Contestable City Algorithms

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Abstract

The increasing use of algorithmic decision-making systems in the public realm and in cities has led to an urgent call for more transparency and accountability. While recent work in algorithmic fairness and human-centred ML has explored ways to include the concerns of people into the design of ML systems, the "street-level" experience of algorithmic systems is not well understood. In this paper, we present a case study of a "transparent electric vehicle charge point" which is designed to provide electric vehicle drivers with insights of the operation of smart charging algorithms. Exploring limitations of the transparency ideal, we identify the need for contestability as a critical aspect of future public decision-making systems.

1. Introduction

Cities across the globe are increasingly using intelligent technologies such as big data, sensor networks and artificial intelligence to address key urban challenges. However, it is now widely recognised 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 (Eubanks, 2018; Ranchordas, 2019).

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 (Jobin et al., 2019). 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 (Cities for Global Rights, 2020). Many ethical principles and policy agendas see data and algorithmic transparency as an important prerequisite for effective accountability and public acceptability (Brauneis & Goodman, 2018; Stoyanovich & Howe, 2018). However, despite a recent focus on algorithmic transparency, research thus far has indicated few ways for citizens and non-experts to meaningfully understand the complex and unpredictable nature of algorithmic systems. At the same time, researchers have started to point out the theoretical and practical limitations of the transparency ideal (Ananny & Crawford, 2018).

In the following, we explore if and how ordinary citizens should be able to understand and influence the operation of public algorithmic decision-making systems. We first present a user study of a "transparent smart electric vehicle (EV) charge point" which provides EV drivers with explanations of charging algorithm decisions, and highlight the diverging conception of algorithmic transparency between experts on the one hand and citizens on the other hand. Based on this, we reflect on the need of contestability as a critical aspect of future public algorithmic decision-making systems.

2. 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 (City of Amsterdam, 2019). 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 (Turel et al., 2017). The conceptual prototype uses a *Tetris*-like visualisation metaphor where each horizontal line represents the charging rate of each connected vehicle at a particular 5-minute time interval.

While present-day smart charging pilots make use of relatively simple algorithms with only one or two variables as

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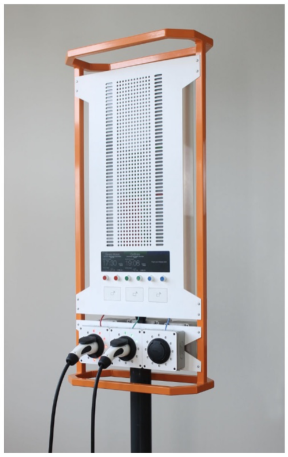

Figure 1. Early Prototype of Transparent Smart EV Charge Point.

input (such as current electricity demand and supply), it is expected that decisions made by the grid and charging infrastructure will quickly become more complex and will use predictive machine learning algorithms based on parameters such as battery capacity of each vehicle, participation in a shared vehicle scheme, predicted daily electricity demand etc.

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.

2.1. User Study

In order to investigate these questions we conducted a research-through-design study (Stappers & Giaccardi, 2017) in which we designed, prototyped and evaluated a transparent smart EV charge point in close collaboration with the city of Amsterdam and smart charging consultancy ElaadNL). The study was part of a commercial trial which aimed to develop and test a functional transparent smart EV charging system in a neighbourhood in Amsterdam.

Figure 2 shows part of the prototype UI and the setup of the field study.

