Designing a Smart Electric Vehicle Charge Point for Algorithmic Transparency: Doing Harm by Doing Good?

Kars Alfrink
Department of Sustainable Design Engineering,
TU Delft
Landbergstraat 15
Delft 2628 CE
The Netherlands
c.p.alfrink@tudelft.nl

Ianus Keller
Department of Human Centered Design, TU Delft
Landbergstraat 15
Delft 2628 CE
The Netherlands
a.i.keller@tudelft.nl

Neelke Doorn
Department of Values, Technology and Innovation,
TU Delft
Jaffalaan 5
Delft 2628 BX
The Netherlands
n.doorn@tudelft.nl

Gerd Kortuem
Department of Sustainable Design Engineering, TU Delft
Landbergstraat 15
Delft 2628 CE
The Netherlands
g.w.kortuem@tudelft.nl

Abstract
The increasing use of algorithms in cities has come under scrutiny. Transparency is widely seen as a way to ensure their fairness and accountability. We investigate how algorithmic transparency helps citizens understand smart electric vehicle charge points and how its conception differs between experts and citizens. Using a research-through-design approach we collaborated over a 10-month period with companies and Amsterdam municipality to prototype and evaluate a transparent smart electric vehicle charge point. We find that experts believe transparency is produced by truthful information about inputs, processes and outcomes, that this information aids understanding and is actionable. We also find that citizens are indifferent to algorithmic decision-making when it serves common interests. Furthermore, transparency invites gaming, creates expectations of control, and adds to the cognitive burden of an already stressful task. Our findings suggest algorithmic transparency benefits professional stakeholders more than the citizens it is claimed to serve.

Author Keywords
Transparency; Algorithms; Electric Vehicle Charging.

CCS Concepts
•Human-centered computing → Empirical studies in interaction design;

Introduction

Cities across the globe are increasingly using digital technologies such as big data, sensor networks and artificial intelligence to address key urban challenges. However, it is now widely recognized that data-driven systems and machine learning can have serious shortcomings and may lead to unintended and unfair outcomes, even if such systems have been designed with the best intentions [8, 5].

These concerns have prompted researchers, governments and civil society groups to formulate ethical principles for the deployment and use of AI, highlighting issues such as transparency, fairness and accountability [6]. Likewise, some cities have started to embrace a digital rights agenda and are formulating principles and policies to influence and govern the use of digital urban technologies [1]. Many ethical principles and policy agendas see data and algorithmic transparency as an important prerequisite for effective accountability and public acceptability [4, 10]. At the same time, researchers have started to point out the theoretical and practical limitations of the transparency ideal [2].

We have investigated the diverging conception of algorithmic transparency between experts on the one hand and citizens on the other hand. Using a research-through-design approach we collaborated with commercial companies and the municipality of Amsterdam to prototype and evaluate a transparent smart electric vehicle (EV) charge point which provides EV drivers with explanations of charging algorithm decisions.

Figure 1: The Transparent Charging Station. Designed by The Incredible Machine.

Designing for Algorithmic Transparency

The digital agenda of the city of Amsterdam entitled 'A Digital City for and by Everyone' lays out values and ambitions for a "free and inclusive digital city" in which the digital rights of all residents are protected [7]. Prompted by this initiative and responding to the rising public concern about the risks of the internet of things and artificial intelligence, a group of energy companies and EV charging providers in 2016 commissioned a design study to develop ideas for how smart charging can be made transparent for EV drivers. The outcome was the 'Transparent Charging Station' (Figure 1), a conceptual prototype of a smart charge point that used a video game metaphor for visualising algorithmic charging decisions [11]. A key aspect of the Transparent Charging Station was the use of priority schemes: shared EVs would get priority access and thus be able to charge faster, sooner and more than non-shared private vehicles.

The design study received significant public interest but also raised questions about the meaning, viability and utility of algorithmic transparency in the context of a street-level public service. Prompted by these observations, our aim is threefold: understand (1) how experts from smart charging companies and the city of Amsterdam conceptualise algorithmic transparency; (2) how ordinary citizens, i.e. EV drivers, experience algorithmic transparency; and (3) the degree of alignment or misalignment of the views on algorithmic transparency between experts and citizens.

