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Overcrowded Ecologies: Designing Value Through More-Than-Human Factors

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ABSTRACT

From domestic environments to urban systems, in current designing landscape human and non-human dynamics affect each other. Thanks to a descriptive case study methodology, the contribution aims at exploring emerging design coordinates in interaction design considering the ongoing computational disruption. Case studies show the interdependence of beings and things, here taken as a compass to cross the entangled complexity of overcrowded ecologies. Hence, the contribution benefits from the design-for-value approach to inquire hybrid ecologies and their impact on design practice, triggering a threefold space to design in/with: the addressee of design intervention, the materiality to design with, the temporality in which design intervenes. The three coordinates constitute a preliminary research framework, which might contribute in channeling designing efforts into the exploration of a new generation of value triggers in interaction design within the computational landscape.

Keywords: AI systems, More-than-human factors, Design for value

OF ASSEMBLAGES AND CONSTELLATIONS

From autonomous vehicles to domestic robots, from sensing surfaces to wearable devices: the *smartness* of everyday things enabled by the technical development and real-life experimentation of Artificial Intelligence (AI) reshapes the landscape of human environments, populating them with artifact ecologies (Bødker and Saad-Sulonen, 2017) or constellations (Coulton and Lindley, 2019). These systems can be understood as extremely fluid assemblages (Redström and Wiltse, 2018) which exist in and across human scales of activities – individual, collective, urban, social. Here, smart objects are sensing and performing actions often through autonomous behavior. By acting without the intervention of human agents, smart objects *disappear*, moving from the center to the periphery of everyday life (Dourish and Bell, 2011). Shapeless and faceless, everywhere and nowhere: smart objects weave themselves deeply into human infrastructures, while being constantly attentive to detect when the "wake command" rousing them to action is given or spoken. In the meantime, they silently observe, sense, harvest data and *learn*, existing in a "constant becoming" mode, by which they *evolve* over time. Moreover, the faded disruption these products bring lies also in their familiar look - a

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pair of glasses, a fridge, a traffic light - allowing them to be experienced with ease in their presence and tangibility; however, they prove to be more than that, since they are an additional, autonomous *agents,* entering a system of decentralized, social interactions (Redström and Wiltse, 2018) in which both technologies and humans are interdependently tied. As a result, the world is filled with *overcrowded ecologies*. Here, the ecological approach is believed to help emphasizing the expanding universe of design, emerging from the interplay between the human and the non-human, the organic and the artificial, in a way that "to explore the futures we might face, we need to inquire into what a more-than-human world might look like, and what happens when technology is not just material but participant" (Giaccardi and Redström, 2020).

The establishment of the *ambient intelligence* paradigm combined with the growing spread of *autonomous social* agents – with AI working in the background to deliver data-driven outputs (Gams et al., 2019) – is pushing society towards its more-than-human futures. Thus, the contribution aims at framing overcrowded ecologies and their disrupting force into everyday life, which turns out to be configured as a new "largely uncharted design territory, ridden with complexity, diversity, opaqueness, and intangibility" (Funk, Eggen and Hsu, 2018). In fact, despite the suggestive more-than-human experiences provided by AI, we are still experimenting with it, often producing risky, concerning, and undesired results (Floridi et al., 2018). Here, one of the main challenges stems from the unpredictability of certain outputs, due to autonomous evolution. From domestic environments to urban systems, in the new designing landscape human and non-human dynamics affect each other, deeply intertwined in *mutual* adaptation and evolution. For these reasons, the contribution aims at exploring emerging design coordinates in interaction design considering the ongoing computational disruption. Thanks to a descriptive case study methodology, a range of case studies will be inquired to show the interdependence of beings and things. Such entanglement is taken, here, as a compass to cross the complexity of overcrowded ecologies. Hence, the contribution benefits from the design-for-value approach (Van de Poel, 2021; Smits et al., 2022) to inquire hybrid ecologies and their impact on design practice, triggering a threefold space to design in/with: the *addressee* of design intervention, the *materiality* to design with, the *temporality* in which design intervenes. The three coordinates constitute a preliminary research framework - to be further tested and validated through design practice - which might contribute in channeling designing efforts into the exploration of a new generation of value triggers in interaction design within the computational landscape. By assuming the values of *beings* and *things*, the contribution takes part in the broader debate on tackling the uncertainty underlying AI systems outputs through design, inviting a perspective on more-than-human factors to build meaning through more-than-human values.