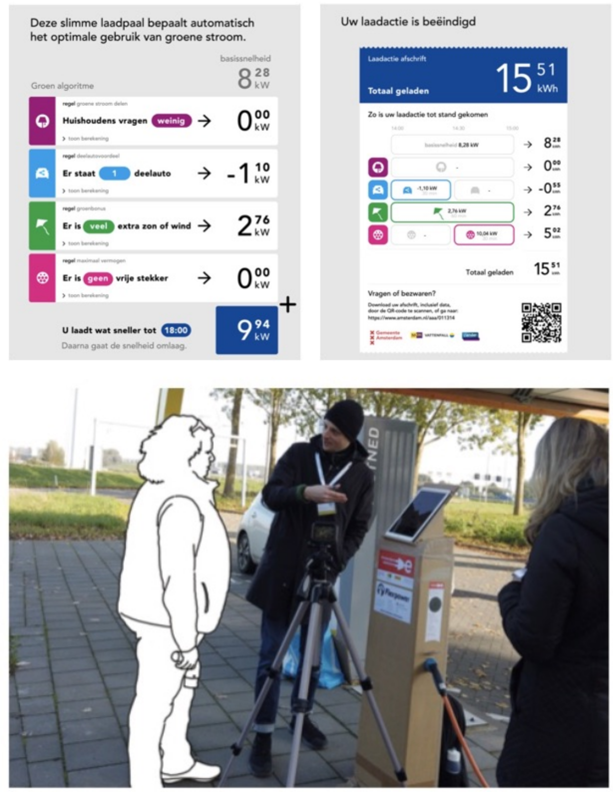

Figure 2. The prototype was evaluated with EV drivers recruited on the spot at a fast charging facility research questions. The UI consists of (1) a screen that is shown once charging has started, and (2) a screen that is shown after charging has concluded.

2.2. Results

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 found that according to experts from industry and municipality, transparency is created by providing truthful information about algorithmic decisions: 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. 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. Furthermore, experts believe transparency information is actionable by citizens and 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.

On the other hand, we found that for citizens algorithmic transparency did not lead to acceptance but created expectations of user control – as soon as citizens became aware of the presence and operation of algorithms (facilitated by the transparency UI) they expected to have the ability to override algorithmic decisions. The absence of control lead participants to question the relevance of the provided explanations. In the case of disagreements with algorithmic decisions, citizens raised the question how they would be able to determine and influence the operation of the smart EV system.

This insights led us to the question of contestability: why and in which way should ordinary citizens be able to influence and object to the operation of algorithmic decision systems?

3. Discussion: From Transparency to Contestability

3.1. Defining Contestability

In everyday language, contestability is understood in two ways. First, "to contest" is to oppose an action, possibly because the action is perceived as mistaken or simply wrong. Second, to contest is to compete for power over something. These two meanings do not exclude each other. Furthermore, it is important to distinguish between contested and contestable. People can express disagreement with the workings of a smart EV charging system, or seek to gain influence over those workings, making it contested. But it is only when the system itself has the capability of responding to such opposition or is opened up to make room for the influence of multiple stakeholders, that it becomes contestable.

3.2. Types of Impacts

The need and desire for contestability arises from the algorithmic impacts citizens experience.

The impacts of a smart EV charging system on drivers can range from the immediately obvious to things that are hard or impossible to predict by an individual user. On one end of the spectrum, a person may notice that their car is charged slower than the one connected to the other point of the station. This may be due to the fact that they are driving a privately-owned car and the other car is shared. In this case policy is enacted correctly but it is something a person did not expect, does not understand or does not agree with.

On the other end of the spectrum, a person may be systematically disadvantaged because of life patterns that are out of step with the norms presumed by the system's design. For example, a schedule that optimises charging around a typical 5-day workweek and 8-hour workdays may interfere with those people that work odd hours. Similarly, dense urban areas with high grid usage may be disadvantaged by stations that are always charging slower, whereas less dense areas suffer no such impacts.

3.3. Channels for Voice, Forums for Evaluation

When mistaken happen or when the system makes decisions that drivers do not agree with, the perceived legitimacy of the smart charging system declines. In such cases, people can respond in one of two ways. One is to opt out or "exit" from the system altogether. The other type of response is to express disagreement in the hopes of influencing the policies that shape the system's behaviour. In the context of public smart EV charge points, for both system operators and users, opting out is undesirable or even impossible. This leaves us with expressing disagreement, or "voice". Adding channels for voice has the benefit of decreasing the likelihood of people opting out, it can also increase the perceived legitimacy of the system.

