is from hybrid to formal to real to social, it is clear that in some aspects, the subsumption of the social is a return to hybrid subsumption. Both modes of subsumption do not rely on production taking place in punctualized places but instead are a way of capturing geographically dispersed acts of labor "at a distance." Both are also characterized by a high degree of labor autonomy and the absence of a wage.

Table 2. Hybrid, Formal, Real, and Social Subsumption.

Form of subsumption	Spatial organization of work	Workers' autonomy over work processes	Type of control by capital	Remuneration
Hybrid	Geographically dispersed	High autonomy	No direct control; at a distance	Unwaged
Formal	Centralized; punctualized in the manufacture	Minor autonomy	Direct but external: grafts on existing work processes	Waged
Real	Centralized; punctualized in the factory	No autonomy	Direct and internal: reorganizes production processes	Waged
Social	Decentralized; geographically dispersed across networks	High autonomy	At a distance: capturing the commons	Unwaged

Although Hardt and Negri's (2018) analysis is inspiring, it is high on abstraction and low on specifics. Apart from that, it involves "a set of communicative networks and digital connections" (p. 416); the reader does not learn *how* the social is subsumed. Neither does Hardt and Negri's (2018) analysis offer any analytical tools to distinguish between different ways of subsuming the social or between different uses of digital technologies. This article is an attempt to flesh out these technical, almost mundane, questions by using Google's reCAPTCHA as a case study. Because, as we will demonstrate, though the reCAPTCHA apparatus is indeed generally speaking a tool for capturing the common, its operation and various mutations over time suggest various modalities in the subsumption of the social. Rather than indicating the emergence of the objective socialization of labor (i.e., the social as understood by Hardt & Negri, 2018), the analysis will show that the reCAPTCHA tool has moved toward what is best described as the objective *individualization* of labor, albeit in a networked (and, in that sense, "socialized") structure. The analytical purchase of the subsumption framework lies, as such, in the nitty-gritty delineation it allows of the historical specificity of these contemporary forms of the socialization of labor.

Where subsumption of the commons has an impact across the whole of the social body, with such exploitation taking place both within and outside of wage-relationships, critical analysis of exploitation should include not only the sites where labor is expended but also the loci where labor power is reproduced (which, in some cases, are the same). The discussion here would thus, arguably, benefit from an interaction with social reproduction theory and, more broadly, critical Marxist work on gender, sexuality, race, and colonialism. Correspondingly, the current article makes common cause with the theoretical coordinates of social reproduction theory, which aims, as noted by Tithi Bhattacharya (2017), at rendering "visible labor and work that are analytically hidden [. . .]" (p. 2). Similar to the analytical move of one of the early theorists of SRT, Lise Vogel, to seek out the "conditions of possibility" for the reproduction of labor power, this article sets out to delineate the conditions that make possible the subsumption and valorization of unremunerated labor (Ferguson & McNally, 2013, p. xxiv). While the intervention here does not directly address the long-

standing discussion on domestic labor and care work, the insights provided by the subsumption framework might be helpful for future analyses in understanding the historical and contextual specificity of the labor involved. However, given the firm situation of this article's theoretical discussion within the Autonomist Marxist body of work of, for instance, Terranova (2000) and Hardt and Negri (2009, 2018), we have opted to limit the scope and leave an extended engagement with this broader field for a different article.

The Curious Tale of a Turing Test:

From CAPTCHA to Google's ReCAPTCHA: Verifying the Internet's Humanity.

The term CAPTCHA (which stands for Completely Automated Public Turing test to tell Computers and Humans Apart) refers to a type of software that was conceived in 1997 by Mark Lillibridge, Martin Abadi, Krishna Bharat, and Andrei Broder, for the security purposes of the now defunct AltaVista search engine (Brodić, Amelio, & Janković, 2018, p. 12995; Lillibridge, Abadi, Bharat, & Broder, 1998). As that engine was vulnerable to malicious automated requests for page indexing, it required an effective test for differentiating between queries issued by human users and those issued by bots. Such a test came to be situated in an algorithm running server-side that, upon a request from the user's browser for a certain operation, generated a visually distorted string of random alphanumeric characters, supposedly illegible to bots but not to human users, which, after being reentered into a given field and assessed by the server, would either grant or refuse access to the requested operation (Lillibridge et al., 1998).

