

Re-constructing an Actor-Network Theory of Design: the necessity of considering individual and intersubjective autonomy and perception

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Abstract: Actor-Network Theory has been used within design studies to demonstrate how design is capable of influencing and encouraging certain behaviors, social ties, and interactions between individuals and objects. This discipline's use of this theory has led to the conviction that design can facilitate daily life and the behaviors that take place within it, affording design a large amount of autonomy and agency while suggesting that individuals are capable of being standardized. Understanding that Actor-Network Theory originated within science and technology studies, this article argues that if this theory is to be brought into design studies, it must expand to more accurately assess the relationship between humans and between humans and nonhumans in the context of designed objects and environments. Specifically, this article proposes that an Actor-Network Theory of design integrates the notion of individual autonomy in order to assess how the human instinct to self-direct one's life can lead to unpredictable perceptions and usages of designs. Through a historical and social analysis of 'de knop,' the bicycle push-button traffic sensor found throughout the Netherlands, this article will demonstrate how individuals' urge to assert autonomy can lead to both subjective and inter-subjective perceptions--in this case being perceptions of ineffectiveness or mistrust--in turn destabilizing design's ability to control or condition behaviors.

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1. Introduction

Autonomy has been defined both as “the right or condition of self-government” and as “freedom from external control or influence; independence.”¹ Autonomy is the ability one has to act out of preference, intuition, or instinct, rather than out of force or coercion. Frequently conceived of as a *human* right, autonomy is rarely associated with environments or objects. Actor-Network Theory has been employed within design studies, however, to illustrate how design “shapes, conditions, facilitates and makes possible every day sociality.”² This suggests not only design's autonomy and authority over daily life, but also its influence over individual

¹ “Autonomy,” *Oxford Languages*,

https://www.google.com/search?q=autonomy+definition&ei=vrGEY_OrG9mQkdUPpvWO2A8&ved=0ahUKEwjzggGJ-ND7AhVZSKOEHaa6A_sO4dUDCA8&uact=5&oq=autonomy+definition&gs_lcp=Cgxnd3Mtd2l6LXNlcjAQAQAzIICA AQOxBGEPkBMgUIABCABDIFCAAQgAQyBQgAEIAEMgUIABCABDIFCAAQgAQyBQgAEIAEMgUIABCABDIFCAAQgAQyBQgAEIAEMgUIABCABDIFCAAQgAQyBQgAEIAEQgoIABBHENYEELADQgcIABCwAxBDOgQIABBDsgOIORgASgOIRhgAUL4BWOkHYOOIaAFvAXgBgAHkAogB-AmSAQc0LjMuMS4xmAEOeEBvAEKwAEB&scient=gws-wiz-serp.

² Albena Yaneva, “Border Crossings, Making the Social Hold: Towards an Actor-Network Theory of Design,” *Design and Culture* 1, no. 3 (2009): 273.

autonomy; when used within design studies, Actor-Network Theory implies that design is capable of revoking or reducing individuals' autonomy. Other design scholars have alternatively noted that "objects show their autonomy...when they fail to serve the purpose that humans recognize in them."³ If this is the case, then autonomy is a quality that can be either constructed or provoked. Many psychologists consider autonomy to be "one of the three basic psychological needs" for optimal human growth and well-being; they understand autonomy as human beings' desire to "make their own decisions, pursue their own goals, and come up with their own ideas."⁴ Therefore, autonomy is an effective terminological anchor for discussing how the application of Actor-Network Theory within design studies can evolve.

This article will first demonstrate how Actor-Network Theory has been used to suggest objects' autonomy and agency over societal behaviors and dynamics, and probes the limitations of this framework when applied to design studies. I will proceed by demonstrating how objects' autonomy can be destabilized through individual autonomy and consequential perceptions. This becomes clear in the case of the Netherlands' push-button traffic sensor, which is perceived and thus used in a variety of fashions depending upon the individual and how they have chosen to assert their autonomy, regardless of its originally straight-forward purpose. In this section, I will also discuss how individuals' subjective perceptions can merge or impact each other and thus form intersubjective perceptions which, too, influence how design is being interacted with. In conclusion, I will propose an approach for applying Actor-Network Theory within design studies which takes into account the autonomy of *both* object and individual, and therefore can more properly assess the dynamics that exist between the two throughout daily sociality.

If Actor-Network Theory is to be employed within design studies, it must be done with a consideration of autonomy, as this is an innate desire among humans that stimulates subjective and unpredictable perceptions and uses of designs. More specifically, one's inclination for autonomy can lead to the perception that certain objects are not operating as one believes they should be, in turn causing their function to be reappropriated and design's facilitation and control of social life to be disrupted. The technical effectiveness of bikers' push-button traffic sensors

³ Mahmoud Keshavarz, *The Design Politics of the Passport: materiality, immobility, and dissent* (London: Bloomsbury Visual Arts 2018), 44, <https://ebookcentral-proquest-com.vu-nl.idm.oclc.org/lib/vunl/reader.action?docID=5568266>.

