User-centred Accessibility as Re-configurability for Location-based Information Systems

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ABSTRACT
Accessibility has been defined as the matching of people's information and service needs with their needs and preferences in terms of intellectual and sensory engagement with that information or service, and control of it. A person engaged in a hands-busy activity such as driving a vehicle is not well matched to information when they use their mobile phone keyboard to cal for directions. A Japanese-speaking person is not well matched to information when they can only access English instructions for a ticket vending machine. Others can understand content better if it is expressed in international icons with nothing that is culturally-specific.

In this position paper, the authors focus on the similarities between problems associated with accessibility and those caused by changes in location: macro-changes such as when a user moves from one country or language region to another and micro-changes such as when a user moves from a home computer to an office computer, or between devices within the same building. As Broadband access increases, and new facilities cross language and borders, accessibility of location-based services becomes more important.

Categories and Subject Descriptors
H.1.2 (**User/Machine Systems**): *Human factors, human information processing*

H.3.3 (**Information Search and Retrieval**): *retrieval models, selection process*

H.3.5 (**Online Information Services**): *data sharing, Web-based services*

General Terms
Management, Human Factors, Standardization.

Keywords
Local-based information and services, accessibility, user profiles, AccessForAll

1. INTRODUCTION
The Chinese traveler who does not speak Greek may have access to Chinese information about Greece while at home but not in Greece. The wheelchair traveler may find the location of an automatic teller machine (ATM) but, when they get to it, find it is too high for them. If they can reach it, they may find the 'foreign-language' instructions incomprehensible. This is a double failure of accessibility: first, the information about the ATM did not suit the user's needs, and second, the ATM failed to meet their needs. Lack of accessibility damages the service's business if it results in the immediate loss of business (the transaction that did not occur) and, in the long term, loss of client goodwill and maybe a customer relationship. Accessibility is about treating everyone as equal, regardless of culture, language or disabilities they may have. Lack of accessibility is defined as a mismatch between a person's access needs and those available to them [1].

User-centered accessibility is satisfied when there is a match regardless of culture, language or disabilities. Accessibility to all at all times, means accessibility in all contexts in which technical access is available. (In this paper, the authors are not concerned with the significant issue of possession of communications technology or issues of economic disadvantage.) The authors' immediate concern is for location-independent accessibility. Particular care is taken to ensure that everyone's needs are considered equally with no distinction between a person using an assistive technology and another using the latest mobile device. The interest in accessibility is as a device, location, context, ability independent requirement for all content and services, across contextual borders. From the perspective of the service provider, this means re-configurability.

1.1 POSSIBILITIES
The international accessibility community, led by the World Wide Web Consortium [2], initiated work to develop technologies and ways of using them to enable authors in many circumstances to construct digital content in ways that can be accessible to all. Such accessibility is known as *universal accessibility*.

Sometimes *universal accessibility* just means making resources using standard technologies in a recommended way, and at other times it means creating additional content or services. For instance, text encoded according to W3C recommendations will be *transformable* and, therefore, equally accessible to those who need to change the font size, the font and background colours, or have the text rendered by a screen reader or in Braille.

In general, accessibility is achieved by structuring text well and separating the presentation of the structure from the substance [3]. Even in language translations, metadata mark-up can add context to a word to ensure its proper translation so the English word "knight" is translated into German differently for "knight, medieval", and "knight, game piece in chess". In other cases, accessibility means substituting or adding alternative content: a video needs to be augmented by captions for a deaf person or a person in a noisy location.

In the first case, the same text is accessible to all because its presentation is reconfigurable, in the latter case the delivered content is matched to the users' needs and preferences at the time and for their context. This is the case when the user has changed location so that they need what, according to their new location, is a foreign language version of the content. Of course, the potential for reconfigurability depends upon the existence of alternative content but it does not necessarily mean that the alternative content and the original need to be available from the same source.