Although this type of software was patented in 1998, the term now commonly used to refer to it was only proposed in 2000 by computer scientists Luis von Ahn, Manuel Blum, Nicholas Hopper, and John Langford (Captcha.net, 2010). Ahn and colleagues' (2008) reCAPTCHA project that followed, attempted to improve on the program, by then widely used by various websites, by substituting the random alphanumeric characters, distorted images, and simple math questions with poorly legible characters from books and newspapers in a simultaneously running digitization project (Ahn et al., 2008; Recaptcha.net, 2009). By transcribing these characters as reCAPTCHAs, users were, in fact, contributing to the development of Optical Character Recognition (OCR) software in a crowdsourced digitization project (cf. Foley, 2014). After, Von Ahn and others, such as Michelucci and Dickinson (2015), have called this *human computation* "distributed systems that combine the strengths of humans and computers to accomplish tasks that neither can do alone" (p. 32). Google bought the reCAPTCHA project in 2009 for its own enterprise of digitizing paper media and creating searchable archives (CyLab, 2017). In addition to assisting and developing its OCR-software, the tech-company used the data generated by reCAPTCHA (v1) to improve Google Maps' Streetview and to train machine learning systems (Google, 2018a). With the latter application, the tech giant followed the suggestion proposed by the software's inventors to use certain CAPTCHAs as a way "to advance the field of Artificial Intelligence" (Ahn, Blum, Hopper, & Langford, 2003, p. 294). The original 1998 patent for this software, which is now assigned to Google LLC, notes that in addition to its application toward search engines, the necessity for such a test stemmed from, on the one hand, the undermining by bots of an advertisement model of the Internet as based on site-audience size and advertisement engagement, and on the other hand, the spamming of networks and inboxes with automated messages (Lillibridge et al., 1998).

Looking into the fundamental form of these initial installments of CAPTCHA and reCAPTCHA from the viewpoint of subsumption, we observe that reCAPTCHA in this first form involves a subsumption of "the social" in a number of ways. First of all, a CAPTCHA is inserted in the communication flows of individual Internet users, effectively arresting the flow of communication and forcing them to execute a small task. This performs two functions: the humanity of the user is established, and the (use) value of the various Google services is further enhanced because the user provides input for machine learning to take place (thereby increasing the quality of these Google services). CAPTCHA here functions as a gatekeeper or, to use a more recent term, an obligatory passage-point (Latour, 1994, p. 37): If users want to access the requested website or service, they cannot skip the CAPTCHA. Because there are a plethora of CAPTCHAs spread across the Internet (see next section), the results of all of these decentralized micro-acts of labor are recentralized in a similar way that Facebook's *like button* effectuates a dynamic of decentralization and recentralization (see Gerlitz & Helmond, 2013). It is the latter moment, when the individual and geographically dispersed micro-labors (which have little use value on their own) are recentralized within the confines of Google's ambit that constitutes the precise moment of capture of the social—and also the moment when the aggregated micro-labor acts obtain their use value. Second, note also that this dispositif captures the common in two other senses: (a) by inserting itself in between the communication flows of many geographically dispersed Internet users it intercepts and putting to use the networks in which the commons circulate; and (b) even though these micro-labors are individual, the capacity to discern is shaped by the collectivities we belong to: collective knowledge and perceptions are shared sensibilities and thus belong to the commons (Hardt & Negri, 2009, p. viii).

In other words, this is something more specific than the provision of what Terranova (2000) calls free labor: acts that are "[s]imultaneously voluntarily given and unwaged, enjoyed and exploited" (p. 33). What Moulier-Boutang (2011) describes as cognitive capitalism, a political economy based on the exploitation of "collective cognitive labor power" (p. 37), is probably the best term to frame what reCAPTCHA does in this first phase. In cognitive capitalism, "the essential point is no longer the expenditure of human labour power, but that of *invention-power* [. . .]: the living know-how that cannot be reduced to machines [. . .]" (p. 32).

Even though Moulier-Boutang (2011) has the tendency to overstate the creativity and inventive power required for computerized networking, at least in the case of reCAPTCHA but also in digital sweatshops like Amazon's Mechanical Turk (see Ettlinger, 2016), it is nevertheless clear that this kind of cognitive work not only differs from the fordist factory, but also that it is enabled and at the same time dependent on networked communication.