⁴ Lisa Legault, "The Need for Autonomy," in *Encyclopedia of Personality and Individual Differences*, ed. Virgil Zeigler-Hill and Todd K. Shackelford (New York City: Springer, 2020), 1, https://link-springer-com.vu-nl.idm.oclc.org/content/pdf/10.1007/978-3-319-28099-8_1120-1.pdf?pdf=inline%20link.

found throughout the Netherlands, locally referred to as ‘de knop,’ is commonly scrutinized. As a result, the function of this push button has become flexible, depending upon how an individual has chosen to assert their autonomy and thus shape their perception in response to the doubt this object has become associated with.

2. The Autonomous Nonhuman

Actor-Network Theory broadly rests upon the “general descriptive rule” that “every time you want to know what a nonhuman does, simply imagine what other humans or other nonhumans would have to do were this character not present.”⁵ This directive suggests that nonhumans--objects--have been invested with a specific role or function that, in turn, relieves humans of that particular responsibility. Following this implication, scholars of design studies have utilized Actor-Network Theory to assert that, through its design, an object can “prescribe” or “permit” certain behaviors from those that encounter it.⁶

The term, ‘prescription’--which is one of the key terms from the “convenient vocabulary” delineated by two of Actor-Network Theory’s developers, Madeleine Akrich and Bruno Latour--is defined as “relating to the imposition or enforcement of a rule.”⁷ The use of the word ‘prescription’ throughout applications of Actor-Network Theory consequently grants a high degree of authority to designers and in turn, to their designed objects. Underlying these provocations lies the belief that, without much pushback or friction, nonhumans can control humans more than humans can control themselves. Autonomy’s definition as the state of being free from external control or influence, then, resembles how design studies have used Actor-Network Theory to communicate objects’ power.

Although predominantly establishing the relationship between nonhuman and human as one of assertion and compliance, Actor-Network Theory’s framework does acknowledge the

⁵ Bruno Latour, “Where are the Missing Masses? The Sociology of A Few Mundane Artifacts,” in *The Object Reader* ed. Fiona Candlin and Raiford Guins (Oxfordshire: Taylor & Francis, 2009), 232.

⁶ Madeleine Akrich and Bruno Latour, “A Summary of Convenient Vocabulary for the Semiotics of Human and Nonhuman Assemblies,” in *Shaping Technology/Building Society, Studies in Sociotechnical Change* ed. Wiebe E. Bijker and John Law (Cambridge: Massachusetts Institute of Technology, 1992), 261.

⁷ Ibid, 261; “Prescriptive,” *Oxford Languages*, https://www.google.com/search?q=prescriptive&ei=UigY_fiCjAKdUP7_COqAM&ved=0ahUKFwi3w-6LyIX8AhUIYKOEHW-4AzUO4dUDCBA&uact=5&oq=prescriptive&gs_lcp=Cgxnd3Mtd2l6LXNlcnAQAzIECAAQOzIECAAQOzIFCAAQOgAQvBOgAEIAEMgUIABCABDIFCAAQOgAQvBOgAEIAEMgUIABCRAjoICC4QgAQQ1AI6CwguEIAEEMcBENEDSgOIORgASgOIRhgAUABYpOdgjghoAHABeAGAAfEBiAGuCSIBBTYuNC4ymAEAoAEBwAEB&sclient=gws-wiz-seid.

potential for subversion within this dynamic. The terms “subscription” or “de-inscription” are additional components of the Actor-Network Theory vocabulary, referring to the reactions or responses to a nonhuman’s prescriptions.⁸ Any “programs of action” observed by humans that are “in conflict with the programs chosen as the point of departure of the analysis” are considered “antiprograms” according to Actor-Network Theory’s vocabulary. Nevertheless, this theory does not encourage an exploration of why ‘antiprograms’ occur or of the consequences that such ‘antiprograms’ have. Moreover, the role that autonomy plays within ‘antiprograms’ is downplayed; consequently, the impacts that individual autonomy can have on designs’ perceptions and uses are neglected. This may not have been relevant in the initial applications of Actor-Network Theory within science and technology studies, however the influence that autonomy and perception have when considering the dynamic between individuals and designs cannot be overlooked.

According to theorists behind Actor-Network Theory, any “gap” between a design’s prescription and subscription, or between what behaviors are being encouraged and which are being conducted, can define whether or not there is a crisis. In other words, if you cannot distinguish between what a nonhuman has intended to prescribe upon a human and how a human has subscribed in response, then according to Actor-Network Theory’s framework, everything has “run smoothly.”⁹ This insinuates that if an individual instinctively, naturally, or effortlessly follows the behaviors that an object has asked of them, then there is no ‘gap,’ and no ‘crisis.’ Theorists behind Actor-Network Theory, such as Bruno Latour, have referenced various occurrences that exemplify what is meant by the term ‘crisis,’ from space shuttles exploding to door grooms breaking.¹⁰ When such forms of ‘crises’ take place, according to the framework of Actor-Network Theory, the role that the nonhuman has been inscribed with, and the behaviors it prescribes in effect, are illuminated and can be retraced. If things have run smoothly, then these qualities should not be apparent.