MEASURING THE WORLD

New design challenges in overcrowded ecologies might be grasped by focusing on the interlocking nature of humans and technology; specifically, by

looking at the way technology is humanized, and, in turn, humans are technologized. Through a zoom-out move from smart objects, it appears easier to understand how the ambient intelligence paradigm shaped and built whole new infrastructures underlying everyday life, raising questions on both material and immaterial boundaries of reality. As media theorist Benjamin Bratton (2016) argues, the world emerges as the result of a *Stack*, a *layered* – hence the name – *accidental megastructure*, transcending geographical and political boundaries with its digital fabric. Figuratively, this aligns with *The Continuous Monument* (1971) by radical collective Superstudio, depicting natural landscapes and urban sites wrapped in a seemingly infinite, world-covering architectural grid-system (Deyong, 2002); it was the design of embodied connection. In the same way, Bratton's *Stack* crosses everyday life with its six interdependent layers – earth, cloud, city, address, interface, user – with *beings* and *things* deeply entangled inside it.

Here, planetary computation feeds on an increasingly quantified world, in which objects track, measure, validate any occurring phenomenon (Swan, 2013). From smart traffic lights to domestic smart devices like Amazon Echo: quantification enabled by large-scale AI systems depends on both material and immaterial extractivism – material resources, human labor, and data (Crawford and Joler, 2018). In this sense, planetary scale extraction is what makes AI systems far different from other consumer technologies: they rely on the ingestion, analysis and optimization of vast amounts of any human activity's trace – coordinates, images, sounds, texts. Thus, *quantity* proves to be an essential concept to deliver the performance we expect, which eventually affects and shapes the formal *quality* of our physical world. With its compelling vision, Archizoom's *No-Stop City* (1969) was radical design's prediction of a "quantitative utopia" (Branzi, 2015), an immaterial city exclusively dedicated to the continuous flow of information, so to result in a city without quality, free of all symbolic value, where its material appendixes disappear in a pure urban semiosphere.

As for today, cities are home to overcrowded ecologies, which are sensibly challenging our usual understanding of the social. In fact, smart objects enter social relationships (Cila et al., 2017), either contributing or influencing them: by autonomously recognizing people, tuning with users' needs, and anticipating their preferences – eventually acting upon users' behalf – they behave as *social machines* (Smart, Madaan and Hall, 2019) and play a variety of roles – or rather agencies. The analysis by Cila et al. (2017) provides a taxonomy of *social machines*, focusing on their social features: the Collector, the data reader; the Actor, the interventionist who creates dialogs and the Creator, the self-aware and self-learning one. As scholars note, these agencies overlap and co-exist in a smart object, so they cannot be considered as separated categories. However, humans too seem to play a multi-fold role, exiting the "end-consumer" traditional profile. In fact, "it is difficult to place the human user of an AI system into a single category: rather, they deserve to be considered as a hybrid case. [...] the Echo user is simultaneously a consumer, a resource, a worker, and a product" (Crawford and Joler, 2018). Such concepts identify new design spaces emerging in overcrowded

ecologies, whose quantified foundations seem to overshadow the need of a balancing, qualifying side.

DESIGNING THINGS WHICH DESIGN US

The quantified-world (Swan, 2013) extends its *machinical* nature to all things and beings, so that society resembles something like a machine running by virtue of the quantification opportunities afforded by global AI systems. Today, computing flows in the environment filling every interstice, where humans and computation feed into, and adapt, to each other. The emerging paradigm of "human-computer integration" (Farooq et al., 2017) helps designers understand everyday contexts as immersed in symbiotic relationships, where "humans and software act with autonomy, giving rise to patterns of behavior that must be considered holistically". Moreover, due to the hybrid, overcrowded nature of current ecologies, such contexts are filled with osmotic, elastic relations, which eventually turn to be also tense, frictional and sometimes conflictual. In fact, the plurality of tensions and power-plays between different agencies leads to partially predictable outputs: AI systems are not fully open to outside inquiry, in a way that "it is only their products or outputs that can be addressed" (Willson, 2017). As a result, the co-construction of humans and non-humans in the happenings of social life unfolds through the contamination of human and non-human logics, in a measure that we design things and things design us (Krasmann, 2020).