One might object that since users are not paid for solving a reCAPTCHA, it is not a form of subsumption by capital and that, hence, it stands outside of capitalist relations. However, as the previous discussion on hybrid subsumption made clear, the absence of a wage relationship does not equal the absence of capitalism. It is true that filling in a reCAPTCHA does not involve a monetary exchange between the users and Google, but Google uses the aggregated reCAPTCHA user-input to improve the quality of its services and thus attract and generate more user interactions, which, in turn, generate an advertisement income for Google (since access to members of the audience and their particular profiles is what Google sells on the

advertisement market). In this way, users' input is unpaid for (and thus "free"—for Google, that is), but it is nevertheless part of a validation circuit that in a later stage involves monetization.

The earlier-made comparison with Facebook's like button is instructive in that reCAPTCHA differs in one crucial aspect, namely that clicking the like button on external websites is a voluntary act. A reCAPTCHA widget, on the other hand, inserts itself as an obligatory passage-point and thus forces the user to provide micro-labor. The user can, of course, decide not to use the requested website and is, in this sense, "free," but this freedom is structurally similar to the freedom of the worker *not* to work for the capitalist: behind the formally equal position of worker and capitalist lies an asymmetric relationship, of those who own the means of production versus those who have only their labor-power to sell. Because of this asymmetry, workers are "compelled to sell themselves voluntarily" (Marx, 1976, p. 899). *Mutatis mutandis*, the same asymmetric situation, confronts Internet users: since they do not own the means of communication (i.e., the particular Internet service that they want to make use of), they are formally free but, in practice, are forced to fill in the reCAPTCHA.

Ostensibly, CAPTCHA's verification use lies with the external website, who wants to prevent automated input. But note that also for Google, the Turing test is of crucial importance, since its entire business model is built on selling access to *human* attention. In this sense, establishing the humanity of users is the precondition for Google's advertisement model to work, and the exclusionary practices involved in the verification process indicate a widespread development in the subjugation of online activity. This becomes particularly pronounced when one interrogates the specifics of the latest generations of reCAPTCHA software and their function in the assimilation of the digital commons into the Google ecosystem.

From "No CAPTCHA" to the Invisible ReCAPTCHA

Currently, Google's reCAPTCHA (all versions, except v1) is used by more than 4 million websites in total. Of the top 10,000 most visited sites, 46.5% use this software. From a mere 75 sites in that segment in 2012, the subsequent versions have shown a rapid gain in market share over the past eight years to the current number of 4,651 sites, even doubling between 2018 and October 2020 from a 23.5% to a 46.5% share of the top 10K market (Builtwith, 2013, 2018, 2020). Since 2014, reCAPTCHA (v1) has slowly been phased out and has been discontinued as an application programming interface (API) option for users and developers to implement on their sites as of March 2018 (Guerar, Merlo, Migliardi, & Palmieri, 2018, p. 257). Instead of this first version, which was text and image based, Google rolled out the click-based NoCAPTCHA reCAPTCHA (i.e., v2) in 2014 and the Invisible reCAPTCHA (i.e., v3) in 2017.

Google introduced v2 naming reasons of security and accessibility: The CAPTCHA's had become increasingly less secure as machine intelligence developed and bots became more sophisticated over the years, which, in turn, spawned a reaction from developers resulting in the increased illegibility of the tests (Guerar et al., 2018, p. 257). The second version of reCAPTCHA does away with the initial necessity to solve a text-based challenge and instead asks users to check a box stating they are not a robot. Upon clicking, the reCAPTCHA risk analysis engine (RAE) determines whether the user is to be granted access to the point beyond or whether a challenge is required (Google, 2018b). If the latter is the case, v2 falls back to presenting a challenge similar to those of v1. Here, a pop-up appears containing—depending on the

assessment of the RAE—either an image reCAPTCHA or an alphanumeric one (Sivakorn, Polakis, & Keromytis, 2016a, pp. 2–4). The image reCAPTCHA presents the user with a set of images out of which the user is required to select the two to four images that correspond to the object requested for identification (Sivakorn et al., 2016a, p. 2). The text-based reCAPTCHA presented here is not the OCR type from v1 but rather a generic scramble of characters.