While Latour’s examples *could* be analyzed from a design studies perspective, they indicate the extremity of Actor-Network Theory’s understanding of ‘crises’ or failures between nonhuman and human. There are other moments in which what an object (or nonhuman) has

⁸ Akrich and Latour, 261.

⁹ Ibid.

¹⁰ Latour, “Where are the Missing Masses?” 235-236.

prescribed and the reactions it is met with do not align; this does not strictly need to be because an object has crashed or broken, but can be because humans' instinctive desire for autonomy leads to varied and unpredictable perceptions. While assorted perceptions may not seem to fit the characteristics often associated with the term 'crisis,' they fit Actor-Network Theory's understanding of this term since they cause a disconnect between objects' intended usage and experienced usage.

Evidently, Actor-Network Theory affords a large degree of confidence to nonhumans, its theorists making statements such as, "no human is as relentlessly moral as a machine."¹¹ Though understanding that it is possible for a design to fail, ANT theorists have disregarded how the notion of failure lies upon a spectrum from suspected failure to absolute failure--a spectrum that has been constructed through individual perceptions of functionality and success. In turn, this theory disregards the implications that various forms of failure, which are less extreme, have regarding the autonomy of both human and nonhuman. An absolute and complete malfunction is not the only instance in which an object's prescriptive qualities are made evident. In fact, the perceived failure of an object is similarly revealing. 'De knop' is an appropriate object for demonstrating the consequences of individual autonomy being asserted upon a design, through the ways in which perception, both subjective and intersubjective, has destabilized this object's role.

3. Where Non-Human and Human Autonomy Meet

'De knop' is one technical component of a broader network of Dutch bicycle infrastructure that has been nationally funded, installed, and developed throughout the country since the 1970s and 1980s.¹² During these decades, cars' growing popularity posed a threat to cyclists' ability to safely navigate the roads.¹³ Following various accidents and injuries, activists successfully convinced government administrators across the Netherlands that well-developed bicycle infrastructure was necessary to ensure the safety, accessibility, and autonomy of cyclists

¹¹ Ibid, 234.

¹² "The rise of cycling in the urban areas of the Netherlands," *Centre for Public Impact*, 22 November 2016, <https://www.centreforpublicimpact.org/case-study/focusing-bicycles-transport-urban-netherlands>.

¹³ Ibid.

of all ages.¹⁴ Advocates for bicycle infrastructure across the world have stated that “not even great public transportation can beat the autonomy and flexibility that cycling provides.”¹⁵ Thus, design has served as the means for facilitating or materializing this sense of agency; when a city embeds bicycle infrastructure into its urban fabric, choosing cycling as one’s method of transport can be an intuitive decision. Further, it can symbolize a city, or nation’s, investment in cyclists’ safety and comfortability while they navigate traffic.

‘De knop’--a seemingly straight-forward push-button traffic sensor mounted upon a metal pole beside traffic lights--is one design that has been implemented to encourage safe cycling throughout the Netherlands (Figure 1). Simultaneously, ‘de knop’ materializes and symbolizes the autonomy that is intended to accompany cycling in this country. Bikers who have grown up in the Netherlands have communicated that they believe in the need for ‘de knop,’ in theory, because it allows them to exert “a certain amount of power over traffic that is much more powerful than you.”¹⁶ Though this sense of empowerment is meant to be prescribed by ‘de knop,’ this is not always accomplished due to the varying perceptions of ‘de knop’s effectiveness. Yet, the manner in which Actor-Network Theory has been applied within design studies has assumed that individuals can be standardized; in its conviction that an object can assert autonomy over individuals, the impacts that autonomy, and therefore perception, can have are overlooked. Therefore, ‘de knop’ cannot be understood solely through what it was intended for; though the object itself may be the product of standardized mass-production, it does not face the same homogeneity within its use across daily sociality.

¹⁴ Ibid.

¹⁵ Sabina Fratila, “Bike sharing will change city life,” *Donkey Republic*, <https://www.donkey.bike/bike-sharing-will-change-city-life/>.

¹⁶ See Appendix 1: p. 21.



Figure 1: Biker's traffic sensor push button and corresponding instructive graphic

Individuals' perceptions and uses of 'de knop' are far from standardized. Many individuals doubt the functionality of this traffic sensor, causing the effectiveness of its inscribed and prescribed symbols and directives to diminish. Traffic engineers and scholars of urban studies have asserted that this push-button sensor, made initially to fulfill a specific, technical function, does not contribute much regarding mediating traffic flows, instead declaring it is "only there for reassurance."¹⁷ While assuring cyclists *was* originally one motivation for developing bicycle infrastructure across the Netherlands, 'de knop' is a mechanical and technical object meant to serve a specific, practical purpose--namely, to sense cyclists' presence and shift traffic lights in response, guaranteeing that they cross safely. This object, then, should be providing reassurance by *demonstrating* its effectiveness upon being pushed by cyclists. This has not been the case, however, as bikers across the Netherlands have observed and recounted mixed outcomes

¹⁷ "Traffic lights in 's-Hertogenbosch; an interview," *Bicycle Dutch*, 21 June 2016, <https://bicycledutch.wordpress.com/2016/06/21/traffic-lights-in-s-hertogenbosch-an-interview/>; Sterk, "Use of Bicycle Sensors by Dutch Municipalities," 8.

to pushing this button. As a result, the ways in which individuals perceive and interact with ‘de knop’ has become completely dependent upon the narrative that an individual chooses to believe.

