Designing for Difference: How We Learn to Stop Worrying and Love the Doppelganger

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ABSTRACT

To use social media is to interact with digital representations of oneself in the form of algorithmically-determined personalized content. Yet when we assume that interactions with personalized content will be a persistent feature of our futures, the concepts available to frame such digital representations – things variously called doubles, twins, and doppelgangers – appear as worryingly creepy. Where might one find optimism amid such presumptive creepiness? Through conceptual analysis of data doubles, digital twins, and data doppelgangers, we identify and explain one source of justifiable optimism. Unlike the double and twin, the data doppelganger's dynamics center *difference* rather than *presumed sameness*. Fostering justifiable optimism about the futures of personalization – with social media as a starting point – requires learning how to design for the experience of difference represented by the doppelganger: the irreducibility of the person to the represented user.

CCS CONCEPTS

• **Human-centered computing → HCI theory, concepts and models**.

KEYWORDS

data doppelganger, data double, digital twin, data subject, posthuman, onto-epistemology, social media, personalized content, creepiness, justifiable optimism, difference

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1 INTRODUCTION

Social media platforms like TikTok are systems that serve users with personalized content. Such personalized content is algorithmically-selected in relation to a user's online behavioral data and is often described explicitly as "for you" (e.g., [54, 56, 77]). In the form of something "for you," such personalized recommendations reach out from beyond the screen to *you* in a language you know – the intimacy of the second-person, the immediacy of direct address. Such a reaching out constitutes the context of interaction with which we concern ourselves here. In particular, we are concerned with how available concepts subtly configure the actors implied in the posthuman assemblage of the erstwhile user – an assemblage often described as the data subject [21]. For all of its linguistic familiarity, the inferred "you" that peers back from the other side of personalized content surfaces and realizes a defiantly flatter ontology than the one to which we have bent our subject/object/predicate worlds so as to communicate *about* them.[1]

In our present sociotechnical conditions of entanglement [31], we become more obviously (if also nebulously) posthuman through the ubiquity of computing (i.e., as members of the category, "data subject"; e.g., [16, 17, 48, 88]). Yet the *language* and *concepts* available to describe such posthuman conditions as we might achieve within the emergent category of the data subject filter such conditions through the dualism of the grammatical subject and object – and they do so to creepy [63, 69], even dreadful [37], effect. How might we see beyond the continued normalization of what we already know to be creepy [67, 69]?

Written in the tradition of humanistic HCI [7], this essay adopts an epistemologically pluralistic position. It does so to identify the kinds of agential cuts [6] that available concepts seed when used to describe the assemblage of actors that comprise the micro-level context of an individual user (i.e., a data subject) receiving personalized content served to them via social media. Such implicit agential cuts necessarily color and shape the *kinds of human* that HCI designs for, constructing them as either products of normalized creepiness or as resistors of the logics that allow creepiness.[2] Such epistemologically pluralistic inquiry becomes necessary as HCI's objects of study grow to account for its own success in "pushing" [7] the computer further into the social world of people.

...

When two-thirds of the world's population are social media users, the importance of understanding the futures latent within personalization becomes apparent: such content shapes the infrastructural experience [63] of "you".[3] Yet because of the privacy-invasive data practices that facilitate personalization on social media under the

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[1] The entangled digital worlds experienced by data subjects are not ones sensitively describable through simple subject-object relationships. Nor are they productively characterized by historical assumptions about the dualism of sociality and nature (see: Latour on modernity [53], Haraway on naturecultures [41], and Parikka on medianatures [58].)

[2] Barad describes agential cuts as follows: "Agential cuts do not mark some absolute separation but a cutting together/apart – 'holding together' of the disparate itself" [6, p.46].

[3] As of 2024, roughly five billion people, or 67% of the world's population, are social media users: https://www.statista.com/statistics/617136/digital-population-worldwide.

regime of surveillance capitalism, (e.g., [67, 69, 71, 82]), receipt of algorithmically-personalized content is also a persistent site of creepiness. Futures in which hyper-personalization remains a core design logic for serving social media content therefore appear as implicitly and presumptively creepy.[4] They are futures lined with funhouse mirrors – unreliable reflections that narrate the present tense and force the co-existence of competing ontologies.

From the perspective of a social media platform, the motivation for serving up personalized content is simple. Personalized content sustains and increases *user* engagement, which results in sustained or improved monetization [23, 60]. Fine though such a model is when interpreted strictly in relation to the financial viability of social media corporations, such a base motivation for serving up personalized content leaves much to be desired from broadly humanistic (e.g., [8, 83]) and onto-epistemologically progressive (e.g., [5, 6, 31, 78]) perspectives.[5]

Algorithmic personalization that is solely motivated by increasing engagement reduces *people* to a specific kind of object optimized for use in surveillance capitalistic markets (i.e., users). Such shallow personalization thus presents as a cruel optimism [12, 13]: in this context, an attachment to the idealized, data-driven representational Other through which various sociotechnical conditions may be improved, but which is deeply tied to the degradation of the set of values represented by the term, "human" [64].[6]

We seek *justifiable optimism* in the futures of personalization: modes of designing interaction with personalized social media content that foster self-reflection and acknowledgment of the irreducibility of the self even as it is distributed in cyborgian systems [42]. In contrast to cruel optimism, we define justifiable optimism as an affective-aesthetic relation to phenomena in the world (e.g., interactions with algorithmic personalizations) grounded in the pragmatic logics of satisficing [75]. Such satisficing must, however, and in the context of justifiable optimism, be undertaken in the light of human resilience and ongoing care for the set of values represented by the largely symbolic term, "human" [64]. Per Dostoevsky, humans *can* acclimate to (almost) anything; but that doesn't mean they should have to [63].

In search of such optimism, we analyze three theoretical constructs from the literature that may be used to frame data subjects' interactions with personalized content on social media: the data double [40], the digital twin [36], and the data doppelganger [85]. We focus on these three concepts for two reasons. First, they are the most prominent in the interdisciplinary literature about digital *representations* of things-in-the-world, up to and including individual people.[7] Second, conferences and symposia on these concepts have been frequent in recent years, yet there has been little-to-no comparative analysis of the concepts – and certainly none from an HCI perspective.[8] As such, two questions motivate our analysis:

(RQ1) *What are the conceptual dynamics of data doubles, digital twins, and data doppelgangers in relation to personalized content on social media?*

(RQ2) *Is there justifiable optimism to be found in such dynamics?*

While the problematics of algorithmic personalization obviously extend beyond the context of social media use (e.g., banking and finance [48, 88]), we limit the analysis presented here to the context addressed in our RQs. By focusing on the conceptual dynamics of data doubles [40], digital twins [36], and data doppelgangers [85] as they relate to the mundane phenomenon of social media use, we identify a possible pivot toward *justifiable optimism* in the futures of algorithmic personalization on social media and beyond. We do so to offer a productive foil to the discourses of surveillance [40], control [50], and creepiness [63, 69] that birthed the terms, and which create pervasive conditions of cruel optimism [12, 13] at the scale of the "data subject" (e.g., [70, 88]). Further, we do so to identify a foothold for designerly resistance to the data gluttony of pervasive personalization.

Against the interdisciplinary backdrop described above, our work is further motivated by: (i) a call from within the HCI community to explore the limits of personalization on social media [56, p.5-6]; and (ii) prior calls to engage in language-centered work in HCI as we come to grips with looming, hyper-algorithmic futures [72]. We make four contributions to the HCI literature:

(1) provide the first conceptual analysis of data doubles, digital twins, and data doppelgangers;
(2) describe the *conceptual dynamics* of such concepts in relation to personalized social media content (i.e., how the concepts seed agential cuts among the assembled actors they describe);
(3) explain the need to design in such a way that privileges *experiential difference* over hyper-personalization; and
(4) situate designing for difference as means of manifesting justifiable optimism.

2 BACKGROUND AND FOUNDATIONS

We begin by introducing an example scenario to ground our conceptual analysis. Such a scenario constructs a hypothetical but realistic micro-scale context in which a given social media user interacts with a social media platform in the form of receiving personalized content. We then present a systems framework to scaffold thinking in such a micro-scale context. Such a framework is used solely for illustrative purposes. As we engage with the concepts that concern us, we will return to the scenario and systems framework to illustrate.

