Negotiating Privacy Boundaries in Social Applications for Accessibility Mapping

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ABSTRACT
Privacy is often used as an abstract concept, and negotiating what information to disclose to whom, where, at what times, and in what situations is a challenging one. In this paper we apply a previously proposed framework from Palen and Dourish for understanding and discussing privacy to a setting of sharing and acting on information about physical accessibility. We do this by describing existing practice for sharing of such information among wheelchair users, and compare that with new practices emerging from the use of ICT, the mobile, collaborative route planning concept OurWay. Through highlighting these changes, we discuss concrete privacy issues, and hope to provide a contribution to users, designers and analysts for creating and using mobile, networked technologies for accessible navigation of urban and built environments.

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INTRODUCTION
The disability research area covers many aspects, including physical accessibility and e-accessibility. In previous work, we have suggested the use of ideas from social applications on the web to create and share information about physical access to built and urban environments. In this paper, we introduce the issue of privacy that arises when these technologies are applied in an attempt to solve the gargantuan task of collecting, disseminating and maintaining such information. We refer to this process Accessibility Mapping.

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negotiation of privacy in mobile, networked systems for accessibility.

RELATED WORK

We now briefly review relevant literature in the fields of accessibility, social software and privacy. This literature provides a background for next section’s discussion of privacy in mobile, networked ICT for collaborative, accessible route planning.

Accessibility

Accessibility is a term with many connotations, and covers a wide range of topics, such as the accessibility and usability of ICT, as well as to accessibility in the urban and built environment. In the work with OurWay, the primary focus is on physical accessibility, and the communication of information relevant to moving around in the physical world. Universal design and accessibility in general is currently receiving a lot of attention, as can be seen for instance in programs within the European Union with regards to accessible technology and urban planning. Our current focus is on use of mobile ICT for sharing information about accessibility in the physical world.

Also in the physical world, accessibility can have different meanings. For instance, in results from the AUNT-SUE project [5], social aspects like fear of crime are mentioned as important factors when users assess the overall accessibility of an area. Völkel et al. [17] describes requirements for accessibility annotation of geographic data, with the aim to collect detailed information for different needs and preferences.

Existing literature on accessibility focuses mostly on the interaction between a single user and a computer system, with some notable exceptions, e.g. [18] and [8]. Hedvall [8] argues that the accessibility field is lagging behind the HCI field, focusing mostly on regulations and predictability. His work bridges work in the HCI field and the accessibility field, and by comparing the evolution of the two fields, he suggests that the accessibility field has much to learn from the work in HCI and CSCW. In particular, the focus on the individual is key to Hedvall’s argument, in what he calls experienced accessibility.

Social Software

Grudin, although not using the term social software, puts forward four characteristics he considers key in these kinds of technologies [7]: . . . they 1) can be extremely lightweight, 2) make information and activity highly visible, 3) provide individual and group benefits, and 4) are grassroots, self-organizing phenomena. Grudin refers to studies of using project blogs and wikis as well as the use of hash tags for coordinating and maintaining project-related content and activities. We have used Grudin’s characteristics for discussing OurWay as a social application.

The role of negotiation in CSCW systems is put forward by Schmidt et al., as important for coordination and articulation work [14, 15]. A complementary form of negotiation of contexts created by introduction of new technologies is introduced by Satchell and Dourish on their study of non-use in HCI [13]. This perspective is useful for understanding mechanisms by which new technologies are introduced, but not necessarily accepted.

Privacy

ICT-related privacy research often focuses on technology and implementation, and related to rules and regulations (see for example [2]). Palen and Dourish have proposed a framework for a more nuanced understanding of privacy in a networked world [11]. Building on the seminal work of Altman, they identify three boundaries central to the negotiation of information disclosure. The first and basic boundary is the disclosure boundary, that is, what information to reveal or share, and what to keep from others. Secondly, the identity boundary is defined by the role taken on by the user. For instance, if the user is representing herself personally, or if she represents a group such as a company or organization. Finally, within the temporal boundary the effects of persisted information is discussed. That is, the information left behind in a networked system can be interpreted by unintended recipients at a later time, and there is little or no way of controlling the interpretation of information, or the context in which it is interpreted.