The two issues of significance with respect to the accessibility of content are, therefore, how appropriately it is authored and how it is discovered and reconfigured for presentation.

If there is appropriate content available, wherever, and it can be identified, and it can be used in preference to other content to improve the match between the user's needs and preferences at the time, then the accessibility of the service being offered will be increased.

1.2 RECONFIGURABLE CONTENT

There are many well-documented arguments for why web content and service providers in general, should be concerned about accessibility. Major arguments cited include social responsibility, market-share, financial benefits and legal liability. By not dealing with accessibility issues, a provider excludes a large number of people from using their service. By treating accessibility as re-configurability, providers gain market share.

In Australia in 2004, a digital news publishing house re-built their website to make it fully accessible. They reported that they now save $1,000,000AUD in transmission costs per year [4].

1.3 COMMON DESCRIPTION FORMATS

Given the distributed nature of content objects to make accessible composite resources for users, it is important to have a standard way of describing the characteristics of resources and of describing the needs and preferences of users. Such descriptions should be available as metadata. If the metadata is interoperable, it can be used for discovery purposes so that closed captions in Russian for the film of Hamlet can be searched for in the same way as the film itself.

1.3.1 User accessibility needs profiles

Similarly, the user's needs and preferences should be described as interoperable metadata. Such definitions should work also for users who, for whatever reason, are equivalent to people with disabilities. That is, the disability is not important, only the resultant needs and preferences for accessibility. These change according to location, time, and other contextual matters just as much as with changes in devices. People, for this reason, can be expected to have a number of profiles of needs and preferences and to want to generate or change their profiles dynamically.

Institutions such as corporations may also want community or location-based profiles. It is likely that users will require multiple profiles, and these profiles should 'cascade' allowing some to override others. The management of profiles will need to include the switching of elements within the profile according to immediate needs, the over-riding of more essential profiles over less essential ones, and the choice of profiles according to location or circumstances.

This means that resource presentation *and* device controls need to be adjusted so the profile must contain the relevant information. In fact, there are three major dimensions for the profile: presentation, control and content characteristics. In addition, an over-riding context description is necessary.

We can imagine a businessman moving from city to city and finding the business centres' computers unsuitable because they have accommodated users with different language needs and preferences. The businessman will not want to set up their needs and preferences every time they make such location changes. In fact, they may not be capable of determining their own needs and preferences and yet, making the changes might be critical to their access. Users will want to define their needs and preferences once and use them many times.

1.3.2 Location identification and description

Contexts often account for the special needs and preferences of users. In a noisy location, users will probably not enjoy audio output. Content needs can also change because of device changes and these are often associated with location changes. Sometimes context influences are related to locations and sometimes they are temporary, personal, or independent of location.

When location changes are from one country to another, it is likely there will be language changes. When location changes are small such as from one room in a house to another, the difference is often device changes and so in the means of control of the device.

Location in one country or another is usually identifiable by a co-ordinate reference system [5]. Such systems do not work well on a smaller scale, such as within a shopping centre or home. Global co-ordinate reference systems are usually two-dimensional and, where height is recognised, usually offer little help to users changing floors within a building.

The characteristics of locations should be defined in a way that makes them reusable to many users.

1.3.3 Resource descriptions

The objects that will comprise the controls or substance of a resource must be appropriate for a user. This means they must match the user's needs and preferences profile. The most obvious way to describe the resource is in the same terms as are used for the user's profile.

The difficulty with describing any digital resource is that it is almost always composed of a number of objects and often one or some of those objects are inaccessible. This means that somehow the alternatives have to be organised in a logical fashion and presented together, even where some of them are not collocated.

Most resource descriptions are done at resource level, so management for a distributed model of resources where they are described at object level is an extra challenge. It makes sense to

classify the original objects that comprise the total resource as primary objects. Then objects that are needed in special circumstances can be described as equivalent resources.

To manage all this, automating at least part of the description process and storing the results is necessary. Some characteristics of a resource or object can be determinable automatically, such as the format of the digital file, but some are subject to human judgment, such as whether a text description of an image is really equivalent to the image or not.