2.1 Example Scenario

Pat is a nineteen-year-old college student. They are also a social media user. Enamored of TikTok, Pat often spends the last moments of their day scrolling through cat videos on their For You Page (FYP). They find it to be both relaxing and engaging. The content reflects their vibes.

[4] See Seberger et al. [69] for a discussion of the normalization of creepiness in data-hungry in app culture.

[5] We deploy "humanistic" here in the sense of humanistic HCI where the dated signifier "humanistic" expands to include posthumanist and more-than-humanist positions [29].

[6] Seberger and Bowker [64] argue that in posthuman archives, "human" acts as a signifier for a set of values worth perpetuating *in service* to more-than-human care for our worlds and those entangled phenomena-things in it.

[7] Such terms as "databodies," for example, have not survived [62]; although they are echoed in such terms as "data selves" [55].

[8] As examples of such symposia, consider Data & Society's "Digital Doppelgangers" workshop in May of 2023 and the "Digital Twins and Doubles: Media of Cooperation" symposium convened by the Media of Cooperation group at University of Siegen in July of 2023.

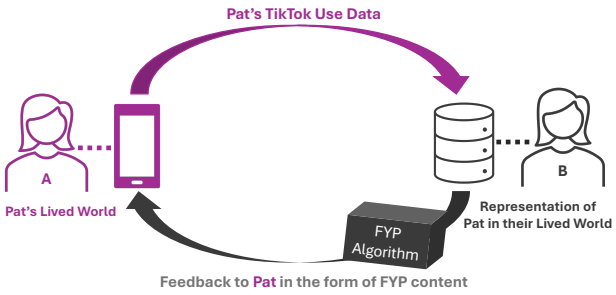

Figure 1: This figure provides a stylized depiction of the micro-scale systems context in which a given user interacts with personalized content on TikTok. The system is comprised of a user-device assemblage (A) and a stylized representation of social media platform back-ends (B). A and B are connected in this system by a feedback loop in which behavioral data about a user's TikTok use moves from A to B, is algorithmically processed, and results in the presentation of personalized content back to A by way of the functionally black-boxed FYP algorithm.

> *This morning, the sink backed up in Pat's dormitory bathroom. They searched up videos on unclogging sinks, called maintenance, and went to class. After returning home, doing some coursework, and eating dinner, Pat lies down to scroll through some cat videos and relax. They find their FYP populated with "super satisfying drain unclogging!!" clips.*
>
> "I watched *one* video," *they say to themselves as they just keep scrolling.*

We provide this scenario in order to ground the analysis that follows: an analysis that seeks to assess the onto-epistemological implications of framing that which peers back at data subjects [21] as a "data double," "digital twin," or "data doppelganger." We explore the possibility that through the characteristics of the terms used to signify such Others, the application of such terms seeds agential cuts [5] that centralize or specifically de-centralize *people* like Pat.

2.2 Systems Framework

Pat's interaction with TikTok can be understood and represented as a system. As such, we will rely on a simplified systems framework to represent the concepts we analyze.[9] Figure 1 presents a representation of social media use as a system.

In relation to the Pat scenario described above, the primary actors involved are: Pat (i.e., a *person* who is also a user, represented in purple and with the letter "A"); TikTok (i.e., the social media platform, represented by an assemblage of servers, a functionally black-boxed algorithm, and the letter "B"); and flows of information from Pat to TikTok (i.e., from A to B) and from TikTok back to Pat (i.e., from B to A, as mediated by the FYP algorithm).

[9]By "systems," we mean to connote a perspective open to cybernetics [86], complex systems [57], infrastructure studies (e.g., [79, 80]), and cultural techniques [35, 73, 74]. Such a perspective allows that contemporary mundanity emerges as a function of infrastructural assemblages.

The analysis we provide will demonstrate how Pat or their Other – the inferred, data-driven representation of them that they encounter through receipt of algorithmically personalized content on social media – is either centered or de-centered when their interaction with personalized social media content is framed using the concepts of the data double, digital twin, or data doppelganger, respectively. By "centered" or "de-centered," we mean whether Pat as an embodied actor, for example, is understood to be the primary actor in the system, or whether such concepts seed agential cuts that de-center Pat by constructing data-driven representations of Pat as the primary actors in the system. In essence, ours is an investigation into the ways in which the human (as a set of values [64]) may be distributed across the posthuman assemblage of the data subject. Such centralization or de-centralization has to do with the nature of the feedback loop directed from TikTok to Pat (i.e., from B to A in Figure 1). This will become clear through the conceptual analysis that follows. But first, we provide an abbreviated overview of relevant literature.

2.3 Personalization and Identity

When users interact with algorithmically personalized content on social media, they are exposed to information derived from their past online behaviors. In *being* information (i.e., difference that *may* make a difference [cf [9]]), such information requires assessment in relation to the user's *experiential* sense of self.[10] A great deal of research describes relationships between algorithmic personalization and identity (e.g., [14, 20, 54, 56, 76, 77, 84]). Such work is contextualized by a relatively long history of concern over the roles that algorithms play in the construction of daily life – particularly non-experts' understanding of such roles (e.g., [16]) and their laborious efforts to exert control over algorithms (e.g., [17, 70]). Yet exploratory work among teenage TikTok users indicates that such laborious auditing or gaming of algorithms might be a thing of the past: today's teens have grown up alongside the increasing reach of personalization [56]. McDonald et al.'s findings provide evidence that young social media users have normalized personalized content as reflections of their *selves*, but that they are uncomfortable with the privacy-invasive normality of personalization [56].

More broadly, prior works have considered the ways in which social media use challenges identity (e.g., [77]), particularly in relation to the framework of intersectionality [56]. Indeed, such work (perhaps unintentionally) reifies the location of identity as separate and separable from one's *self* [54] in order to reconcile the experience of self with the receipt of personalized content; yet such works are generally oriented toward triage-like implications for design [26]. Where Lee et al. [54] approach encountering digital representations of oneself through the metaphorics of refraction (i.e., light through crystals), they also concede the power to define identity to external actors (e.g., algorithms, platforms). We trouble such concession through actively situating identity in the embodied self.

[10]Per Goldstein [38, p.243] the self refers not to an individual as a biological organism or actant – an Other than can be reductively known through observation or definition – but to the experiential and embodied understanding that a human has of their state of being in cultural, historical, material, and social contexts. It is rooted in the perceptual continuity of encountering the world [45].

2.4 The Creepiness Backdrop

Interactions with representations of oneself tend toward a nebulous discomfort often described as creepiness (see: [71, 81, 82]) – particularly when set against the backdrop of recent work on creepiness in HCI (e.g., [67, 87]) and the normalization of affective discomfort in relation to surveillance-capitalistic data practices [69]. Yet creepiness remains a slippery concept, in part because of its vernacular appeal.

The earliest work on creepiness in and around HCI is from 2012 [82] and 2014 [71]. It coincides roughly with Tene and Polonetsky's canonical legal theory of creepiness in relation to technology [81]. HCI work on creepiness remained sporadic until the past few years, spurred by research in psychology [52]. Wozniak et al approach creepiness as a property of devices or apps: something to be designed around [87]. Seberger et al. [69] approach creepiness as part of a larger set of negative affective experiences related to enrollment [19] into app culture. Subsequently, Seberger et al. [66] described the existence of at least two discourses of creepiness in HCI: an aesthetic discourse that focuses on the appearance of computational technologies (e.g., [87]); and an existential aspect that focuses on the human experience of interacting with surveillance capitalistic app culture (e.g., [63]). They posited that addressing the aesthetic aspects of creepiness cannot address the existential aspects of creepiness unless by chance [66].

Our approach to creepiness is aligned with the existentialist approach (e.g., [63]) in which creepiness emerges as a result of experience of alienation that is precisely located at the muddy ontology of people in relation to algorithmic media. (When language forces the world into a rough triptych of subject, object, and predicate, the aspirational flatness of posthuman ontology achievable through social computing recedes into the cruel optimism of futures predicated on presumed equivalencies between data subjects and the data their online behaviors produce.) Such an existentialist approach bears relevance to the encounter of one's data-driven representation: to encounter oneself as an externality is alienating [63], particularly when one is externally constructed by digital actors possessed of profound power [17].

As we will describe later, the creepiness of such encounters is central to the early definition of the data doppelganger [85] *and* serves as an unexpected pivot toward justifiable optimism. Ours appears as a user-culture of perpetual alienation where creepiness is the new norm – an ontological creepiness that stems from a disconnect between data subjects' posthuman modes of being (i.e., *as* data subjects) and linguistic confounds that reduce such posthuman modes to historical dualisms. This is the culture of cruel optimism we seek to put behind us.