Altman’s insight is that privacy is not a static set of rules, rather it is a dynamic process, a constant negotiation depending on the situation. Grudin puts this in the context of situated action, which is precisely what allows the constant negotiation just mentioned [6].

Why then the uneasiness, the widespread attention to privacy? It may reflect an awareness at some level of something more fundamental than privacy that is being challenged: The steady erosion of clearly situated action. We are losing control and knowledge of the consequences of our actions, because if what we do is represented digitally, it can appear anywhere and at any time in the future. We no longer control access to anything we disclose.

The role of negotiation, according to Schmidt, is key component for a successful CSCW system. It seems obvious from the privacy work cited above that this is particularly true when it comes to issues of privacy. In fact, we would argue that the experienced accessibility discussed by Hedvall has a parallel in privacy, in what may appropriately be dubbed experienced privacy. This experience is difficult to assess in situ, since the control over interpretation is no longer in the hands of the user.
We will now provide the background for our case, OurWay. First, the concept and early work is presented, before we summarize a discussion of OurWay as a social application. Finally, we present findings from interviews with wheelchair users to illustrate existing practices for sharing of accessibility information.

The OurWay concept
OurWay is a collaborative route planner, where users are providing feedback on accessibility through their interaction with the system. Users are equipped with mobile phones running a client application, which connects to a central route planning and feedback server over a mobile Internet connection. The client displays a map of the area, and allows the user to ask for a route between two locations, which is then displayed on the map. The user can at any time provide feedback to the central server about the part of the route being traversed. To keep the threshold for contribution low, we have used only three levels of feedback: good, uncomfortable, and inaccessible. The submitted ratings are attached to route segments, and are used as weights by the route planning server when calculating new routes.

Social applications for accessibility mapping
The OurWay project started as a technological prototype, without extensive work on designing it for collaboration. Throughout the project the focus has shifted towards the social aspects of use, and by using Grudin’s four characteristics we have re-framed the concept as a social application. A summary of this discussion is presented here, for more details see [9].

Lightweight
From the end user’s perspective, OurWay can be considered extremely lightweight. The feedback mechanism is a vast simplification of the typically form based inquiry taking place in traditional accessibility mapping. We do not propose that the OurWay concept should replace such detailed approaches, rather that the information generated by users can augment existing information. One obvious challenge is the use of mobile phones for people with special needs. Although mobile phones are ubiquitous among all user groups, the necessary HCI challenges related to use in the field must be considered carefully. One key argument for using an open, lightweight infrastructure for a social accessibility mapping application is that the opportunities for adaption to different needs and requirements are moved away from the core of the system and towards the end user.

Information and activity made visible
A tool which provides route suggestions must adhere to high standards when it comes to dependable information and social transparency. There is little doubt that allowing the user to see the ratings and context which is used to calculate the routes is important. Some suggestions can be found in the WikiTrust [1] and WikiDashboard [16] projects, where exposing the source and history of information is a key point. Perhaps the main drawback of the current OurWay prototype is that it only indirectly provides this information, through the resulting route suggested to the user. In other words, there are no clues provided as to who provided the annotations that led to the suggested route, or what context they were captured in.

Individual and group benefits
Some individual benefits of a social software system for accessibility mapping are obvious, such as the opportunity to provide feedback on suggested routes and get immediate reward in the form of an alternative route from the system. The benefits for the group(s) are, as we have shown through the work with OurWay, more accessible routes over time. Another benefit for the group as a whole, is that this way of collecting and maintaining accessibility information is a potential resolution to the resource challenge mentioned in the introduction of this paper. Further, the social awareness of mobility challenges and special needs can be raised, also outside of the group of core users.

Self-organizing grassroots phenomena
There is obvious value in the networks, agendas and political power represented by established interest organizations. At the same time, parts of what make social applications work is the ability for users to rapidly form groups and processes, often to influence the organizations or establishments they are taking part in. There should be a mutual interest from institutions, individual users and user groups to make use of social software tools, however the suitable balance of initiative and power remains to be established. See for instance Borchorst et al. [3], where they look at the application of Web 2.0 technology in the interaction between citizens and municipalities in Denmark.