The study by Ghajargar, Wiberg, and Stolterman (2018) provides an in-depth analysis on the variety of relationships that might bind temporarily smart objects and humans, producing given effects on the latter: the "augment me", "comply with me", "engage me" and "make me think" relationships shift the focus on the deep but unperceived contribution – or influence – of computing artifacts to everyday life dynamics. The study highlights the need to adopt ecological theories to fully grasp how our physical and cognitive abilities and behaviors have evolved as a result of the environments in which we dwell. The synergy theorized in the human-computer integration paradigm seems to frame meaning construction in a codependent partnership among humans and non-humans, around each other's activities, negotiation and sometimes compromise. Everyday life is filled with Google assistants, Fitbits, and Airbnb algorithms shaping change in human dynamics (Giaccardi and Redström, 2020). However, what is disrupting current behaviors, lifestyles and worldviews is the growing autonomy of AI systems. In fact, autonomous information processing leads to information *immediation* rather than mediation, as it is less and less subject to negotiation (Issar and Aneesh, 2021). In times of *posthuman performativity* (Barad, 2003), humans become the third wheel of knowledge production, with AI systems producing *reflectional knowledge* - namely knowledge which humans can use to think about phenomena with new insights - and *actionable knowledge* - namely knowledge which non-human agents can use to do things and achieve goals. As a result, *meaning* emerges from non-human agents whose action is not fully predictable, because "the whole point of autonomous systems is that they may change over time, inherently making future interactions unpredictable"

(Höök and Löwgren, 2021). Even though computational indeterminacy produces *unknowns*, it actually rewires human cognitive abilities and capacity to understand, to feel, to perceive, to experience (Floridi et al., 2018; Willson, 2017): data-behaviorism (Krasmann, 2020; Issar and Aneesh, 2021) is in fact the result of the non-negotiated data-driven knowledge which eventually produces more-than-human experiences, with all its clustering, classifying and patterning information happening autonomously and almost instantaneously. In data-behaviorism decision-making happens in the wake of different values and principles compared to decision-making processes enacted by humans (Höök and Löwgren, 2021): given their heterogeneous nature, those processes cannot be measured and compared with each other; one is computational, the other is human and they don't respond to the same coordinate system. Therefore, autonomy and systemic integration makes AI systems a disrupting force to be tackled: they challenge current approaches in interaction design providing humans with more-than-human experiences to be tackled by more-than-human factors.

DESIGNING VALUE THROUGH MORE-THAN-HUMAN FACTORS

As AI systems spread more and more into overcrowded ecologies, everyday life can be depicted as a complex tangle in which it is not worth distinguishing whether humans extend their own agency through objects or vice versa (Krasmann, 2020).

Notwithstanding the transformative power of social machines and their social impact, the most urgent questions now are "by whom, how, where, and when this positive or negative impact will be felt" (Floridi et al., 2018). Arguments built so far illustrate autonomy seems to be a gravitational point, since it implies independent *action* and *learning*, leading to *adaptation* and *evolution*. Even though change happens in response to context stimuli and interaction with other beings or things, it is a process that cannot be completely addressed. In fact, designers – humans – "look for correlations and patterns that fit with their understanding of how the world works. Machine learning, on the other hand, finds machine-recognizable correlations and patterns in data, sometimes appearing strange in the eyes of a designer, and even creating bizarre errors" (Höök and Löwgren, 2021). As a result, the need to deliver the most consistent representation of reality to the senses of *things* becomes a relevant challenge to designers; consequently, the issue becomes even more complex if we consider that things too deliver their representation of reality to *beings*, to our senses.