2.5 Data Subjects (and Agential Cuts Thereto)

We have so far mentioned doubles, twins, and doppelgangers quite a bit. Yet one familiar figure (depending on one's disciplinary background) has remained largely absent. We approach this figure – the data subject – presently. We do so to better situate our concern for those three other concepts mentioned above.

Per Couldry and Yu [21], and as cited in the stellar work of Ziewitz and Singh [88], data subjects refer to "people who are subject to persistent tracking, scoring, and analysis through data-driven systems." Recent critical-legal scholarship, however, raises conceptual issues with the legal function of data subjects and calls specifically for structural analysis [44]:

> the concept of a rights-bearing data subject is being pulled in two contradictory directions at once. [...I]t is necessary to treat the problems facing the data subject structurally, rather than by narrowly attempting to vindicate its rights.

Hull [44] goes on to describe one direction of pull that concerns us directly here, claiming that:

> industry [...uses] promises of personalization to create a phenomenological subject that is unaware of the extent to which it is being manipulated.

As Hull [44] notes, the case-by-case vindication of rights (i.e., a kind of vindication familiar to those focused on negatively-defined concepts like privacy [46]) is not likely to foster a healthy ontology of the data subject. The confounding disconnect between the the abstraction of the "data subject" as a site of care and the immediacy of "you" presumes a distribution of subjectivity across the condition of embodiment and the condition of data-borne representation, but does not usefully specify how such a posthuman condition might be effectively (or least violently) expressed in language bound by the implicit dualism of subject/object structures. Thus, while the data subject implies posthuman ontology, such ontology is generally under-explored in relation to the dualistic grammars available for describing and thinking about such an ontology.

While the data subject constructs a category of being as experienced through the contradictions of cyborgian selves, the data double, digital twin, and data doppelganger each represent options for describing actors assembled through interactions within the category of *being* defined by "data subject." The language of the data subject expresses care for the posthuman assemblage of the contemporary person; each of the three terms we analyze here can be applied to describe discrete interactions that – Gestalt-like – contribute to the experience of data subjectivity, but do not account for it in its entirety. Such partial accounting places much at risk: ontology is a prerequisite to ethics.

The onto-epistemology of the data subject is unclear, and the data subject's genuine mode of being is in such unclarity: as a term, the data subject may be interpreted as a superset to which doubles, twins, and doppelgangers belong. Each of those concepts seeds implicit agential cuts [5] that may shape and/or confound holistic understandings of data subjects *as* posthuman. Through our analysis, it will become clear that such agential cuts as are seeded by the concepts of the data double and the digital twin – but *not* the data doppelganger – diminish the agency of the end-user (i.e., a person in a lived lifeworld) by augmenting the agency of the non-human Other (e.g., the double) to surveil or steer the end-user in service to a second-order goal (e.g., increased engagement with TikTok).

3 METHOD

Here we provide an overview of our methodological considerations. We begin by providing an overview of our epistemological position. We then introduce the method we used: conceptual analysis (CA).

Subsequently, we describe its mechanisms, our deployment thereof, and the approach we take to presenting results. We conclude this section with a description of interpretive caveats.

3.1 Epistemological Position

We adopt an epistemologically pluralistic position to account for the material-discourse of personalized content on social media. Our fieldsite is twofold: (1) the ontology of the algorithmic Other that presents in the form of personalized social media content; and (2) the language available to describe such Others. We deploy conceptual analysis so as to understand how the available language (e.g., data double, digital twin), if applied, might smuggle unwanted agential cuts [6] into the ontology of the "human" for which the HCI community broadly designs (i.e., an ontology of the "human" that must account for the posthumanist contradictions of being as data subjects). We contend that grammatical qualities of the signifiers, "data doubles," "digital twins," and "data doppelgangers" seed possible agential cuts that may unduly center the the data-driven Other rather than effecting a flat ontology across which erstwhile human actors are evenly spread.

3.2 Conceptual Analysis

While CA is deployed most commonly in philosophical inquiry, it is also an historically important method in relation to the analysis of social aspects of computing and interaction (e.g., privacy [2]). Furner [33] provides a useful description:

> Conceptual analysis [...] involves precisely defining the meaning of a given concept by identifying and specifying the conditions under which any entity or phenomenon is (or could be) classified under the concept in question.

We focus on mapping the latent structures and dynamics of three concepts: the "data double" [40], "digital twin" [36], and "data doppelgänger" [85]. By "latent structures," we refer to the ways in which each compound noun produces topically dualistic relationships that would frame things *referred to* as data doubles, digital twins, or data doppelgangers, respectively. By "dynamics," we refer to the various ways in which a term/concept assemblage (e.g., "data double") may seed agential cuts that degrade the values represented by the term "human" in the apparently posthuman world in which data subjects reside [64].

3.2.1 Deployment of Conceptual Analysis. We conducted the conceptual analysis incrementally, analyzing each concept in the order in which they were first introduced in the literature: the data double (2000; [40]); the digital twin (2012; [36]); and the data doppelganger (2014; [85]). Subsequent to the analysis of each term we present, we map results onto the infrastructural-systems framework and Pat Scenario described in Section 2.

3.2.2 Caveats. The findings we present should be interpreted with caution. Such caution requires considering the scale at which we conduct our analysis (i.e., a given individual user as they relate to a given system of social media use) and the specific context of our analysis (i.e., the receipt of personalized content via social media; e.g., TikTok). We have implemented such boundaries on our analysis to allow for productive theorization of our digital Others and our interactions therewith.

4 CORE CONCEPTS

Here, we describe the primary uses of the concepts in question (i.e., [36, 40, 85]). We contextualize such uses with dictionary definitions of their constituent terms (e.g., "data" and "double" in the case of the "data double" [40]). Such definitions provide the latent structures of the terms. We then engage in conceptual analysis of each term based on its common treatment. Analysis reveals a nested relationship between data doubles and digital twins, as well as subtle evidence that the data doppelganger is separate and separable from doubles and twins. The separability of the data doppelganger provides the foundations for understanding it as a site of justifiable optimism, rather than the de facto creepiness of cruelly optimistic personalization, which we discuss in Sections 5 and 6.

4.1 The Data Double

The concept, "data double," is represented by a compound noun. The noun, "double," refers to "a thing that is an exact repetition of another;" the word "data," which functions as an adjective modifying "double," transfers the characteristics of data (as a noun: "Related items of [chiefly numerical] information considered collectively") on to the double.[11] Vernacularly, then, the data double refers to an exact repetition of a person produced through analysis of information that is collected about them. Such a vernacular definition is not far off from that provided by Haggerty and Ericson [40], although theirs is couched in a rather more nuanced theoretical assemblage.

Haggerty and Ericson [40] introduced the concept of the data double as part of a larger theory of the "surveillant assemblage" [40], which the authors construct through engagement with literature from cultural studies [59] and philosophy [11, 24, 25, 30]. They describe the data double as a decorporealized body [40, p.613]. Borrowing language from Poster, they further describe the data double as a kind of separate and separable "second self" ([59] in [40, p.613]). Thus, by virtue of its separability, the data double emerges as something that can possibly be encountered – and interacted with – by the user it represents.

But to understand the data double with sufficient nuance, it is necessary to describe the other key component of Haggerty and Ericon's [40] work: the surveillant assemblage. Indeed, Haggerty and Ericson's initial definition of the data double (as described above), has changed in character relative to their focus on surveillant assemblages (e.g., [28]). The surveillant assemblage refers to a coalescing of heterogeneous surveillance systems that were previously separate. Data doubles, then, arise from the coalescing of separable surveillance systems into a generalized surveillant assemblage [40, p. 615-616]: the data double is that which makes it possible to effect surveillance on behalf of a particular surveillant assemblage. In the context of Pat and their use of TikTok, we limit the surveillant assemblage to TikTok itself – an assemblage of several different actors (e.g., a person, their smartphone, the TikTok app), which amounts to a discrete surveillant assemblage (as opposed to the ever-growing surveillant assemblage that concerns Haggerty and

[11] All dictionary definitions of terms presented in this section are drawn from the Oxford English Dictionary, accessed during August of 2024.