As was cited earlier, objects’ autonomy has been said to emerge when they fail “to serve the purpose that humans recognise in them.” Due to its straight-forward design, bikers are encouraged to expect that in pushing ‘de knop’ the red light will shift to green, and its perceived failure to do so endows it with a new sense of autonomy. Though autonomy insinuates freedom from external control, individuals’ influence over the purpose of ‘de knop’ simultaneously activates its own agency. The object is freed from the purpose it has been inscribed with and becomes entitled to host a variety of alternative usages. At the same time, the perceptions of ‘de knop’ as ineffective or unpredictable result from the activation of cyclists’ autonomy, who can decide to reject the prescriptions of ‘de knop’ and self-determine what its function will become.

The discussions of autonomy that have been referenced here suggest that this is a quality that will be activated in certain contexts in response to various perceptions or impulses. Psychological understandings of autonomy have indicated that “all individuals will naturally strive to have this need [of feeling self-directed and autonomous] fulfilled.”¹⁸ Therefore, cyclists throughout the Netherlands will instinctively attempt to assert their autonomy throughout the road, an instinct that the country’s bicycle infrastructure has intended to support. However, when certain pieces of this infrastructure, such as ‘de knop,’ restrict one’s desire for autonomy and self-direction rather than encourage it, bikers must find other ways to fulfill this need.

Bikers that have moved to the Netherlands from countries such as the United States, where technology such as ‘de knop’ hardly exists, have explained that upon first arriving, they consistently pushed ‘de knop’ to ensure that they would have “right of way over cars” and thus avoid collisions.¹⁹ Yet, after a bit of time, they observed other bikers interacting with ‘de knop’ in a myriad of ways: “I noticed that a lot of people didn’t push it. Instead, they were just using the pole it was attached to to balance on. Or some people just acted like it wasn’t there, so then I realized it wasn’t really a rule necessarily.”²⁰ This narrative illuminates how autonomy, the urge to feel self-directed, can become activated by one’s encounters with other people around a

¹⁸ Legault, “The Need for Autonomy,” 1.

¹⁹ Appendix 1, see p. 23.

²⁰ Appendix 1, see p. 23.

design; in observing how other bikers were interacting with ‘de knop,’ this biker, instinctively, began to question their own perception of how it was to be used.

Upon encountering differences in how various bikers used, or did not use, ‘de knop,’ this biker began to question the genuinity of its function; they noted that these experiences made them “wonder if it [‘de knop’] really even worked,” explaining that, if it was effective and functional, they “figured everybody would want to push it.”²¹ This recollection illuminates the impact that individual and intersubjective autonomy and perception can have upon object usage. Upon developing this understanding of ‘de knop,’ this biker stopped pushing it, instead using the pole it is fixed upon to balance while waiting at the red light, which they said to find “much more helpful...than pushing the button and maybe naively hoping for it to respond.”²² Evidently, in noticing that ‘de knop’ was not serving the function they believed it was meant for for other bikers, it became open to serving alternative roles for them. The role that autonomy played in this situation is apparent in this biker’s explanation that they would rather repurpose ‘de knop’ than feel naive by abiding by its initial function; individuals, reflexively, want to self-direct their course of action so as not to be misguided, or feel out of control, by its impacts.

While some bikers have chosen to reappropriate the function of ‘de knop’ in response to their perception of its futility, others alter their usage of ‘de knop’ to accommodate others’ perceptions. As a biker born and raised in the Netherlands admitted, “I know I don’t have to touch it [‘de knop’], but with someone else, I feel like...like they’re expecting me, and I feel bad if I don’t push it.”²³ Such a sentiment demonstrates how one’s autonomy can become intersubjective when interacting with public objects. While having formed her own perception that she does not *have* to push ‘de knop,’ she is aware that not *all* bikers perceive of ‘de knop’ this way and thus caters her use of ‘de knop’ depending upon the context--the context being whether or not she is alone at the red light. In this example, the influence of the object’s prescription is not what guides this biker’s usage, but instead, her intersubjective understanding of this object in regards to bikers’ autonomy does. Usage of ‘de knop’ has become shaped by individuals’ narratives, constructed out of their desire to “be directors of their own lives.”²⁴ This biker understands that other bikers feel autonomous, or in control, when pushing ‘de knop,’

²¹ Appendix 1, see p. 23.

²² Appendix 1, see p. 23.

²³ Appendix 1, see p. 18.

²⁴ Legault, “The Need for Autonomy,” 1.

therefore she chooses to do so on their behalf and, thus, attempts to self-direct others' perception of her.