Change happens in the wake of a duet, where humans and non-humans mutually evolve and resonate with each other. Here, *dissonance* might occur: a perception gap due to algorithms deploying a strikingly different mode of cognition compared to human sense-making. In fact, dissonance can also be conceived as a meaning mismatch between humans and non-humans, which eventually end up in pursuing the same goal through far different values. For this reason, dissonance might require a new designing framework to be tackled. Drawing from mediation theory, technology assessment methodologies, and theory on value change, the design-for-value approach (Van de

Poel, 2021; Smits et al., 2022), enables designers to reiterate and reframe value frameworks throughout the designing and implementation process of a given technological solution that is going to be socially embedded. Therefore, in overcrowded ecologies, *more-than-human values* need to be framed in order to meet the interdependent dynamics among humans, non-humans, and values themselves. Here, interdependence is a central concept, as it problematizes autonomy by setting its boundaries on the edge of established relationships. In this sense, overcrowded ecologies impact on design practice, triggering a threefold change:

- *the addressee of design intervention*. Designing in overcrowded ecologies means entering the interdependence of synthetic and organic agencies: it is very likely that designers will not only design *with* them, but also *for* them. Assemblages of natural and computational entities can in fact be thought of not only given objects - wheter they be enabler or disabler - but *agents* participating in the design space, triggering the development of corresponding design methods, frameworks, and practices to better address the challenges to be faced today as a planet. For instance, this encourages change in how designers approach user experience, which is now related to both human and non-human experiences.

- *the materiality to design with*. Designers are used to handling tangible matters, sharpening their understanding on all the qualities, functionalities, and affordances of things. However, computational things entail a ghostly component: despite it dwells in the faceless Stack, we have strived to build narratives that speak to the physicality of computational things. In other words, following the warning of negative utopias, to understand AI's *aliennes* we turned to aesthetics as the primary means of making manifest and comprehending it. Designing with(in) overcrowded ecologies means embodying both shells and ghosts to keep track of all their autonomous interactions, tensions and conflicts among each other and with humans. For instance, this calls for transparency, which becomes one of the most crucial factors to handle computational materiality.

- *the temporality in which design intervenes*. In overcrowded ecologies humans and non-humans evolve constantly, so that designers cannot deliver designs that can *solve* these issues. Instead, design becomes the continuous act and responsibility of working with and through these things. As a result, considering things "in use" turns out to be limited, since the design process develops in a time span which is highly fragmented: every single stage is dedicated to a certain goal and kind of interactions. Moreover, based on the situation of interest, the roles of the agencies involved may follow a certain script, which might eventually be different in the next stage. Even though this links with the change in the addressee of design intervention, temporality applies also to values: since they arise only in the interplay between humans and autonomous technologies, they are far from being stable.

CONCLUSION

The works of the Radical Movement from the 1960s and 70s served, here, as powerful design inquiries warning us about design challenges raised by

planetary computation, since their *negative utopias* envisioned the designing issues stemming from the global establishment of information systems. Now as then, cities are the most effective object of inquiry for designers to address those systemic consequences. Those *embodied fictions* show how a purely technological approach to cities, interpreted as the most favorable places for large-scale transformations to occur, would eventually produce *atopias*, void, distorted and meaningless platforms to be accessed through devices only affording parameters of access, quantification, computation. Here, it seems that cities are more likely to be post-human places, wherein technology pushes society towards its non-human futures.

However, AI is offering the possibility to live other-than-human experiences, that can be still handled to build meaning through more-than-human values. Therefore, the threefold change encouraged by the establishment of overcrowded ecologies invites alternative approaches for design practice to address more-than-human challenges. By outlining a preliminary set of coordinates, the presented framework aims at providing a direction for interaction design students to better cope with the transformations triggered in both design process and practice whit(in) computational landscapes. Notwithstanding the need to test, validate and reiterate the actual state of the preliminary research, it is believed that this might help in dealing with a hybridized, applied notion of *value* and *factors* in design.

Today, to design things that matter is to grasp how beings and things relate, influence, and shape each other. Thus, human knowledge and non-human knowledge shape overcrowded ecologies through hybrid values, influencing collective life from complementary perspectives: from one side, designers might address *thing factors* so that they could sense and understand the world through more-than-human values; from the other side designers might address *being factors* to build meaning through shared values.

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