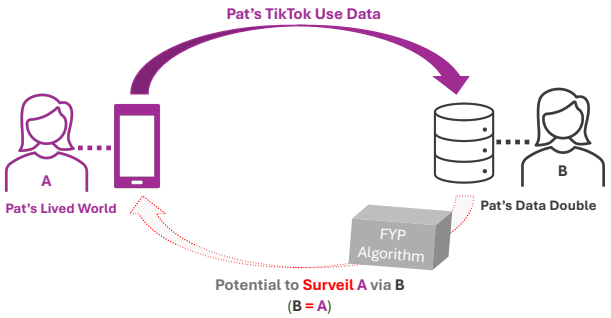

Figure 2: The latent structure of the data double includes Pat (i.e., a user-device assemblage represented in purple) and the inferable Other that might be described as Pat's "data double," which is represented in gray. Conceptual analysis of the data double and its dynamics revealed that its primary function is to afford surveillance rather than to enact surveillance (i.e., surveillance for a second-order purpose). The return loop is not implied when framing Pat's encounter with personalized content as an encounter with a "data double." The functionally black-boxed FYP algorithm that mediates feedback from Pat's erstwhile double is not strictly implicated in the language of the data double.

Ericson's subsequent treatments of "data doubles" (e.g., [28]). We focus on the sub-system of Pat's interaction with TikTok to assess the appropriateness of the data double as a concept through which to understand interactions with data-driven Others in social media.

We focus on the relatively limited scope of data doubles as they relate to social media because mass surveillance (through and by means of heterogeneous actors) is a normalized part of daily life – it is a means by which, for good or bad, the contemporary world asserts itself to individual people; it is the primary cultural technique [34, 35, 73, 74] of the data subject's becoming. Surveillance culture is therefore a prerequisite to the existence of the data double. Surveillance in and of itself is only a first-order function of a system. Surveillant assemblages effect surveillance over individuals for various second-order reasons (e.g., marketing, user-engagement), yet they remain *merely* surveillant at their core. In other words: surveillance is their first-order function; the purpose of such surveillance, their second-order function. The double that might be encountered is a kind of adjacent possible [47] potentiated by the existence of a surveillant assemblage, but not defined until put into use.[12]

4.1.1 Conceptual Dynamics of the Data Double. As formulated by Haggerty and Ericson [40], the data double does not technically provide feedback to the thing it doubles; rather, the data double communicates something about that user to the actors that co-comprise the surveillant assemblage. Figure 2 presents a graphical representation of the dynamics of the data double derived from Haggerty and Ericson's [40] introduction of the term. The system depicted in Figure 2 differs from the simplified system presented in Section 2 in one notable way. It assumes an equivalence between A and B. Such equivalence is implied through the value of the first-order surveillance function of the data double and the surveillant assemblage that supports it: if, in terms of Figure 2, B is not assumed to be equivalent to A, there would be no point in surveilling A via B. In the absence of an equivalence between A (i.e., the user) and B (i.e., the data-driven representation of the user), surveilling A via B would be like counting with colors. More specifically, though, the equivalence is A *in terms of* B, where data collected from A and stored for subsequent future use [15] is understood to be an accurate representation of A. The data double, if applied to the micro-context of receiving personalized content on social media, effects an agential cut that de-centers the human in the system (e.g., Pat, i.e., A) precisely because of the directionality of, "A in terms of B" or "Pat in terms of their double."

4.1.2 Pat and the Double. Pat uses Tiktok. TikTok collects data about such use, processes such data in relation to the existing archive of data about Pat's online behavior. TikTok then deploys personalized content based on Pat's online behavior – yet Pat is de-centered through agential cuts implied by the concept, "data double." Relative to the concept of the data double [28, 40], the provision of personalized content is a second-order function; the first-order function (i.e., that which makes the data double a data double, per se) is the surveillance that potentiates the provision of personalized content. Yet because the double exists as an adjacent possible [47], the data double is not necessarily *encountered* or *interacted with*. Rather, the data double in its most accurate usage would specifically refer to an actor in the system in which the data subject lives daily life. Yet it seeds an agential cut that resolves the apparent ontological tension of the data subject toward the representational power of data and the Other it produces en masse. As we will argue later, this would indicate that the data double is not an appropriate concept for identifying sources of justifiable optimism in relation to personalized content on social media.

4.2 The Digital Twin

The digital twin is also a compound noun. The term, "digital," is an adjective: "Of technologies, media, etc.: involving digital data; making use of digital computers or devices. Also: of or relating to such technologies or media." The noun, "twin," is used in its figurative sense: "Two persons or things intimately associated, connected, or related [...] or, [...], closely resembling or agreeing with each other; two forming a pair or couple." As such, the digital twin can be understood as an intimate association or connection between one non-digital thing and another thing that is digital.

Yet, while the grammatics of the digital twin bear resemblance to those of the data double, the provenance of the digital twin concept is somewhat murkier. Per a public-facing definition from IBM:

> The idea of digital twin technology was first voiced in 1991, with the publication of Mirror Worlds, by David Gelernter. However, Dr. Michael Grieves [...] is credited with first applying the concept of digital twins to manufacturing in 2002 and formally announcing the digital twin software concept. Eventually, NASA's

[12] Kauffmann's concept of the adjacent possible can be simplified as a set of latent possibilities that exist in relation to any given context [47] – they might be thought of as parallel futures caught in the inescapable now.

> John Vickers introduced a new term – "digital twin" – in 2010.[13]

In a belated write-up, Grieves and Vickers [39, p.85] situate the digital twin strictly in relation to complex systems and cybernetic control. They identify the digital twin as a linkage between "a physical system with its virtual equivalent." The language, "equivalent," does much to describe the ontology of the digital twin and to validate the vernacular definition above.

Where the data double is constructed at the scale of the individual – i.e., a given person under the gaze of a given surveillant assemblage – the digital twin is both broader and more specific. It is broader because it is not strictly applied to individuals or even people. Rather, the concept of the digital twin in technical discourse refers to a loosely defined set of mirror-like representations that actively function as "steering mechanisms" [50]. Through feedback loops, the digital twin guides its primary (e.g., a user/person) toward a desirable state.

Yet for the breadth of its applicability, the digital twin is more specific than the data double. It is more specific, in a way, *because* of its generality. In being imaginable in relation to any given thing-in-the-world, the digital twin decries a stringently positivist background: the world in which digital twins might be created is one in which the world ceases to include any phenomenon not theoretically tamable by techno-science. The digital twin quietly assumes that what is worth knowing about a thing-in-the-world is, by definition, datafiable.

Where the digital twin was defined in relation to vehicles, ships, and industrial things [50], and has been deployed in relation to cities (e.g., [49, 51]), governments (e.g., [3]), dead artists (e.g., [43]), etc., one cannot help but assume that the object "individual" belongs to the set of things that might be twinned digitally. Such a state of *being knowable* in relation to digital twins is one that eschews concern for that which is *not* datafied (i.e., metricated, enrolled into contemporary techno-science, etc.): it is a mode of knowing that, if applied to individual people, subjugates such people to existence as a kind of object. We contend that the realities of existing as *objects for use* in relation to the assemblages represented by social media platforms is inherently creepy: it presents a challenge to any imaginary in which individuals are deserving of dignity by virtue of being individuals. Indeed, it perpetuates the cruel optimism [12, 13] of a belief in aspirational data-driven futures that requires one to first become objects for data-harvesting use.

4.2.1 Dynamics of the Digital Twin. Per the remarkable analysis by Korenhoff et al. [50], the digital twin is to be understood as a cybernetic steering mechanism. The dynamics of the digital twin, then, are somewhat more concrete than those of the data double [40]: where the data double lacked a clear feedback loop to the user (i.e., "A" in Figures 2 and 3), the digital twin suffers no such lack. If the data double is the adjacent possible manifest in potential data-driven interpolations [22], then the digital twin is the realization of such an adjacent possible for the achievement of specific second-order goals (e.g., user engagement).