Many other bikers have formed the perception that 'de knop' is pointless when accompanied by other pieces of traffic sensor technology; "nowadays, you know, you know when there are pressure pads, or those magnetic loops in the ground, you know that that is as effective as pushing the button is...if they're there then I don't even bother pushing the button because I know that it has no effect."²⁵ There is no confirmation of this perception, although it was stated by other interviewed bikers, as well. This conclusion, thus, demonstrates how the instinct to assert one's autonomy leads to certain self-determinations that directly influence how individuals move through their environment. It is unclear why traffic engineers would install 'de knop' if it did not serve any practical purposes or, additionally, why 'de knop' would remain installed if its function was being completed by loop sensors in the same location (Figure 2). Nevertheless, bikers across the Netherlands have constructed this perception in response to their encounters with 'de knop' and their desire to feel autonomous in their usage of it. By self-determining when and in which contexts this object is functional, bikers can feel more in control of how they navigate the road.

²⁵ Appendix 1, see p. 20.



Figure 2: Loop sensors installed beneath road accompanied by ‘de knop’ at a signalized intersection

While ‘de knop’ was constructed and installed as a part of a broader agenda in the Netherlands that intended to ensure cyclists’ safety and control, its meaning and role is frequently redefined by individuals. Design studies’ application of Actor-Network Theory has situated objects’ functionality as quite fixed, implying that individuals can be standardized and will abide by the prescriptions they are being faced with without resistance. However, by taking into account humans’ “critical psychological need” for autonomy, the use of Actor-Network Theory could more thoroughly understand the dynamics that occur between humans and nonhumans. Through incorporating the role that autonomy has in human behavior, the unpredictability of object usage could be discussed, particularly regarding autonomy’s ability to enact both subjective and intersubjective perceptions of skepticism towards objects. In order to account for such dynamics, I will conclude by proposing how Actor-Network Theory could be expanded upon when applied within design studies.

4. Conclusion: Expanding Upon an Actor-Network Theory of Design

Scholars within design studies have determined Actor-Network Theory to be beneficial for illuminating design's role in shaping daily life and the ways in which individuals understand how to navigate it. Yet, there should be a more thorough consideration for how individual autonomy and subjectivity can disrupt, challenge, and destabilize the intentions or prescriptions of a design. I propose that a greater attunement to where and how individuals assert their autonomy should become integrated when completing analyses using Actor-Network Theory within the discipline of design. Through this attunement, Actor-Network Theory can accommodate the role that perception plays in how designs are understood and used. Latour has directly stated that Actor-Network Theory “has very little to do with the study of social networks,” instead aiming to “rebuild social theory out of networks.”²⁶ In proposing a theoretical framework that regards social theory as a network, Actor-Network Theory aims to be about a “network-tracing activity.”²⁷ However, if design studies employs this theory, this act of network-tracing must simultaneously account for human autonomy and subjectivity in order to properly illustrate the ways in which humans and nonhumans interact in the context of design.

Latour has expressed that Actor-Network Theory is not “human-centered,” regarding actants as having “no specific homogenous morphism,” meaning they can be humans, objects, signs, ideas, and so on.²⁸ Therefore, this theory is evidently not meant to explore human psychological or sociological responses or the various conditions and instincts that shape how human experiences can unfold. However, when considering the relationship between a design and a society or an individual, these components must be considered in order to understand this dynamic as holistically as possible. While certain components of Actor-Network Theory have enabled design scholars to consider and contemplate the relationship between individuals and a design, there are still crucial elements to this dynamic that are not being accounted for.

Madeleine Akrich, an additional theorist behind Actor-Network Theory, has acknowledged that some people will not “come forward to play the role envisaged by the

²⁶ Bruno Latour, “On actor-network theory: A few clarifications,” *Soziale Welt* 47, no. 4 (1996): 369-370, <http://www.jstor.org/stable/40878163>.

²⁷ *Ibid.*, 378.

²⁸ *Ibid.*, 379.

designer,” or that “users may define quite different roles of their own.”²⁹ However, Akrich does not specifically associate this possibility with the subjectivity of individual perception. In neglecting the power that societal perception can have in molding how humans interact with nonhumans, the function that autonomy can play within the design discipline is underestimated. Moreover, ‘de knop’ presents a situation in which not only are individual and intersubjective perceptions impacting how this object is interacted with, but specifically, individual and intersubjective perceptions of failure, distrust, or futility. Within the context of technology design, such as objects like ‘de knop,’ these perceptions can severely disfigure how a design is treated and understood.

Psychologists have determined that autonomy is an innate human desire that can be facilitated or nourished by one’s environment.³⁰ This understanding also suggests that an influential dynamic exists between humans and the nonhumans they are surrounded by, as Actor-Network Theory has been used to propose. Therefore, there is a clear foundation for incorporating the concept of autonomy into the use of Actor-Network Theory within design studies, if it is going to continue to be utilized in this field. While scholars of design studies have utilized Actor-Network Theory to share their understandings of objects’ capacity to influence individuals, it could be reshaped so as to demonstrate how individuals are simultaneously shaping objects.