The third version of the reCAPTCHA (v3) gets rid of the widget altogether and runs in the background. Its RAE can be called automatically or programmatically, either initiated by user action or upon meeting programmed conditions. In all cases, when conditions are met, a JavaScript call is made to the reCAPTCHA API server. For all call paths, the subsequent steps are the same: The user is presented with a pop-up following the trajectory of v2, if a negative security assessment is generated by the RAE (Google, 2018b).

When the widget has been loaded onto a visited page, either for v2 or v3, data about the user's browser is collected while the browser is verified and checked for signs of automation (Sivakorn et al., 2016a). Upon clicking on the check box of v2 or when the set of conditions of v3 are met, the following data is sent to the RAE: (a) an (NID)cookie for the google.com domain placed onto the browser, and (b) the encrypted data obtained from the various checks run by the front end of the API (i.e., the widget or the invisible process of v3). In order for a checkbox captcha to be presented or no reCAPTCHA to appear at all, the (NID)cookie needs to be at least nine days old—this is regardless of the trust assessment of the user's IP, browser, or even a Google account, if present. Although the (age of the) cookie seems to be a necessary input variable for the RAE algorithm, the data obtained from the browser check also seems to play a role in determining whether or which reCAPTCHA is presented before the nine-day threshold (cf. Sivakorn, Polakis, & Keromytis, 2016b). The exact data sent to the API server under (b) is heavily encrypted—making it difficult to reverse engineer the RAE algorithm since the input variables at play are obfuscated. In the case of v2 however, the source code has been deobfuscated by an anonymous contributor to Github (Neuroradiology, 2014). The deobfuscated code indicates a form of browser-checking that is particularly important here: *canvas fingerprinting* (Sivakorn et al., 2016b, p. 394). Since both v2 and v3 call to the same Google domain, before and after the initial request has returned, it stands to reason that the encrypted information in both versions is, to a large degree, similar.

Canvas fingerprinting is a Web-tracking mechanism suggested by Mowery and Shacham (2012). Contemporary browsers running HTML5 (e.g., Chrome, Safari, Firefox, or Android Browser) use a Canvas API that allows for extended functionality by drawing on the operating system and hardware of the machine rather than in-browser resources. Such a reliance on machine resources entails that information on the browser's operation can be deployed to differentiate between users' systems. Accordingly, canvas fingerprinting works by first having a script on a website render text onto a canvas element, set to be invisible to the user visiting the page, and second to read "the pixels produced" for soft/hardware specific differences (Mowery & Shacham, 2012, p. 1). Taken together, these differences constitute a consistent and relatively unique fingerprint of the browser and machine—especially when combined with information on, for instance, the plugins used. In their empirical study of Web-tracking technologies on the top 10,000 visited sites, Acar and colleagues (2014) correspondingly note that "correlating [these fingerprints] with cookie based identification" (e.g., cookie syncing and ever cookies), as, for instance, third-party trackers

are known to do, allows for cross client (i.e., across sites and devices) identification of users (pp. 674–680). Strikingly, they observe that the capture and tracking of these persistent and long-term fingerprints cannot be blocked without compromising functionality and is not halted even if users have opted out via governmental or corporate options. A reason for the latter, Acar and colleagues (2014) suggest, is "that most companies offering or honoring the opt-outs [. . .] do not promise to stop tracking when a user opts out, but only behavioural advertising" (p. 685).

In the case of reCAPTCHA v2, and presumably v3, the specifics of the canvas fingerprint are checked by the RAE against the information on the user's browser and OS as reported by the user-agent (i.e., the browser) to the visited website and with the initial request to Google's API server (Sivakorn et al., 2016b, p. 394). Where Acar and colleagues (2014) found that a minimum of 5% of the top 10,000 sites contain (third-party) scripts running canvas fingerprinting, we may argue that with its 46.5% prevalence, Google's reCAPTCHA is currently one of the most widespread cross-client tracking technologies as it too combines these fingerprints with user-identifying cookies, such as NID, as mentioned above under (a)—and SID and HSID if a signed-in Google Account user is involved.