As visualized in Figure 3, because of its steering function, the digital twin implies the existence of a closed system of social media

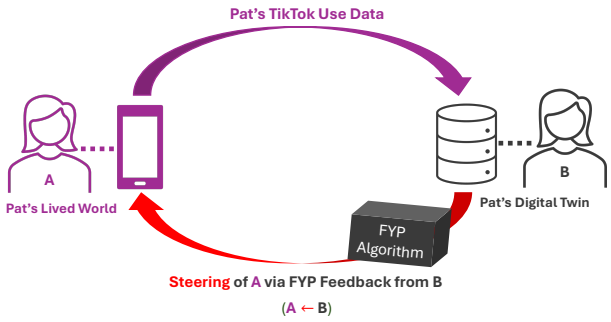

Figure 3: The latent structure of the digital twin includes Pat (i.e., a user-device assemblage represented in purple) and the an inferable Other that might be described by the concept, "digital twin,' which is represented in grey. Conceptual analysis of the digital twin revealed that its primary function is cybernetic steering. Such steering effects a relationship between Pat and their erstwhile digital twin that produces Pat as a function of their twin. The concept of the digital twin seeds an agential cut in which Pat is again de-centered, but also constructed as subservient to their twin. The return loop (i.e., from B to A; TikTok to Pat) is mediated by the functionally black-boxed FYP algorithm is the means by which Pat is kept engaged, steered toward the goal of continued, highly-engaged use. The decentralization of Pat occurs *through* the primacy given to data about Pat and such data-turned-information's feedback *to* Pat to impact their behavior.

use. The user generates data through use; such data is aggregated and analyzed (across time); the results of analysis are deployed in the form of feedback to the user in order to steer them toward a certain behaviror or state. If we were to apply the term digital twin to the sub-system of social media use, such feedback is delivered in the form of personalized content – content that is predictively determined to mesh with a given user's interests based on analysis of their online behavioral data traces. The presumptive end goal of providing personalized content as a form of feedback would be to maintain or increase user engagement with the social media platform. Such a presumptive end goal potentiates the creepy experience of cruel optimism. It asserts, however quietly, that an individual person is reducible *as a user* to the algorithmic interpretation of their data traces.

4.2.2 Pat and the Twin. In the context of the digital twin, the provision of personalized content is understood as a second-order deployment of first-order surveillance: it steers Pat toward an intended goal or state determined by the actor "in possession" of the digital twin. In relation to the system of social media use introduced in Figure 1: the provision of personalized content keeps Pat engaged with the platform and therefore steers their behavior toward the benefit of the platform itself. Where the double is a thing of surveillance, the twin is a thing of *enacted* surveillance: of control via cybernetic mechanisms. Because of this conceptual feature of digital twins, the Other (i.e., "B" in Figure 3) becomes

[13] https://www.ibm.com/topics/what-is-a-digital-twin

the central actor in the feedback loop: B exerts influence over A. B de-centers A by existing as the most agential actor in the system. That is, when framed with the concept of the digital twin, the interaction Pat has with personalized content on TikTok renders TikTok as the central actor, not Pat. TikTok steers Pat toward continued use: yet Pat is only ever a mere *user* of TikTok, not an ontological *person* that exists beyond what might be datafied about them. They are paradoxically reduced to a duality (i.e., self and Other) which manifests as incommensurable with the posthuman mode of being experienced by data subjects. We see no justifiable optimism in the social application of the digital twin concept at the scale of the individual.

4.3 The Data Doppelganger

As with the previous terms, the data doppelganger is a compound noun. We have already presented the vernacular definition of "data." The doppelganger – a German word that translates directly to English as "double-goer" [65] – is a cultural trope. It emerged in the 18th Century but rose to literary prominence in the 19th Century.[14] It was subsequently adopted (through the term "double") by psychoanalysis in a lineage of work between Otto Rank and Sigmund Freud (e.g., [32]). Yet it is worth keeping its literal translation in mind: the double necessarily goes *with* or *in relation to* that which it ostensibly represents. We will see later that the double-going nature of the doppelganger situates the perceiver of its motion as the central actor in the system.

Despite the doppelganger's association with 19th Century literature, the *data doppelganger* is the youngest of the three concepts covered in this paper. Watson coined the term in a 2014 essay published in The Atlantic Monthly [85].[15] Watson [85] introduced the term specifically in relation to the ways in which users are constructed through the practice of online behavioral advertising (OBA), creating an immediate resonance with then-contemporary work [71, 82]. In this way, the data doppelganger emerges first as a site of creepy interaction.

Whereas the double is a kind of decorporealized body extant in an ontology predicated on surveillant assemblages, and the twin is an externalized steering mechanism that provides feedback to users in order to achieve a second-order goal (e.g., continued use), for Watson, the doppelganger is a distorted reflection of the self [85]. Such a distorted reflection is *experienced*. More specifically, the doppelganger is located at the site of experience in relation to distorted reflections: the experience of perceiving of difference between oneself and their digital representations:

> Google thinks I'm interested in parenting, superhero movies, and shooter games. The data broker Acxiom thinks I like driving trucks. My data doppelganger is made up of my browsing history, my status updates, my GPS locations, my responses to marketing mail, my credit card transactions, and my public records.

Drawing on the work of Freud [32], Watson [85] constructs the doppelganger as the "identical other [...] connected almost supernaturally, sharing feelings, behaviors, and actions."[16] By aligning her treatment of the doppelganger with Freud's, Watson effects a frightened stance: for Freud, the uncanny (of which the double is a prime example) is categorically frightening [32].

Paradoxically, the justifiable optimism of the data doppelganger that we will highlight in the remainder of this essay is to be found at precisely the same site as its creepiness described by Watson [85]. The data doppelganger emerges from the *experiential* aspect of the set of digital Others to which doubles and twins belong. Doubles and twins are products of assemblages: they are applied, top-down, to represent people in their capacity as users of given systems. The doppelganger, on the other hand, is a thing *of the person*. Its mode of existence is in the perception of the user: not like beauty is in the eye of the beholder, but because the recognition of a reflection as *different* from oneself necessarily occurs in and through the embodiment of they who perceives. Watson's reliance on Freud positions the data doppelganger as an adversary to the unfrightening, the normal. Yet in the ten years since she masterfully coined the term, these doubles, twins, and doppelgangers *have* become normal. The data doppelganger that emerges is the image in a funhouse mirror, grounded in the experiential present tense – and having more to do with inter-subjectivity [61] than the uncanny or the creepy (cf [32, 85]).

4.3.1 Dynamics of the Data Doppelganger. The data doppelganger is distinguishable from its predecessors – the data double and the digital twin – because the data doppelganger is encountered through the *perception of difference*. The doppelganger is the messy reality of the lofty double and twin – stark evidence of the disappointment of representation; and the site of a creepiness derived from the presumed persistence of such disappointing personalization. Difference is the doppelganger's mode of existing. In being *through* difference, the doppelganger provides an opportunity to design for difference and against creepy hyper-personalization. The recognition of difference that instantiates the Other as a doppelganger effects an agential cut that acknowledges the equal distribution of the self throughout the social media sub-system, even if such distribution is apparently contradictory.

Such a mode of being through difference located in, and achieved through, the embodiment of the human-user differentiates the data doppelganger from the double and the twin because the doppelganger presents as persistently possible evidence of the irreducibility of the self to analyses of online behaviors. As depicted in Figure 4, the actors involved in the comprisal of the system, "social media use," remain the same for the doppelganger as for the double and the twin. Yet the locus of perspective constructed by the doppelganger within such a system is decidedly different: it is located *at* and *in* the perception of the end-user. Earlier in this section, we noted that the literal translation of the doppelganger is "double-goer." That which is known to go *as a double* or *in double*, is known to go in relation to that which it ostensibly represents. Recognition of any difference

[14] There is a long and rich history of the trope that extends well into the 21st century, which unfortunately falls beyond the scope of this work. See Seberger and Bowker [65] for context.

[15] The data doppelganger has subsequently received a broader definition: Aymerich et al [4] define virtual doppelgangers as "virtual humans that highly resemble the real self but behave independently."

[16] It is worth pointing out that Watson's invocation of the supernatural – while obviously a rhetorical move – places the doppelganger in the territory of creepiness. That which exceeds whatever is understood to be the "natural" world is by definition a challenge to any social norms that historically explain or choreograph such a "natural" world.