I have proposed a reconsideration of the use of Actor-Network Theory within design studies so that individual and intersubjective autonomy, and thus perception, is not minimized or ignored. I have demonstrated the role that autonomy can play in destabilizing Actor-Network Theory’s understanding of prescription through the Netherlands’ push-button traffic sensor, ‘de knop.’ While traffic engineers initially inscribed a certain role and function to ‘de knop,’ individuals’ instinct to assert autonomy upon their daily lives and environments have led many bikers to question whether this role or function is effective or genuine. As a result, the ways that ‘de knop’ is used varies completely upon the person and their individual, as well as intersubjective, perceptions of this object. The use of Actor-Network Theory within design studies has not entirely accounted for the fluidity and unpredictability that autonomy encourages.

²⁹ Madeleine Akrich, “The De-scription of Technical Objects,” in *Shaping Technology/Building Society, Studies in Sociotechnical Change* ed. Wiebe E. Bijker and John Law (Cambridge: Massachusetts Institute of Technology, 1992), 208.

³⁰ Legault, “The Need for Autonomy,” 1.

By recognizing and studying the autonomy of both humans and nonhumans, we can further understand both how design can shape daily life and how individuals can shape design.

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List of Figures

Figure 1: Taken from “Use of Bicycle Sensors by Dutch Municipalities.” Bachelor End Project, Delft University of Technology (2020): 8.
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Figure 2: Taken from “Use of Bicycle Sensors by Dutch Municipalities.” Bachelor End Project, Delft University of Technology (2020): 9.
<https://yufei yuan.eu/wp-content/uploads/2020/06/2020-06-2998.pdf>.

Appendix I: Interview Transcriptions

Transcription 1: between Mayim Frieden (author) and Charlotte van Dorssen

00:00-00:07: Setting up microphone

00:07 **M:** So, the first question is just tell me about your earliest experience or your earliest memory with 'de knop,' you know the push button, I'm just gonna call it 'de knop' because it's shorter than, like, push-button traffic sensor, but what is your earliest experience or memory with 'de knop' that you can recall?

00:30 **C:** I think I was in the front of my father's bike, in the front seat, and he's like pushing the button and then leaning on it and I'm just watching him do it and seeing the cars pass by

00:47 **M:** Awe, cute, that's so Dutch..okay, my second question is how has your relationship with 'de knop' changed since this moment and if it has changed, why?

01:04 **C:** First, I went to use it myself and later on, my mom told me about this, that you can get sick if you push it because everyone is touching it, and I got a bit more afraid of it, and then I learned that they are not, that there are sensors in the ground so I didn't push it anymore

01:30 **M:** Mmm, okay, so do you still avoid touching the button because of these two things or, does, how does your usage of 'de knop' change or does it always stay the same?

01:45 **C:** Since Corona, it is even more that I don't touch it, but if there's people behind me, I touch it, because they feel different about 'de knop,' so then I push it for them, as they expect me to do it

02:04 **M:** Mmm, and you always do that?

02:07 **C:** Yeah, I always do it, and sometimes I do it more often, if there comes someone else, I do it again, because if there are two people, maybe the second one thinks I didn't push it *laughs* so I push it again

02:24 **M:** I love that..if someone were to ask you what 'de knop' was for, what would you tell them?

02:32 **C:** To get the light green, so the cars will stop and you can pass

02:37 **M:** So, why do you believe, or do you believe that 'de knop' works? Or, if you believe that it does not work, what makes you think that it does not work?

02:50 **C:** Still, I believe it works, but if I see like these lines on the ground, that there are sensor lines, I always check it, if I see they are on the ground, I know the push button is for nothing

03:03 **M:** Ah, so you think if there's like the induction loop underground, the button doesn't work, but if there's no induction loop underground, then the button does work?

03:13 **C:** Yeah, I still believe *laughs* I know it probably doesn't work, but I still believe that something happens when I push it

03:21 **M:** What makes you think that it doesn't work when there's the induction loop?

03:27 **C:** Because the induction sensors your, like your weight, so then the light goes green

03:34 **M:** Mm, okay, and then I have one more question, um, have you ever used 'de knop' for another reason other than like pushing it when you see other people?

03:46 **C:** Leaning on it, always, and that's it, I think

03:53 **M:** So you mainly push it for other people because you think that they think it works, and you also kind of think it works, but it depends

04:03 **C:** Yeah, I also think it works but I know I don't have to touch it but with someone else I feel like this, like they're expecting me, and I feel bad if I don't push it, so yeah

04:15 **M:** Mmmm, okay, perfect, well that was all the questions, so. I told you it would be quick, but thank you so much for helping out.

--END OF TRANSCRIPT--

Transcription 2: Between Mayim Frieden (author) and Victor van Pieterse

00:00-0:06: Setting up microphone

00:07 **M:** Okay, so I'll start off with the first question which is, if you could tell me about your earliest experience, or your earliest memory, with 'de knop'

00:19 **V:** My earliest experience with 'de knop' is when I was still in front of my, you know you have these little seats in front of bikes and, I don't know how old I was but I think about three or four years old and that my father leaned the bike over to 'de knop, so I could push 'de knop'

00:46 **M:** Aw, and so, your earliest memory is pushing 'de knop' and do you feel like your relationship, or the way that you use 'de knop' has stayed the same or has it changed?