Existing practice
We performed in-depth semi-structured interviews with three wheelchair users early in the OurWay project. The goal was to assess the interest in such technology, and the privacy issues related to use. Two of them have been active participants in organizations for the disabled over many years, and knew about the OurWay idea. The interviews were fully transcribed, and analyzed using an open coding process. This material is now used to describe existing practices for navigating the urban landscape with wheelchairs. Then we discuss the changes in practice introduced with new technology to provide a background for the discussion of negotiating privacy.

For anyone, planning is an important part of a trip to an unknown location. The most common practice for planning a trip in a new or unknown urban landscape, according to our subjects, is direct communication with other trusted people who understand the needs of the person who asks:
"When you are in a situation like ours, as wheelchair and crouch users, we become very creative in finding solutions, and we always have to think ahead. We can’t just go."

This communication often implies an intimate knowledge of each other, including previous common experiences and knowledge of each other’s respective needs:

"If I know that he has been there, right, and I know that he and I share the same needs, if he says this worked for him, then I can go there, too."

"I would use a mobile phone, right. And talk to them and then ask [...] are you sure it will work with my chair? Of course, if [friend] was the one sharing the information, I would have done it anyway, right. Because I know him so well."

This is emphasized by the fact that many wheelchair users have different assistive technologies for different occasions, be it motorized chairs (light and heavy), manual chairs, and in some cases crouches. Says one user of an electric chair:

"I sometimes use a manual chair, but then I need someone along to push me. [...] I can make two trips to the center and back between charging the battery. Then I’m not using this chair, I’m using the large chair."

One frequently recurring theme from the interviews is that of individual needs and the issue of trusting information coming from others. This anecdote aptly illustrates what can happen if the shared understanding of needs is absent, or different reference points exist:

"I called a hotel to book rooms for the National Association of Disabled, and they told me that their hotel was accessible to disabled, and they knew that because a Paralympics team had stayed there. [...] There were no obstacles, right? These people even used the stairs to get to the dining hall. [...] The receptionists experience was that she had seen many people in wheelchairs, and it all worked well in her hotel."

Even interpreting standardized accessibility, for instance by signposting toilets as accessible, requires the similar knowledge. In this situation, intimate knowledge of the formal requirements are needed:

"The toilets, for instance, are a problem for many. Some want them high, others want them low. I want them low, as I’m 145 tall. There are no regulations on height for the toilet seats. A whole group in the Association of Disabled of course want to change the regulations so that all accessible toilet seats should be high, right. [...] I know the regulations so well. It’s impossible to make a toilet seat both low and high, right. [...] So if [anony- mous] says that the criteria for universal design has been followed, I know that it works for me. But I also know that if Mrs. Olsen comes along, and she has problems with her hip, I’m able to say that you shouldn’t trust that these toilets will suit you. Because they suit me."

Some urban features, like shopping malls, are considered accessible “by default” by many users. Both because of easily accessible and designated parking spaces, and because of thoughtful design of the built environment:

"When it comes to shopping malls, they have trolleys, shopping carts, baby strollers, and they build for them. Everyone must have access, because they need to shop. And if baby strollers and trolleys can get in, a wheelchair user can also get in."

"... and the fire regulations. These regulations demand quite a bit with regards to escape routes, the size of those, that there shouldn’t be stacks of goods placed everywhere, and so forth. This makes it secure enough for you to use it."

Thus, we get the impression that shopping malls are preferred over shops in the streets because of the general accessibility:

"You know that if you’re going shopping you go to the shopping malls. You don’t go looking for the smaller local shops, right?"

Several initiatives to map out the accessibility of urban areas has been undertaken, mostly (so far) based on paper maps and by the help of volunteers. Further, other less formal activities have been carried out, like this attempt to signal the accessibility of individual shops:

"We had this campaign once where we sold accessibility stickers. We made the criteria, but we were obviously not sufficiently specific about the criteria, and then we sold these stickers [to the shops]. So when you came to a shop and saw the sticker, you knew that everything was OK. That was the intention. However, after a while, when different people did this [sold the stickers], we blurred the criteria, and we knew each other, and it became more important to sell stickers than to [indicate accessibility]."