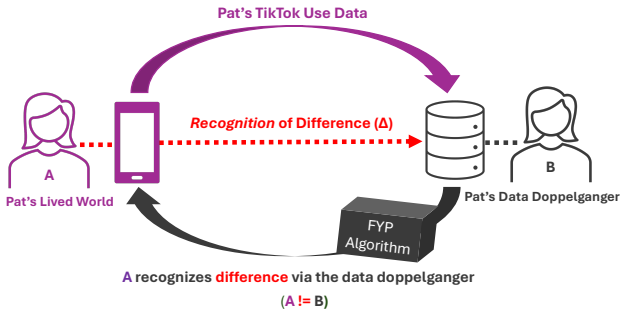

Figure 4: The latent structure of the data doppelganger includes Pat (i.e., a user-device assemblage represented in purple) and an inferable Other that might be described by the concept, "data doppelganger,' which is represented in gray. Conceptual analysis of the data doppelganger reveals its function as the revelation of difference. Where the data doppelganger is understood as something that exerts difference in the face of anticipated sameness, it presents as a site of justifiable optimism because the recognition of difference necessarily centers Pat in the sub-system they co-comprise. The data doppelganger seeds an agential cut that recognizes the entangledness of Pat and their Other – *but*, it manages to do so while maintaining Pat's experience of self (i.e., self-awareness that predicates the recognition of difference) as central to the sub-system. The data doppelganger is not creepy because it is inaccurate: it reveals the creepiness of presumptions in which the self can meaningfully reduced to anticipated sameness between subject and data.

between the representation and the user-as-person necessarily occurs at the site of the user-as-person. Through the language of the doppelganger, the user-as-person becomes the central figure in the social media system represented in Figures 1–4.

Because the data doppelganger is located at the point of perception (i.e., as an effect of the user's undeniable embodiment), it presents as the only of the three concepts that centers the end user not as a *user* but as a *person* in relation to the infrastructural sub-system of social media use. In the context of the data double, the user exists such that it might be surveilled. In the context of the digital twin, the user exists so as to be steered toward continued use. In the case of the data doppelganger, however, the motivations for surveillance or steering are supplanted by the *user's* recognition of difference that is born of presumptive sameness and steering.

Doubles and twins center the perspective of the Other: they presume a persistent and a priori sameness between person and data, which creates a gaze in which the person who uses is wholly represented by data about use.[17] Through the agential cuts of the data double and the digital twin, the person becomes the user; and its becoming de-centers the human by constructing it solely in relation to its data-producing, and therefore commodifiable, qualities [89].

[17]We use the term "gaze" to refer to an institutionalized or otherwise standardized mode of seeing people, where "seeing" refers to assessing their mode of being in society.

The data doppelganger emerges as a kind of real-world foil to the idealized one-to-one relationship that exists between users and the data double or the digital twin. The doppelganger is the reality of the inherent lossiness of online behavioral data in relation to complex systems that function at multiple scales (e.g., the intimacy of the self and the statistical smudge of world society, respectively). It is the annoying – and therefore conveniently discountable – reality that the representational-predictive system of hyper-personalization is not living up to its potential as something more than a distributed shill for this advertiser or that advertiser. It is the reality of the irreducibility of the self even as the self becomes distributed across emergent and ill-regulated platforms and technologies. Application of the term "data doppelganger" effects an agential cut that does not resolve or lean in one direction, but rather forces recognition of unresolvable contradictions. It therefore presents as a site for resistance: from users and designers alike.

4.3.2 Pat and the Doppelganger. Pat's recognition of difference – i.e., the fact that their Other appears to cast Pat as a plumbing enthusiast – does not align with Pat's historical use of TikTok (i.e., to watch cat videos). Where, with regard to the data double and the digital twin, Pat is de-centered in relation to their digital Others, that is not the case with the data doppelganger. The doppelganger emerges as something in the world *through* Pat's perception of difference: such perception of difference, we argue, is a recognition of the inappropriate reductiveness of such data-hungry figures as the double and the twin in relation to individual users who exist simultaneously (and primarily) as *people*. The double and the twin seed agential cuts in the data subject that perpetuate the very impossible a priori sameness that renders the data subject as stuck in perpetually cruel optimism – they presume a sameness between things that are fundamentally and irreconcilably different: the experience of being and data about behaviors. The fact that the difference perceived Pat situates and centers them – rendering the doppelganger unlike the data double or the digital twin – serves as the foundation for what follows: a search for justifiable optimism in the concept of *difference* as a motivation for design(ing less).

5 FINDINGS

Prior to offering the set of inferences we make as a result of our conceptual analysis, we summarize the main conceptual dynamics of data doubles, digital twins, and data doppelgangers in relation to the receipt of algorithmically personalized content on social media.

5.1 Summary of Comparison

Table 1 provides a site of ready comparison among data doubles, digital twins, and data doppelgangers according to their defining features, the conceptual dynamics that describe them, and the actor that such conceptual dynamics centralize (e.g., Pat or their double, twin, or doppelganger). The primary differences among data doubles, digital twins, and data doppelgangers are found in their dynamics. Data doubles assume an equivalence between, for example, Pat and the data they produce through the use of TikTok. They assume such equivalence because their function is essentially surveillant. Relatedly, the digital twin presents itself as a steering mechanism by which data about Pat's TikTok use can be used

Table 1: A succinct tabular comparison of data doubles, digital twins, and data doppelgangers in the context of social media use. Each concept is boiled down to its defining feature and the actor revealed as central through analysis of conceptual dynamics presented in Section 4.

Concept	Fig.	Defining Feature	Dynamics	Central Actor
Data Double	Fig. 2	Surveillance	$A = B$	Pat's Double
Digital Twin	Fig. 3	Cybernetic Control/Steering	$A \leftarrow B$	Pat's Twin
Data Doppelganger	Fig. 4	Revelation of Difference	$A \neq B$	Pat

to produce algorithmically-personalized content that keeps them engaged with TikTok. In Pat's context, then, the dynamics of the digital twin are such that Pat is steered toward resembling the ways in which their TikTok data might be used to keep them engaged with TikTok. Pat is steered toward mirroring their digital twin. Finally, with the concept of the data doppelganger, we encounter a difference that *makes* a difference: the conceptual dynamics of the data doppelganger are such that the centralized actor is always already the one that perceives of a difference between themselves and the ways in which they are implicitly constructed through social media use. In this way, the doppelganger emerges as separate and separable from the double and the twin. Such general findings allow us to make a set of inferences.

5.2 Inferences and Answers to RQs

We make five inferences based on our analysis. Such inferences structure the ensuing answers to RQs 1 and 2 and scaffold our presentation of implications in Section 6:

(1) the data double and digital twin are complementary parts of the same assemblage in which an a priori equivalence characterizes the relationship between a given user and their data-driven representation;
(2) the digital twin is a *maturation* of the data double that manifests in the coupling of the double's first-order functionality (i.e., surveillance) and the twin's second-order functionality (i.e., steering toward a goal, e.g., sustained or increased engagement with a social media platform);
(3) the data double and digital twin appear likely to seed agential cuts upon the posthuman assemblage of the data subject that de-center people in favor of their representations – the conceptual dynamics of both terms indicate that the user is known *in terms of* their representation. The user (and the person who ontologically precedes such user) thus becomes secondary to the data they produce about themselves through *use*;
(4) the data doppelganger differs from the data double and the digital twin in that its mode of existence derives from *experiential difference* rather than *presumed or anticipated sameness*; and
(5) the centrality of *difference* in the conceptual dynamics of the data doppelganger offers an opportunity to centralize the experience of the self (e.g., self-reflection, introspection) in the design of systems in which users encounter their Others (e.g., social media).

In answer to RQ1, we note that the data double, digital twin, and data doppelganger each share *topically* similar conceptual dynamics. Each enrolls [19] a person (i.e., in the form of a user) into a conditions that comprise or precipitate a feedback loop between themselves and a set of actors one might call a platform. Where the dynamics of the data double and digital twin unite them as a set which de-centers the person in favor of *representations* of that person, they are always already creepy – they challenge the received (and heavily marketed) sanctity of the individual even as they instantiate it. Their mode of existence (i.e., in relation to surveillant assemblages and the goals of complex systems that span markets, domains, etc.) is one that challenges not only social norms (see: [81]), but ontological and experiential norms: the centrality of oneself in relation to experience. In psychological terms, doubles and twins effect and exert an externalized locus of control over identity that yields data subjects who are undeniably heterogeneous in their composition, but who are reduced to objects to be acted on by those other objects that co-comprise them (e.g., TikTok, the FYP algorithm).

The data doppelganger is different. Its mode of existence is not one of repetition, or of a priori sameness. Its mode (and site) of existence is in the recognition of difference. Such recognition is necessarily located at the site of the user: the conceptual dynamics of the data doppelganger are best suited to framing interactions with personalized content on social media in such a way as to address those concerns raised by McDonald et al. [56]: that hyper-personalization on social media is obviously lucrative but possibly socially and culturally detrimental.