As there are legal requirements that relate to the accessibility of content objects, it is necessary to know the descriptions are reliable. Similarly, it is important to know when the resource or object was evaluated, as it may change over time. As the content may be distributed, so may the descriptions of it, and so they should all be in a standard form and interoperable.

1.3.4 Digital repositories and intelligent servers

A service that provides the right combination of content and services for the user, where and when they need it, depends on a way of bringing together all the pieces, including the user and resource profiles, the context information, and the pieces that are to be delivered to the user as the resource they require.

For a user, or an assistant working with them, it must be possible to create the necessary profiles and to change them for the immediate circumstances. In addition, it must be possible to make the formal descriptions of the resources and link together all of these for the matching process. There are several layers of discovery involved.

1.4 LOCATION BASED ACCESSIBILITY

When the location is fixed in one sense, as is the case in a train, but varied in a global sense, because the train moves, relative and absolute location descriptions become necessary.

We need a way to be precise about the locations so we can ease the burden of adapting the devices. This in turn means being able to specify a particular location with precision and in three dimensions. It also means being able to describe dynamic locations, such as a seat in a train. These may be relative locations. There is a need then for flexible, interoperable, machine-readable descriptions of locations for cases in which locations are determinants of choice of user profiles.

This is a requirement for both location-dependent and location-independent profiling. The aim in both cases is the same, stability for the user and thus a personal sense of location-independent accessibility, but one depends upon not being affected by a change in location and the other upon being affected by it. The location-independence is thus as viewed from the user's perspective.

1.5 LANGUAGE ACCESSIBILITY

The number of languages in use by travelers, real and virtual, is constantly increasing. Web servers are often smart enough to determine from where a request is coming and to use this information to customise content for the user. This 'accommodation' is likely introduce inaccessibility if the user is not native to the location, and so it can be inappropriate. The Indonesian-speaker visiting Rumania will want their profile to override the general, location-specific one that would be chosen by the server.

We imagine a traveler wanting to have their profiles somewhere and always available for them to communicate somehow to the intelligent server that is trying to give them what they want. Already, browsers, the most common user agents, provide an accessibility feature that allows the user to choose to reject the content provider's style sheet and use their own. Although this only works where the content is well formed, it suggests a model that could be used for the fuller profiles now being advocated.

While the traveler is possibly interested in being presented information in their chosen language, they do not want to find that, when traveling to another country, the information they seek about the nearest ATM, for example, is in the language of their location. Their location is relevant to their needs but not to their language use. The user needs locally based services that are modified, or constrained, by their personal profile of needs and preferences.

1.6 CONCLUSION

Emerging from this is a complex set of requirements that gives hope for a solution to the user's need for location-independent, location-specific services.

Work is already being done in the relevant fields by such bodies as:

- ISO/TC 211 [6] - Geographic Information, who have a forum for developing location based service standards;
- Dublin Core Metadata Initiative [7] who have developed a simple but useful metadata architecture;
- IMS Global Learning Consortium [8] who host work on an information model by a wide collaboration to provide the necessary well-structured semantics, and
- INCITS V2 [9] who have developed specifications for a universal remote console.

The user and resource profiles that are the subject of the IMS hosted information model, developed with broad input, are suitable for adoption and use by many metadata communities. The metadata for the location and other location specifications are not yet developed but there is a natural base for them in other geographic specifications and standards.

The Inclusive Learning Exchange (TILE) [10] is context sensitive and matches resources to users' profiles statically as stored or dynamically as changed. TILE does not deal with location-dependence as proposed above but there is an associated project WebForAll [11] that does.

There is an urgency to ensure interoperability and accessibility for the work going on in location based services and for standards development organizations to work closely together and produce the solutions to the problems outlined in this position paper.

1.7 ACKNOWLEDGEMENTS

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2. REFERENCES

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