A second element needed for contestability is a forum for the evaluation of contestations. This can be understood in at least two ways. On the one hand, it can be thought of as the capacity of a system to respond to user feedback in the moment, exercising something akin to the discretion exercised by street-level bureaucrats when enacting official policy (Alkhatib & Bernstein, 2019). In the context of smart EV charging, maybe it is possible for an individual charge station to deviate from the default charging speed for a single session if requested by a user, provided global network conditions allow for it. Such types of "slack" would go a long way towards alleviating some of the frustrations that arise from being subjected to automated decision-making.

On the other hand, for other types of contestation, those that demand more permanent change on the scale of a part or all of the network, it will likely be necessary to involve humans in the loop. With smart EV charging, which is characterised by a complex network of stakeholders each controlling part of the system's behaviour, it is not immediately clear where such a forum should be located. Here, a level of impartiality or separation of power on the part of the forum may be desirable. It may also be necessary to create a platform for a system's users to identify shared grievances and collectively argue for changes.

3.4. Transparency as A Ground for Contestation

As the design study illustrates, transparency may offer some insight into the workings of such a system, but in the event of a mishap, it does nothing for people who want to address the issue by changing the system. Contestability, on the other hand, does not necessitate full comprehension of an algorithm by an end-user. Instead, it addresses the problem of legitimacy by adding "channels for voice" as well as forums for evaluation, so that the loop between the policy that has shaped the algorithm and its on-the-ground actual unfolding can be closed.

Furthermore, contestability recasts transparency as a resource for contestation. This helps us address the issue of people's already scarce attention in a saturated informational environment. From an information ethics perspective, quality instead of quantity should be the goal (Floridi, 2014). Contestability provides us with a specific qualitative measure to use as a way of determining which information to include in the transparency "layer" of smart public infrastructure.

4. Emerging Research Questions

Having established the reasons for contestability and some of the related issues within the context of smart EV charging (and more broadly in the context of public socio-technical systems), a number of research questions emerge. These are all grounded in our ongoing design-led research.

First of all, we need a better understanding of how people view and understand smart public infrastructure. Specifically, for contestability, a question is what concrete harm people experience now but also in the future.

Second, as has already been identified, there is the matter of what to include and exclude in the transparency layer of a contestable system. What criteria should we use to determine those elements that are crucial for as a basis for contestation? This goes hand in hand with a consideration of which parts of a system should be contestable in the first place. A related question is if there are any barriers to making particular elements contestable. Or, to put it in another way, what is the view of each stakeholder in smart public infrastructure on the relative merits of contestability?

Third, we feel the distribution of algorithmic decision-making capabilities across the various parts that make up a system needs to be pulled into the design process. Because those decisions impact the capacity for the system as a whole to respond to contestations. The question then becomes how to determine the optimal site of automated decision-making in a larger system. Here it may also be relevant to focus on the significance of the fact that we are focusing on public infrastructure. Is a different model of contestability necessary when we are dealing with systems that are (partially) publicly owned or for public use?

Fourth, turning to people's contestations itself, the conceptual notion of "channels for voice" needs to be made concrete in actual system features. What are the most suitable modalities for expressing disagreement? When and where should these be offered? How can we move beyond a model of contestation that is based on individuals voicing their concerns? How can people who share a similar fate find and connect to each other, and how can they collectively make themselves heard?

Fifth, the matter of evaluating and responding to contestations should also be made part of the design effort. What categories of dissent should a system respond to automatically, and what categories need to be handled through human intervention before flowing into a system's ongoing design, development and operation? What resources do non-experts need to be a part of this evaluation? How can a system be given discretionary capabilities so that it can deviate from standard policy in individual cases when local circumstances warrant it? How can we measure the relative contestability of a system?

Together, these questions constitute the beginnings of a research agenda for the design of contestable algorithms.

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