That canvas fingerprinting is used by Google to identify users across different clients (i.e., devices) can be deduced from an observation made by Sivakorn and colleagues (2016b): A cookie generated and thus linked to a certain user-agent can be used by a different one without triggering the RAE to invoke a challenge. Because cookies, which are meant to be stored and read locally, can be moved between clients without generating a challenge, indicates that reCAPTCHA v2 and v3 are more than mere botguard software, since this creates a severe security risk and therefore probably is not the result of faulty coding (as of 2016, this vulnerability seems to have been mended upon publication of Sivakorn et al., 2016b, p. 400) In fact, what the fingerprinting allows for is establishing the history of how a particular ID (possibly linked to a Google account) is associated with different user-agents and thus patterns of online behavior. Even if on some of these user-agents the user does not use a Google account, reCAPTCHA enables the registration of a user history, which ties precisely into Google's business model.

The question then becomes: what does Google do with that data? Users visiting websites running v2 or v3 are presented, respectively with a widget or a reCAPTCHA logo, both of which contain links to the general *Terms of Service* (ToS) and privacy policy applicable to all of Google's services. Although visitors are not presented with a section of the ToS *specifically* pertaining to reCAPTCHA, individuals looking to sign up for Google's reCAPTCHA API so as to implement the software into their website's source code are met with the following text:

> You acknowledge and understand that the reCAPTCHA API works by collecting hardware and software information, such as device and application data, and sending these data to Google for analysis. The information collected in connection with your use of the service will be used for improving reCAPTCHA and for general security purposes. It will not be used for personalized advertising by Google. (Google, 2018c)

While the last sentence assures the reader that the data is not used directly for targeted advertising, the previous sentence remains more ambiguous: Data acquired through canvas fingerprinting (i.e., "hardware

and software information") is collected by Google for purposes of "analysis," which seems to uncouple reCAPTCHA from Google's business model. However, we argue that this data can nonetheless be very well used by the tech-giant to underpin its advertisement-based model, albeit in an indirect manner, by first establishing the humanity of users, and second by tracking these human users across the different browsers and agents used to access the Internet. To understand the details of how this works, we must turn to the position of reCAPTCHA and its API in the Google ecosystem.

The Affordances of ReCAPTCHA for a Horizontal API Structure, the Authentication of the Common

It is well known that income from advertisement comprises nearly all (98.9%) of Google's revenues (cf. Alphabet, 2017). Various researchers have argued that Google's business model shows a great deal of similarity with those of broadcast-era network television, observing that supposedly free content and services are deployed to foster user engagement that, through advertisement, can serve as the basis for the valorization of either audiences, online work, user generated content, and/or data (cf. Fuchs, 2010, 2011; Lee, 2011). Rieder and Sire (2013) note that although these similarities are indeed present, the monopolistic relationships Google has with its users and advertisers indicate "very different configurations of both practice and power" (p. 196).

As Bechmann (2013) argues, in the oligopolistic structure of the Internet, major players such as Google and Facebook deploy specific data strategies to leverage their position vis-à-vis users, developers, and advertisers, and to subsequently establish the before mentioned "asymmetrical power relationships [. . .] making them more powerful as data hubs and [obligatory] passage points" (p. 75). Bechmann (2013) observes that in comparison with Facebook's vertical strategy of collecting data points under "the overarching theme of socializing" and feeding this data back to the central Facebook domain, Google has pursued a horizontal strategy aimed at "collecting data points across a user's everyday doings" (Bechmann, 2013, p. 84). Where Facebook initially was limited in its data collection to its own domain, various initiatives deployed from 2006 onward, such as the share and like button and Facebook connect (i.e., login by Facebook), have allowed the company to establish external points of data collection as well (Bechmann, 2013, pp. 80–82; Gerlitz & Helmond, 2013). Although Google has from the very beginning expanded its range of external points of data collection by focusing on providing various services and products to both users and developers, its corresponding horizontal strategy of setting up open APIs that can be integrated into websites and domains outside its own has had the consequence of a problematic scattering and diversification of the collected data. This was a problem because, as Bechmann (2013) observed, where Facebook's vertical strategy inherently authenticates the collected data, Google's compiling of authenticated data linked to registered accounts with "public nonauthenticated" data from, for instance, Search and Maps, rendered some of the data points "less valuable because they [could] not be cross-correlated" despite the implementation of a single privacy policy (p. 84).