Study Setup

In order to investigate these questions we conducted a research-through-design study [9]. We collaborated in the design, prototyping and evaluation of a transparent smart EV charge point in close collaboration with the city of Amsterdam, ElaadNL (a smart charging consultancy) and design agency The Incredible Machine. The study was part of a commercial trial which aimed to develop and test a functional transparent smart EV charging system in a neighborhood in Amsterdam. Our research was conducted alongside the commercial project yet investigated independent

research questions. Our study resulted in a non-functional prototype that took inspirations from the original transparent charge point mentioned above, but used a different user interface approach to address obvious usability flaws. The ultimate responsibility of the design lay with the commercial design agency, we helped inform and evaluate the design.

Figure 2: The design prototype was evaluated with EV drivers recruited on the spot at a fast charging facility

Prototype

The resulting prototype consists of a 1:1 scale cardboard replica of the charge points in use in Amsterdam. The signage on the stations is reproduced and ports have been added for actual charge connectors to fit into. An 12.9-inch iPad Pro is attached to the top of the charge point for the transparency interface to run on.

Figure 3 shows a selection of screens from the prototype. The basic structure consists of: (1) an idle screen, (2) a screen that is shown once charging has started, and (3) a screen that is shown after charging has concluded. We used two types of screen elements: elements that support the task of charging (e.g. a prompt to swipe a card to begin) and elements that aim to make the smart charging algorithm *transparent*.

We created two version of the user interface design, v1 and v2. V2 addresses some usability issues that were detected during initial evaluations, yet otherwise v1 and v2 were identical.

Method

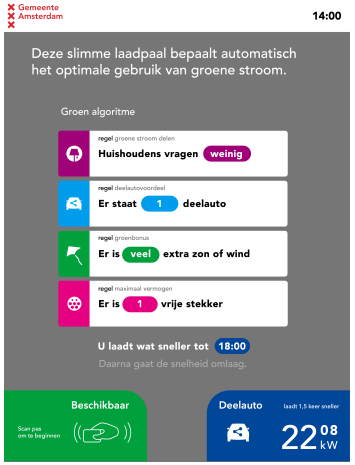
Our overall research method is qualitative-interpretive and informed by research-through-design [9]. Data collected consisted of project documents, field observations, and interviews. Analysis was performed using reflective thematic analysis [3]. The first author was present at all meetings of the design team to observe and participate in the discussions. A reflective field journal was kept and documents produced during this phase – such as the design agency's project proposal and slide decks used during presentations – were stored for future analysis.

Results & Discussion

Using a reflective thematic analysis of documents from a design process and transcripts of prototype evaluations we have captured the ways in which a group of experts understand algorithmic transparency, and how the transparent algorithmic system resulting from their efforts – a transparent smart EV charge point – is experienced by citizens.

We have found that according to experts, transparency is created by providing *truthful* information about algorithmic decisions. Our experts believe that, because algorithmic decisions might benefit some more than others, and because algorithms are by their nature hidden, they need to be made *visible*. Our experts do not pursue transparency because it is the right thing to do, but because if transparency is not created, citizens may reject the application of algorithmic decision-making in public infrastructure. Our experts believe transparency information is *actionable* by citizens. Experts expect this information makes it possible for citizens to assess the *fairness* of decisions – by evaluating the inputs, processes and outcomes of "the algorithm", by having access to a justification for the algorithm's design, and by knowing who "owns" the algorithm.

The experience of citizens is characterised first of all by an overall acceptance of, or even indifference to, the presence of algorithmic decision-making. Algorithms are seen as a convenient way of optimising towards broadly shared collective interests such as electric grid stability and sustainability. It is only when goals are introduced that are more contentious – illustrated in our study by the shared



(a) Idle state

(b) Charge session started

(c) Charge session completed

Figure 3: Prototype v2 screens

car priority feature – that citizens start to question the algorithm. Furthermore, the information provided in the interest of transparency is frequently experienced by citizens as burdensome – it is *not* perceived to be supportive of the task at hand (charging an EV) a task which is rather error-prone and stress-inducing to boot. Moreover, citizens intend to use transparency information as a resource for adapting their own behaviour towards egoistic or altruistic ends. Also, transparency information created expectations of user control – the ability to override algorithmic decisions. The absence of control lead to some participants questioning the relevance of the explanations provided. Lastly, in the case of disagreements with algorithmic decisions, most citizens opted to "exit" from the system altogether rather than exercise "voice" to try and influence the policies shaping system behaviour.