In summary, existing practices for sharing accessibility information is often based on individual needs and personal relations. The information is local, and is interpreted based on the individual and the situation. As the examples presented indicate, even formalized regulations and knowledgeable people can create uncertainty regarding the experienced accessibility. Having presented existing practice as a background, we now move on to the main discussion.
DISCUSSION

Introducing new assistive technologies will change the practice of getting around. Introducing aids for sharing of accessibility information will change the way people share this information. It will most likely not replace the existing practice, and it is key to our discussion that the technology is augmenting existing practice, not substituting it for something completely different. In the first part of the discussion we identify privacy issues that can result from use of a collaborative navigator, before we focus on negotiation of privacy in this context using Palen and Dourish’ framework in the second part.

Privacy issues

Staying focused on the individual, we now attempt to highlight some of the changes that will arise with the introduction of new assistive technology. We do this to answer our main research question.

Change in practice

As we have shown, identifying accessible routes and locations for the individual is largely accomplished by intimate knowledge of respective accessibility needs and relations between people, and understanding of the criteria behind standardized accessibility. With the introduction of ICT for assistance, the communication forms changes, and the old practices cannot be directly applied. For instance, relying on persisted accessibility information provided by strangers will require support for sense-making, both through the technology itself, and by traditional means. However, to allow for this negotiation of meaning, the activity of other users in the system must be made visible, including information about the user(s) who provided the information.

Providing details about other users in the system is a balancing act between full disclosure and privacy. Will full identities, activities and assistive technologies in use be required for this negotiation? Perhaps building trust networks and social relations into the application can be one way forward. In this way, some form of anonymity can be maintained, whilst still providing cues about the trustworthiness or relevance of information.

In the existing practice, this information has an ephemeral and personal nature. Individual needs are communicated on a trusted need-to-know basis, and often it is not even an explicit part of the negotiation, as the knowledge is tacit and does not need to be addressed specifically.

Another potential change in practice comes with the new opportunity for more spontaneous trips, since the information is readily available on the mobile device. There might be a shift from detailed pre-planning of routes to more ad-hoc route planning. The mixed reality of an annotated map with route planning capabilities provides the ability to adjust the route along the way, taking into consideration local and temporal changes in accessibility, such as construction work or weather conditions.

Further, simply introducing a device like a mobile phone into the process of negotiating accessibility on the spot has practical implications, such as simply managing the extra device in an already demanding situation. Further, use of such a solution may be regarded as a special case of using a public terminal [4], which in itself has impact on the use situation. This is different from using navigation equipment in a car, where the car provides a private sphere in which interaction with the technology can be negotiated.

Reach and persistent information

Existing practices for sharing of accessibility information are largely local, personal and ephemeral. A mobile collaborative system can extend the reach of such information in more than one way. First, the potential number of people who can access and provide information to the system is increased. This means that information left behind can be used by people who would not normally have easy access to the information (they are not part of a local community, or lack personal relations in the area in question). It also means that users expose their activities to strangers, which raises privacy issues. Further, the exposure of activity can provide new and perhaps awkward situations, illustrated here by a quote from one of the interviews. The topic was whether annotating a goods lift as accessible could be justified if the benefits of getting to another floor were significant:

“This is very dangerous. Because, as you say, this system could also be used by the municipality. If it [the use] in any way reflects that the group that I represent [when annotating the lift] accepts goods lifts as equally good alternatives to ordinary lifts, they might conclude that they won’t bother about [installing] an ordinary [accessible] lift.”

This statement highlights several privacy aspects, such as the representation of self and other, and the persistence of information over time and the interpretation of the persisted information. We will return to these issues in the next section.

One of the premises for a collaborative navigator like OurWay is that users leave behind traces of their activity, in other words, that parts of their interaction with the system is recorded to facilitate calculation of accessible routes with updated information. Persistence of information is perhaps the most important source of privacy issues to be discussed in the next section. Persisting traces of user activity extends the reach, not only in terms of audience, but also over time and use contexts.

Based on these observations about changes in practice and the introduction of technology to extend reach and persisting accessibility information, we switch gears and discuss these privacy issues with the help of the frame-
work proposed by Palen and Dourish.

**Negotiating privacy**

Our focus in this part of the discussion is on the need for *negotiation* of privacy in different situations, emerging from the introduction of ICT for sharing of accessibility information.