01:00 **V:** Oh, no, it has changed because nowadays, you don't really have a knob, it's just, you have to touch it, you can't really push it, it's less tactile, you know?

01:14 **M:** Mm, yeah, they've changed some of them

01:16 **V:** Yeah, most of them now, you caress them or you stroke them more than you really push them, so you've lost really the feeling about pushing someone, something, into the post, I think. It's less interesting now, it's just you stroke it and then the red light goes on instead of really pushing

01:46 **M:** Right, do you think that this change has made it more effective, or do you think that it works appropriately?

01:56 **V:** Hmm, I think that's a really..I think it's more something that appeals to younger people as if you really push the button, it is more something for, for my age because we were always used to pushing things and that affected something and nowadays it's all touch-screen so I think a lot of that feelings of pushing things and making things work has changed in heads of young people, but maybe that's something that you're more familiar with than me, but.. I really like the pushing thing because when I was young, you also pushed the button on the radio and it clicked, it gave a real feeling about something mechanical

02:58 **M:** Right, so, do you think that when you were growing up and you were pushing the button, did you think that it actually worked? Like, when you pushed the button, the light would turn green, because a lot of people have made statements that it doesn't actually do anything, it's just there to reassure people, but it's not actually making the light turn green

03:20 **V:** Well, when I was young, I really thought it was working, I also thought because my grandfather and my father and my mother they all knew exactly how the traffic light worked, so when that stopped, then we go, so they always clicked their finger and then, now it's green, so I really thought they were

magicians so when you're young, you think everything works, in that respect. Nowadays, you know, you know when there are pressure pads, or those magnetic loops in the ground, you know that that is as effective as pushing the button is, and if they are not there, well I, then I push the button, but if they're there then I don't even bother pushing the button because I know that it has no effect

04:17 **M:** So, even though you know it has no effect, do you think it has an effect if the loop sensor is there, or isn't there?

04:27 **V:** Mm, I don't really think it has an effect when the loop is there

04:33 **M:** But when it's not there, you think it does work?

04:37 **V:** For when it's not there, I think it works, yes

04:40 **M:** Okay, yeah because a lot of traffic engineers, even, have said that, have made statements that, oh most of the time they are just there for reassurance, and some people have said that they don't actually think it does anything but they are just so used to pushing it because they've pushed it their whole lives that they push it anyways but then, yeah, it's like, why would they install them if they didn't actually do the job they're supposed to do?

05:07 **V:** That's, that's a good question but as I also mentioned I think, some of them have lead to..well, quite funny experiences I think, in Rotterdam you have, I know, I lived in Rotterdam, and there you have buttons that are connected to rain sensors so when you push the button and it's raining, you get priority over cars because those people are nice and dry and warm inside of their cars and pedestrians and bicycle riders, they are outside in the rain, so in Rotterdam they think it's more sociable if you have right-of-way when it's raining and, I think there are other possibilities you can think of when you have a button so you can experiment with them, and if you really rule them out completely then those experiments, or those extra functions, you cannot produce them anymore, you cannot experiment with them anymore, so once they're gone, they're gone and everything is mechanized, so, the whole holistic and human sector is taken out of the equation and you can argue that that is nice, because you don't have to care about pushing buttons anymore or installing buttons, on the other hand I think it's really nice and social when you have a structure that you try to use it to make things nicer for people or more equal for people, so for instead, when you're with a bike, nowadays, you have a crossing, it is often so, with a bike, you have to cross two traffic lights, instead of cars, they only have to pass one traffic light, so you could use 'de knops,' if it's possible, to reduce the time you take with a biker or a pedestrian to cross the crossing so it's more nicer for the bike riders, or you could use them in, for instance, if you want to create a more bike-friendly environment to use them to, to give other sorts of priorities to bikes in different circumstances, and if you take those buttons away, then you have no infrastructure to do that

07:54 **M:** Yeah, that's a really good point and yeah, a lot of times, like, if you look at 'de knop's' in another perspective, by existing and by being there, it's sort of like reminding people in the Netherlands that there is a safe way to bike here because, you know, that kind of infrastructure doesn't exist in a lot of

other countries, you know, that's made specifically for bikers, so I was gonna ask you, do you think that maybe, is a part of why you believe in 'de knop' and also choose to use it when you see it because you perceive of it as an important object that you think should stay, or do you think you're just used to using it because you always have or why do you think it is that you feel inclined to believe in 'de knop' and use it?