To summarize our comparison of expert understanding and citizen experience, we see that algorithmic transparency is not straightforward to achieve, and produces a range of unintended side-effects. Most importantly though, in an environment where citizen attention is already scarce, adding more information in the interest of transparency puts additional demands on citizens. Experts are concerned about user rejection of algorithmic decision-making, and think that by giving citizens tools to assess the fairness of algorithms, they will increase the odds of acceptance. Citizens, on the other hand, are largely welcoming of automation, and are annoyed and confused by the additional responsibility put on them to determine if each and every single interaction with a system is fair.

Provisional Design Guidelines

Our findings should help interaction design researchers working on smart urban systems and algorithmic systems in other contexts to navigate issues related to transparency, fairness and accountability.

To aid in this act of navigation, we propose three provisional guidelines for designing algorithmic transparency in the context of smart urban infrastructure: (1) assume algorithmic indifference & provide calm explanations; (2) account for limited user attention & shift the locus of fairness assessment; and (3) provide channels for voice & build in discretion.

Conclusion

In our study, experts believe algorithmic transparency is achieved by providing truthful information about automated decisions. They imagine that citizens are able to assess system fairness using this information, and that they can act on this information. Meanwhile, our citizens are largely indifferent to automation, they primarily experience transparency information as burdensome, and question its relevance if it is not accompanied with the ability to override system decisions.

Algorithmic transparency is a growing topic of interest in interaction design research, and in public discourse it is commonly invoked as a solution to the negative effects of algorithmic opacity. Our findings illustrate that it is necessary to remain critical of the assumptions driving the pursuit of algorithmic transparency in user interfaces of algorithmic systems. Transparency puts additional cognitive demands on people, and shifts the responsibility of ensuring fairness onto them. It is our belief that alternative strategies for making algorithmic systems fair and accountable should be investigated.

About the Authors

The first author has a background in interaction design practice and community organising for social justice in

the tech industry. The remaining authors combine backgrounds in interaction design research (Keller), philosophy of technology (Doorn), and computer science (Kortuem). The first author's values are informed by a left progressive politics. He has an interest in doing research that contributes to more democratic urban algorithmic systems, where "democracy" is understood in a tragic, agonistic sense: conflict is intrinsic to life, cannot be transcended, but can be productive. The first author operates from an assumption that any design knowledge is provisional and contextual, and that effective change through design happens by doing both practical design interventions "on the ground" and engaging with the "immaterials" that shape everyday urban life, such as policy and software code.

REFERENCES

[1] 2020. Cities for digital rights. (2020). https://citiesfordigitalrights.org/

[2] Mike Ananny and Kate Crawford. 2018. Seeing without knowing: Limitations of the transparency ideal and its application to algorithmic accountability. *new media & society* 20, 3 (2018), 973–989.

[3] Virginia Braun and Victoria Clarke. 2006. Using thematic analysis in psychology. *Qualitative Research in Psychology* 3, 2 (2006), 77–101. DOI: http://dx.doi.org/10.1191/1478088706qp063oa

[4] Robert Brauneis and Ellen P Goodman. 2018. Algorithmic transparency for the smart city. *Yale JL & Tech.* 20 (2018), 103.

[5] Virginia Eubanks. 2018. *Automating inequality: How high-tech tools profile, police, and punish the poor*. St. Martin's Press.

[6] Anna Jobin, Marcello Ienca, and Effy Vayena. 2019. The global landscape of AI ethics guidelines. *Nature Machine Intelligence* 1, 9 (2019), 389–399.

[7] City of Amsterdam. 2019. Agenda Digitale Stad. (March 2019). https://www.amsterdam.nl/wonen-leefomgeving/innovatie/digitale-stad/

[8] Sofia Ranchordás. 2019. Nudging citizens through technology in smart cities. *International Review of Law, Computers & Technology* (2019), 1–23.

[9] Pieter Stappers and Elisa Giaccardi. 2017. Research through design. *The encyclopedia of human-computer interaction* 2 (2017).

[10] Julia Stoyanovich and Bill Howe. 2018. Follow the data! Algorithmic transparency starts with data transparency. (2018).

[11] Thijs Turel, Dominique Joskin, Frank Geerts, Eric van Kaathoven, and Marcel Schouwenaar. 2017. Designing a Transparent Smart Charge Point. *The 30th International Electric Vehicle Symposium & Exhibition* (2017).