**Disclosure: Privacy and Publicity**

The way we interpret the framework, the fundamental boundary is that of privacy and publicity, in other words what information users in a situation regard as private, and what information it is desirable or necessary to share with others. First, we need to identify the core types of information at stake. Obviously, positioning information is fundamental in a navigation system. This might be geographical coordinates, or approximate information such as *venues* used in the social application FourSquare. Time can also be crucial, for instance for taking into account the temporality of certain obstacles (like weather conditions), or time of day (related for instance to opening hours etc). The level of accessibility experienced by the user must also be recorded. In previous research, we have observed that it is largely *inaccessibility* which is recorded, and mostly when users *have* to provide feedback in order to get an alternative route from the route planner [10]. This might change, though, if such a collaborative navigator is used in a campaign setting.

The first question a potential user must answer is whether to join the service or not. Trivial as this might seem, it is a fundamental question, and one that is well illustrated by the social pressure to join and participate in successful on-line communities like Facebook or Twitter. Once a participant, it must be possible to quit the system, and potentially delete traces of one’s own activity. Quitting or changing ones association with the service will be a public activity, which again touches on the social pressure to be a participant in the community. As an example of the publicity of private actions we present an anecdote about Facebook from one of our colleagues:

Gisle joined Facebook when it first opened for the international audience. He added many friends, including his wife who he identified as such. Realizing that this resulted in public information on his profile revealing his private family relations, Gisle decided to change the relationship from “spouse” to ordinary friend. The unintended effect of this change was that all his friends got a system generated status message from Gisle that said “*Gisle is no longer listed as in a relationship*”; which in turn resulted in a number of concerned friends contacting him to investigate what they interpreted as a terminated relationship.

In this story, it was not Gisle who decided to make this a public announcement, it was the system. It illustrates the need for negotiation of what information goes out to whom, and what activity is triggered by interaction with the system. Some activity might be extra valuable to make public, for instance to make visible ones own contributions to the system and community of users in order to gain credibility or good reputation. Making activity visible can also be a means for limiting vandalism or improper use. However, as we shall argue later, there are instances where visibility of activity needs to be kept private.

In summary, the negotiation of what information to disclose must be left to the user, and whether or not activity should result in public traces must be negotiable by the user at any time.

**Identity: Self and other**

Who you are, who you represent and the role you have in a situation are key to the negotiation of disclosure. For instance, some obstacles might be considered to apply in a specific context, and not be valuable to others. A user who considers an obstacle to be “private” must still be allowed to use the system, for instance for getting an alternative route, without this activity being persisted for later retrieval. Even when deciding to share the information with the community, the role has to be negotiated. Does the user represent “all” wheelchair users, or only users of motorized chairs or manual chairs? Does the user represent an interest organization with an agenda, or is he a casual user only using the system as a navigation tool? These are all questions that in the existing practice is negotiated from situation to situation, and similar ability for negotiation must be in place in the new practice.

The role taken on by the individual is negotiated in the situation, and evolves over time as well. For instance, the amount of effort put into the “cause” can change:

“[These days,] I don’t sit down and write to the management and tell them how it should be. I don’t, because I get so angry, I go home because I’m so upset. [...] So I don’t go to that church, because I don’t like it. I think the ramp is ugly. Now, in my younger years [...] I wrote an angry letter to the council down there, right. But I left it at that. I was very angry.”

The experienced accessibility is personal, however it can trigger actions taken on behalf of a larger group:

“[...] I don’t think much about the fact that other people are going to that church later. In a way, I have told them what I think. [...] Well, I react on behalf of all [the other users]”

And if the context is explicitly coordinated by a group, the role taken on can be very different:

“Then, sometimes, the Association of Disabled has
Negotiation of identity is an involved and dynamic process. Capturing this process in an ICT system is challenging, and requires careful attention in the system design process. We suggest that the negotiation will take place mostly outside of the system itself, which means that the system must be open to the result of the negotiation, for instance by allowing anonymous or non-traceable activity, and the ability to revoke information at a later stage.

To summarize, place, time and situation are key components in the process of negotiating ones identity - the answer to the question Who do I represent here, now?. An extra layer of concern is added when the reach and persistence changes are taken into consideration. The question then changes to Who do I represent here, now and later?. The time boundary is discussed next.