08:35 **V:** Mmm, I think for me, the reason for using it, and the reason I think it could be important, is it gives you, as a biker, it gives you a sense of power over traffic you don't have power over, so if you cross a crossing and there's a car, you're toast when it hits you, and you cannot stop the cars and with a simple action, by pushing a button, you can make a car stop and make it safe for yourself, so it exerts a certain amount of power over traffic that is much more powerful than you and that also gives away a signal, just as laws in the Netherlands make bikers, they're always right, if you hit a bike with a car you're always wrong, that's...so, the most vulnerable users are actually best protected and that's how it should be in my perspective not only in traffic, but in everything, because that's why we make laws, but, an expression of that is a knop you can push and it's much more an action than waiting passively on an electric pad or on a loop, so, although it has the same effect

10:16 **M:** Yeah, it gives you like autonomy, in a way

10:19 **V:** Yeah, yep, yep, so that I think is like important about it, or could be important

10:27 **M:** Yeah, would you say that among people you know, most people believe in 'de knop,' that it works?

10:35 **V:** Mmm, I think most people don't really believe in it but also, people I know that don't believe in it, when I ride bikes with them, normally they use it

10:52 **M:** Aaaah, why do you think that is?

10:54 **V:** Mmm, partially habit, and you always can see people, if there are people who are in a hurry, they tend to push it multiple times, so it gives you something to do when you're impatient as well, and it's, well as you said, we have the habit of pushing the knop in the Netherlands and I still see, I think it's funny, I still see little children that are pulled up by their parents to push the knop

11:31 **M:** Yeah, so you're sort of taught that that's how you use it, and then that's how you use it

11:34 **V:** Yes, yeah, yep

11:37 **M:** It's like nostalgia

11:38 **V:** And it's a fun thing to do, it's nostalgia, and it's a fun thing to do for children so, it's just picked up naturally, because children want to participate

11:49 **M:** Yeah, yeah, exactly, and it's an interactive way of..awesome, okay well that was all my questions. Was there anything else you wanted to say about 'de knop' while you have the chance or do you feel like you were able to get to the thoughts that you were thinking?

12:08 **V:** I think I've, yeah, I think your questions most of the things I wanted to say

12:15 **M:** Okay, cool

--END OF TRANSCRIPT--

0:00-0:05: Setting up microphone

0:06 **M:** Okay, so my first question, what was your earliest experience or memory with 'de knop'?

0:13 **N:** Well, my first experience was when I first got to Amsterdam at the end of August.. and when I got my bike, I tried to pay attention to how other bikers were navigating the bike lane, and I saw people use 'de knop' in different ways

0:29 **M:** How has your relationship with, or usage of, 'de knop' changed since this moment? And, why?

0:35 **N:** Well, at first, I was pushing 'de knop' whenever I was at a red light, because I thought you had to and because I wanted to be sure I would have the right of way over cars, so we wouldn't collide. But, then, I noticed that a lot of people didn't push it. Instead, they were just using the pole it was attached to to balance on. Or some people just acted like it wasn't there so, then I realized it wasn't really a rule necessarily and this made me wonder if it really even worked. Because if it was effective I figured everybody would want to push it. But, then, sometimes, I saw people pushing it multiple times, so then I was like, does it work if you push it more than once, or are we just frustrated with it not working?
laughs I don't have a clear consensus, because how would I, but I definitely have more doubts about if it works now than I did at first

1:31 **M:** Yeah, no, I get that, I had a similar experience *laughs* well, would you say, then, that your usage of 'de knop' changes in each encounter you have with it?

1:45 **N:** Mmm, yeah kind of. I feel like I am never pushing it because I think it works, but if there's a bunch of bikers around me, I feel like I should just in case anybody there is confident that it is effective, I don't want them to get annoyed that I'm not pushing it, but if I'm alone I usually don't. I will lean on it, though, because I honestly, I find that much more helpful when I'm waiting for the light to turn green than pushing the button and maybe naively hoping for it to respond..Yeah, I guess 'de knop' is like a way to keep yourself busy at a red light, and doesn't feel so much like it has anything to do with actually mediating traffic, but wants you to think so. Maybe that is also why I don't use it, I'm like, trying to reject it in case it is trying to convince me of something. There is a lot of doubt around it, at least I've heard, so I don't want to be naive

3:45 **M:** Yeah, that definitely all makes sense. You don't want to feel like you're being falsely guided, or something. Well, if someone were to ask you what 'de knop' was meant for, what would you tell them?

3:57 **N:** I guess I would say it's meant to make bikers feel in control, by making them think that the traffic lights will shift for them. I still think it does this, though. Because by ignoring them, or even by ignoring the red light itself and biking through it, we are still asserting our control over the road and I guess over cars, because they sort of have to stop

4:11 **M:** *laughs* that's true, they really do have to stop..or should. But, why do you believe that 'de knop' doesn't work?

4:20 **N:** Well, I have pushed it and waited for a really long time for the light to change, which made me think it maybe wasn't actually picking up on anything when I pushed it. And, then, seeing other people ignore it so much kind of affirmed that. It is possible that it works, but I don't think it will ever really escape the doubt, like I think maybe because bikers want the light to change really fast, it will always be sort of doubted, but maybe it really just will take a moment to sense you, and we expect it to be faster. We have the control we need as bikers, but maybe we just want it faster *laughs* but then again, we'll never really know, right? So it will be up to your own judgment

4:38 **M:** That's true..It could be a lot of different explanations, you're right, we may never know. Well, that was all, thank you so much for taking the time.

--END OF TRANSCRIPT--