In answer to RQ2, we locate justifiable optimism in the existence of the data doppelganger and its use to frame research at the intersection of identity, the self, algorithmic personalization, and social media use (i.e., facets of the ontological complexity of *being* as posthuman data subjects). Such optimism paradoxically arises from the same characteristics that Watson [85] described as creepy; yet the pervasiveness of data-hungry objects, platforms, etc., effects a scalar transformation on the form of creepiness Watson described. Ours is now a creepiness that is pervasive, and in its pervasiveness offers an opportunity for genuine empowerment [1, 67]: a creepiness that has concretized and normalized to the point that it can sustain grassroots activism *against* itself. In what follows, we unpack these claims where necessary and describe "designing for difference" as an impetus to *design less*. To design for difference is to resist the giddy drive to design for personalization via the explicitly reductive commodification of the *self*.

6 IMPLICATIONS

Here we describe what researchers and practitioners in HCI might *do* with conceptual findings we have provided.

6.1 From Personalization to Difference

The data doppelganger is predicated on the recognition of difference, rather than presumed sameness. The recognition of difference centers the user as a *person* (i.e., a humanly embodied actor living among complex sociotechnical systems that subtly, but undeniably, construct people as posthuman data subjects whose mode of existence is confounded by the dualism built into language – we become what we cannot yet describe). As such the task of designers in HCI is to design for such difference. By this we mean to distance ourselves from frameworks like doubles and twins that presume a priori sameness between data and the things which data represent so that we might acknowledge the experiential irreducibility represented by the doppelganger. Such acknowledgment is the first step in designing for critical self-reflection about the fundamental differences between who we are and how we are represented by online behavioral data.

McDonald et al. [56] noted that personalization, such as it is, creates a frictionless online environment for young users, even though the experience of friction (e.g., conflicting worldviews) is essential to the development of a sense of *self*. Such frictionlessness may be understood as the result of focus on data doubles and digital twins superseding focus on discrete *people*. The design of personalization algorithms must extend beyond the algorithm itself, and, indeed, beyond the myopic context of thumbs on screens and the monetized desire to keep thumbs tapping screens.

Designing for personalization in social media contexts says much about how the ontology – indeed, the onto-epistemology [5, 6] – of the human *as a reductive user* occupies a troubling space in the HCI discourse. As we will discuss below, learning to design for difference means considering "unmaking" [78] and resonates with calls to move away from "user-centered design" per Frauenberger [31]:

> Despite its honourable role in reminding technologists to think about people, I want to argue to abandon user-centred design. Not because humans do not matter, quite to the contrary: to shape who we want to be in this world, we should be designing meaningful relations, not user experiences.

Recognition – and acceptance – of the doppelganger as something that is always encountered through difference offers an opportunity to abandon user-centered design in precisely the way Frauenberger describes. It does so because the difference that always already instantiates the doppelganger reveals the concept of the user to be too reductive. Users produce fodder for doubles and twins: they exist in an ontology in which a one-to-one relationship between data and phenomena is assumed. Yet people enact the difference of the doppelganger: by centralizing the *perception of difference*, the doppelganger evidences the limits of assuming one-to-one representation. Doubles and twins have users and produce such users as data subjects; people have doppelgangers and may use the difference inherent to the doppelganger to interrogate the values and meaning of their data subjectivity. The doppelganger is a site of difference; difference is a site of resistance and empowerment.

In the micro-scale context of Pat's social media use, the doppelganger reminds us that the human encounter of difference – the interpretive, subjective – abides, perhaps stubbornly, alongside the reduction of people to users who can be described through the aggregation and algorithmic analysis of their online behavioral data traces. It is in such uncomfortable processes of reduction and aggregation that we identify a core implication: the doppelganger is the only concept available to us for describing micro-scale interactions with personalized content that does not assume a reductive equivalence between user and data. The data doppelganger acknowledges and situates the heterogeneity of actors entangled in the condition of *being* ontologically posthuman (i.e., as a data subject) but always already experientially human (i.e., embodied and possessed of a self).

Thus the data doppelganger appears as the only concept that actually represents the posthuman complexity of the data subject precisely because it highlights the difference between the embodied experience of self and externalized, data-driven representation; moreover, it does so through centering the experiential human as perceiver of difference. What emerges as creepy from this statement is not the doppelganger, but rather the underlying and pervasive assumption that characterizes the data double and the digital twin: the a priori reducibility of people to data points via the obligatory passage point of "use."

Acceptance of encounters with doppelgangers not as something revolting or otherwise creepy (cf [85]) but as opportunities for self-reflection unexpectedly *re-centers* the erstwhile *user* of social media systems not as a user, but as a *person*. What is required for justifiable optimism is genuine engagement with the possibility of scaling back within the context of social media and personalization; of de-growth concerning the surveillance capitalistic logics of data-monetary optimization and the ways in which such logics are deployed to keep thumbs tapping screens.

To abandon user-centered design in the form that merely produces or reconfigures people *as* users (i.e., effects agential cuts upon the phenomenon of the human in such a way as to mirror or steer users) becomes possible through the simple realization that to expect one-to-one relationships between people and their aggregated data traces is naive.[18] Where the sociality of *people* is concerned, up to and including the formation of identity and the performance of one's self, the double and the twin always risk trapping the person in an ontology in which they are superseded by the importance and monetizability of the data they produce. Despite the doppelganger's definitional foundation in relation to creepiness, analysis reveals that doubles and twins appear as the creepiest of concepts precisely because they are predicated on the wholesale representability of inherently irreducible things (i.e., given individuals whose givenness manifests through sociality). The doppelganger resists such creepiness ontologically, yet it is bound up in the discourse of creepiness

[18] It may be – and, indeed, we think it is – reasonable and productive to produce twins about things in the world that are, by and large, artificial and/or static. A building, for example, is a knowable thing relative to safety standards, legal liabilities, power consumption, etc. Each of those aspects of buildings is sufficiently representable through a twin: by and large, buildings possess no subjectivity. But people are not buildings or ships; and people *do* live through a condition of subjectivity.

because of its topical resemblance to data doubles and digital twins. We, like Watson [85], find ourselves creeped out by encounters with our doppelgangers because the culture of the double and the twin – a profoundly monetized culture – prime us to be creeped out.

As we shift away from user-centered design toward what lurks in the adjacent possible of post-userism (e.g., [10]) and posthumanism (e.g., [29]), to design well is to recognize where the imperative of design in HCI reaches its limits. To design is always already to act based on (implicit or explicit) agential cuts [5]. Two of the concepts we have subjected to conceptual analysis (i.e., the data double and the digital twin) reveal themselves as seeding agential cuts that supersede the person (e.g., Pat) with the primacy of their data-driven representations (e.g., doubles, twins).

The existence of the doppelganger is evidence that such limits have been reached: people reduced to the status of users *see* the delta; they *see* the diffraction [54]; creepiness becomes the new norm – but only if we maintain the a priori, and often-implicit, assumption that data represents wholly. The more we normalize such seeing, the fewer options we will have to identify, understand, and address the speculative vulnerabilities [68] around identity, agency, locus of control over the self that lurk in uncritical futures of personalization on social media. We can boil this implication down to one sentence: to foster justifiable optimism, we must design for difference.

6.2 The Joy of Designing for Difference

As designers, we have an obligation to facilitate the recognition of difference. Designing for difference means to embrace a perspective perhaps best described by Judith Butler: life is lived through unresolved contradictions [18]. The conceptual dynamics of the double and the twin presume the resolution of an emerging area of unresolved contradictions: the space between what used to be differentiable as the "virtual and the real," and which now plays out in the location of identity and self among actors enmeshed in the system of social media use. The recognition of the doppelganger in relation to personalized social media content is a joyous event for the designer disinclined to proceed down the yellow-brick road represented by such epoch-defining inanities as, "data has a better idea." It is joyous because it identifies for us a discrete category of interactions – the receipt of personalized content – that comprise an opportunity to design for self-reflection, introspection: to design for the possibility of difference.