Temporality: Past, present and future
Arguably the most influential change to existing practice by introduction of a mobile, collaborative navigation system is that of persistence of information. Palen and Dourish address persistence by using the temporality boundary. In existing practice, it is largely taken for granted that communication about accessibility is of local and ephemeral nature. Sharing accessibility information through technology implies persistence of information, and thus the impact of sharing traces of activities becomes difficult to assess, as is the negotiation of what to share with others.

The example about accessible goods lifts is an example of this, and the user who presented this continues:

“... basically because we see that there are, like, economic interests at stake, and they would effectively create a barrier for many of us, in contradiction of rules and regulations. An we do definitively not want to be part of legitimizing that. You will find that attitude, guaranteed.”

This user has been active in organized accessibility work for many years, and clearly comes across as reflected about the possible interpretations of information, made by others at a later time. There are numerous examples of lack of this kind of reflection, perhaps most notable in current use of on-line social applications like Facebook. For many, the idea that someone “outside the group” will have access to relatively private information seems elusive, and one likely cause is the apparent ephemeral nature of on-line conversations, and in particular the lack of technological understanding by users [12].

Further, changes in privacy policies for such on-line communities often introduces breaches of contract with it’s users. Again, Facebook is a prime example, where current analysis shows recent dramatic changes in privacy policy, where Facebook Inc. has made changes to their policy for providing access to user information for third party.

This also raises an important question about who owns the service and associated contributed data, and who can change the terms under which they are shared with others. By agreeing to conditions of use whereby the service provider can modify the rules without consent from the users, the user is effectively waiving the opportunity for negotiation of these issues. It is our recommendation that these issues must be publicly addressed and communicated to users prior to joining such a social service, and that any user should be allowed to easily opt out of the service and potentially remove traces of their activity and get their own data with them if they choose to do so.

Another aspect of the time boundary is that of interpreting current activity in the light of previous activity. Again, an example from one of our subjects:

“... we’re very good at complaining when things are not OK, but we’re not very good at telling people that things are OK. [...] I never go to the newspaper and tell them the new ramp is in place [...] I like making a bit of fuzz, but I’m not very good at giving people a pat on the back.”

By constantly and publicly being complaining about accessibility, there’s a risk of later being regarded as a negative person. This is true in existing practice as far as actively public statements (like in the newspaper) is concerned. By the introduction of ICT, the aggregated statements made by single users can portray a negative image of a user, even though the user is only leaving traces by making use of technology as a tool to solve local, personal navigational problems. The converse is also true, of course, as in the example with the goods lift, where a positive attitude towards a undesirable solution can be interpreted as legitimizing sub-standard solutions - thus implicitly making the activity trace represent the user group collectively, and not merely as coming from an individual user.

One could argue that aggregating and anonymizing information could limit the risk of standing out from the crowd as a person who provides critical feedback, however the use of aggregation also introduces new problems. These includes a higher risk of the information being interpreted as representing a consensus view within a group, and it also makes it more difficult to assess the reliability of the information, which today is largely based on personal connections.

CONCLUSION
The first question that has been addressed in this paper is specifically about what privacy issues that emerge when social software technologies are applied for situations like accessibility mapping. Introducing new technologies is not only about what the specific technology “does”, but also about what existing practices are changed with the new technology in use. We have seen that there is a balancing act between the disclosure of information and managing privacy when using social systems for route planning. What was local and only disclosed to trusted others in an existing route navigation practice, can potentially be disclosed to all other users of the system now and in the future, and thereby changing the reach of the information.

Through this study, it is seen that the everyday practice of route navigation is fundamentally changed when introducing social applications. This view is of importance, since it is often lost when discussing the potential benefit of new, networked technologies. The second research question is about what forms of negotiation emerge in accessibility mapping. The framework presented by Palen and Dourish was applied in order to discuss the negotiation of boundaries related to disclosure, identity and temporality.

The everyday practice of negotiating information disclosure is changed when introducing social software. The negotiation will both take place within the system, but also by using technologies and communication channels outside the system. Thus, the system must be open to the result of such negotiation.

Privacy issues are both about enforcement of laws and the practice of responding to specific circumstances, like when planning and making a journey. The impact that mobile, networked technologies have on the practice of handling privacy issues is important. Our understanding of privacy issues, and the way this changes with introducing new technology is of crucial importance for users, designers and analysts. By addressing specific use situations of social software, we hope to contribute to this important topic.

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