Google's ReCAPTCHA API allows for the amelioration of the problem of its horizontal data strategy. As a cross-client tracking technology, which bundles authenticated and nonauthenticated data by means of its users' acceptance of the privacy policy and ToS, reCAPTCHA makes it possible to cross-correlate the collected data. However, this cross-correlation is not so much aimed at direct use for the valorization of the

data as much as it is to secure the *conditions* for said valorization. The establishment of cross-correlation is the necessary precondition by which Google's garden can become a greenhouse. As Chun (2018) reminds us: "'Real Names' or unique identifiers lie at the heart of Big Data analytics, for they are crucial to syncing disparate databases and calibrating recycled data" (p. 61). Establishing cross-correlationality allows for the highly individualized tracking and authentication of users as they circulate in the communication commons.

The resulting "authentication of the commons" has little to do with the emancipatory potential of the Internet. Instead of "the objective socialization of labour and production," we see here a form of *individualized socialization*: Individual users are tracked and traced as they move through the digital commons, a phenomenon aptly described by Julie Cohen as "privatized commons" (as cited in Powles, 2015, para. 5). As a result of this privatization of the commons, the processes of autonomous and cooperative work in the digital commons are brought under capitalist relations of production.

Conclusion

This article delineates the various forms in which the social is subsumed through subsequent iterations (v1, v2, and v3) of the (re-)CAPTCHA human computation tool. The analysis has shown that the subsumption of the social takes two different forms in two different periods.

In a first phase, CAPTCHA and reCAPTCHA (v1) were used to capture the collective knowledges and cognitive categories along the lines of Moulier-Boutang's (2011) cognitive capitalism. Concretely, this meant that the widgets captured the *capacity to discern* of individual Internet users, so as to improve various Google services. This was done by inserting the tool as an obligatory passage-point in between the visitor and the requested Web service, thus forcing the user to perform microtasks in return for access. By subsequently recentralizing these dispersed micro-labor acts into the Google domain, we encounter a far-reaching form of "objective socialization," because the work of multitudes is brought together and made interdependent. Moreover, by using them to improve machine learning, Google not only captured but also valorized these acts by creating new use values (OCR first, improvement of Google Maps Streetview next). But we also observed that as human verification tools, they established users' humanity—not only for the requested website but for Google as well.

Despite that Marxist thinkers situate hybrid subsumption before the advent of capitalism, the arrangement during this first phase nevertheless resembles in some crucial aspects of the *antediluvian* hybrid subsumption: They have in common that labor is unwaged and takes place in a geographically dispersed manner. The main difference with hybrid subsumption is the relatively low levels of user autonomy. If users want to access the requested website, they must solve one or several reCAPTCHA quizzes.

From v2 onward, the tool was reconfigured to recede into the background, and it was less based on the direct soliciting of free micro-labor (even though the practice did not disappear entirely). Rather than valorizing "conscious" user input, reCAPTCHAs now deployed various techniques to identify users and cross-track them across different browsers and user agents. This solved a particular problem that followed from Google's horizontal strategy, namely the dispersal of data across different data points that could not be tied to a particular (human) user. One can pose the question if such cross-tracking still counts as a form of

subsumption. We have tried to show that this is indeed the case. Because reCAPTCHAs v2 and v3 largely operate behind the back of the users and do not require any conscious user interaction (or a Google user account), the communication taking place in the digital commons can be registered, tracked, and monitored, and all of this at a distance, without direct, visible meddling by Google, thus offering users a high degree of seemingly unfettered autonomy—an important difference between the first and the second phase.

Because Google's services are ubiquitous on the Internet this implies that *all* of the communication taking place in the spaces of the commons is monitored and authenticated, effectively subsuming the social by drawing it into Google's greenhouse. This means that the subsumption of the social in this second phase is not grafted *a posteriori* on existing communication flows, but that it is immanent to them. Here, the theoretical difference between hybrid, real, formal, and social subsumption becomes clear, and the analytical purchase of the latter is most poignant: Google's reCAPTCHA dispositif has moved from the subsumption of geographically dispersed acts of labor, to surveying and organizing *all* of the networked communication through a horizontal data strategy. This latter phase ensures an immanence of exploitation, combined with a high degree of user autonomy. Even if one takes Google at its word that reCAPTCHA cross-tracking is not used for targeted advertising, it is clear that such an immanent subsumption of the social is the precondition for the latter to take place.

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