The person – the locus at which one experiences the possession of a *self* [38] and the site of design that surpasses user-centered perspectives [31] even as post-userism [10] implicitly reifies the concept of the user by constructing that which succeeds it as a function *of* it – does not exist as double-able or twinnable. Rather, the self as experiential exists as a site of enfolding: the experience of being enfolded as an embodied person into the world of representations and the cultural technique of datafication. The subtlety of posthuman ontology represented by data subjects remains subject, itself, to the dull edge of grammar. In worlds where the endogenous fluidity of being is caught mid-flight and pinned to the classification board — generally with undue concern for nouns and objects — the twin and the double have people; yet *people have doppelgangers.*

To live as a data subject is to live through ontological contradictions. It is to be posthuman in a way made possible through differences between experiences and representations thereof, yet confounded by the assumed equivalencies between experience (i.e., being) and observation (i.e., datafication). To embrace the doppelganger is to acknowledge the fundamental difference that constitutes data subjects. When we design through and by means of doubles and twins, we prime agential cuts that de-center the person (i.e., the data subject as an embodied inheritor of the historical discourse of "the human" [64]). Such cuts are easy, even convenient. Yet their convenience comes at the cost of the dignity to which people – data subject or not – are fundamentally entitled.[19] In the age of the data subject, to design with doubles and twins begs the question of wholesale representability. This is the case because the double and the twin presume specific kinds of representational relationships between individuals and the always already impoverished trail of digital breadcrumbs their online behaviors leave behind. Designing for the doppelganger – designing for the ontological difference fundamental to *being* as a data subject – becomes a compelling trajectory.

To design for difference – and therefore to design personalization algorithms or even aspects of their deployment for *people* rather than reductive users – paradoxically requires understanding and embracing the limits of design in relation to the irreducibility of the experiential self. In the context of algorithmic personalization on social media, designing for difference means letting go of the stranglehold platforms attempt to achieve relative to their users: highly engaged doomscrolling, for example. As social media platforms like TikTok filter the experiential worlds of users through bite-sized clips, as designers of algorithms, interfaces, etc., we in HCI are obligated to consider (and act upon) the obvious, yet uncomfortable, conclusion that algorithmic personalization that is predicated on a priori assumptions about equivalences between users and their data-driven representations is inherently creepy and structures creepy futures. It does so because such a priori assumptions are unwarranted in all but the strictest positivist frameworks that have become baked into the relationship between subjects and objects by way of the market-driven obsession with *scientistic* empiricism.

To escape such creepiness – and the pervasively cruel optimism of surveillance capitalism – we find it necessary to accept and account for the irreducibility of the self to externalized representations, regardless of the techno-rhetorical appeal of the algorithmic and the obvious monetary value of algorithmic personalization on social media. Quite simply: design is no longer the de facto answer to questions about improving interactions between humans and computers. As computing continues to reach out, we in HCI are obligated to engage with questions much larger than those traditionally addressed through our work. HCI is directly implicated in the ontology of the self. Knowing when to analyze versus when to design in the deceptively novel ontology of the self that algorithmic personalization begets has never been more important.

[19] We do not make this claim based in strict humanism. Rather, we note that "human" connotes a set of values [64] worth perpetuating and designing into future medianatures [58].

6.2.1 The Risks of Designing for Doubles and Twins. Hull [44] puts a fine point on the problem of designing for doubles and twins if one reads between the lines:

> to locate any of us as data subjects is to identify what we do and are predictively likely to do – is not to locate a transcendental principle of organization, but to name a particular mixture of networks of data points [44, p.329-330].

Here the sluggishness of legalities – the enacted word games that serve as load-bearing supports for social processes – continue to obscure the ontology of the data subject. One tends to think in dichotomies: the one (self) and the Other (double, twin, doppelganger; the liberal human or "a particular mixture of networks and data points" [44, p.230]). Yet the lived contradiction of *being as a data subject* is located at the very messy edge of that which we *want* to make sense of – ourselves as we unfold through contradictions in language, reality, subjectivity, objectivity, media, etc. The data subject defies its own practical usefulness in relation to Hull's critique above because it primes us to think of the reduction of an identity – a *self* – to a kind of leftover stew made from data scraps. Such a reduction is irreconcilable with the liberal human self in a pure sense. It is possible, however, that the liberal "human" merely represents a set of values worth saving from the anthropocene [64]. The concepts of the data double and digital twin do not challenge such a reduction. Indeed, they foster it. Such fostering, we argue, points toward a path dependency in which the ubiquity of algorithmic personalization in computationally-mediated sociality is always already a site of creepiness: always the site of a likely encounter with a data-driven representation that disappoints because of its reductiveness, yet persists stubbornly as a market logic because of its monetizability. When so many of us the world over are "subject to persistent tracking, scoring, and analysis through data-driven systems" [21] a great deal is at stake in the way we understand just what data subjects *are* so as to be able to design for them. We identify the concept of the data doppelganger as a productive one to this end.

To design with data doubles and digital twins is to adopt and promote – however implicitly – an onto-epistemological position that corners people (e.g., Pat) in the untenable position of being reduced to a kind of object wholly knowable through collection and analysis of their data traces. Such an untenable position is the primary problematic of aligning care for the data subject with design practices in HCI. On the other hand, designing for the doppelganger – designing for *difference* rather than a priori sameness – situates design in the onto-epistemological complexity of data subjectivity. By centering the perception of difference, and therefore the actor responsible for such perception (e.g., Pat), the data doppelganger locates and highlights the irreducibility of the person to their behavioral data. It is in the space between such person and their data (i.e., the site of difference) at which we in HCI and as designers should focus our efforts.

When we design for difference, we remain open to agential cuts that recognize the heterogeneity of actors that comprise people *as data subjects* rather than begging the question of wholesale representability. We contend that designing for doppelgangers in the context of personalization on social media constitutes an initial foothold for learning to design in complex sociotechnical arrangements that do not construct people as reductive users to be surveilled or steered in relationship to their Others. To embrace the difference that the doppelganger represents by designing for such difference (e.g., self-reflection, introspection) is to embrace the possibility of futures in which the mode of being through data subjectivity is one of exploration and aspiration rather than control and de facto creepiness of worlds in which the *significance* of being is reducible, always already, to monetized descriptions of such experience.

In concepts like the data double and the digital twin, the logics of designing for *users* (i.e., things equatable to doubles and twins) rather than *people* who experience themselves through the contradictory conditions of data subjectivity perpetuate the cruel optimism of aspiration by means of degradation to the discourse of the "human" [64]. Such a degradation occurs in and through the presumption that the very ontological heterogeneity of data subjects can be resolved or homogenized through a focus on data that supersedes care for embodied people who live *as data subjects*. Doubles and twins presume the wholesale representability of that which they represent: they are duplications, mirrors that presume the exclusive value of that which they are able to reflect. The doppelganger is a specter [65]: it goes along (as a "double-goer"), and in going represents the vast set of possibilities that accompanies people as they live their lives through and by means of one of the cornerstone infrastructures of digital daily life: social media [27, 63].

7 CONCLUSION

The optimism of the doppelganger – and therefore the optimism of futures in which we continually encounter and interact with data-driven representations of ourselves in an alien condition of data subjectivity – is to be found in how we, as *people* rather than users, orient ourselves toward such possible encounters. Interactions with personalized content already constitute a common part of daily life for two-thirds of the world's population. While data doubles, digital twins, and data doppelgangers all refer to digital Others – representations of things in the world (inclusive of individual people) derived from the collection, aggregation, and analysis of online behavioral data – conceptual analysis revealed that these terms are not interchangeable. Nor are they all well applied in the context of personalized content on social media. Each term carries with it a set of assumptions: implicit dynamics between the actors each implies. Conceptual analysis revealed that the data double and digital twin are predicated on expected or assumed sameness between a given person in the world and the data collected about them. Such anticipated sameness de-centers the person for the representation, and is logically identifiable as the root of the double's and twin's de facto creepiness. The data doppelganger, on the other hand, is predicated on the recognition of difference. Being so predicated situates the doppelganger as a function of the person, rather than the system that attempts to represent them.

We have identified the site of difference – the appearance of the doppelganger – as an inflection point that colors the drive to design in HCI. The time has come to accept the limits of designing for personalization and to consider that the best means of designing for

people rather than reductive users is to design for personalization less. As the fruits of our field's labors are continually monetized and deployed, we are obligated to shift the focus of our design inquiries to those sites of interaction normalized by data- and money-hungry social media platforms: interactions that play out across the blended internality and externality of the self. We are also obligated to learn the point at which hyper-personalization concretizes our futures as presumptively creepy rather than optimistically revelatory. Designing for difference is how we learn to stop worrying (so much) and love the doppelganger.

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