

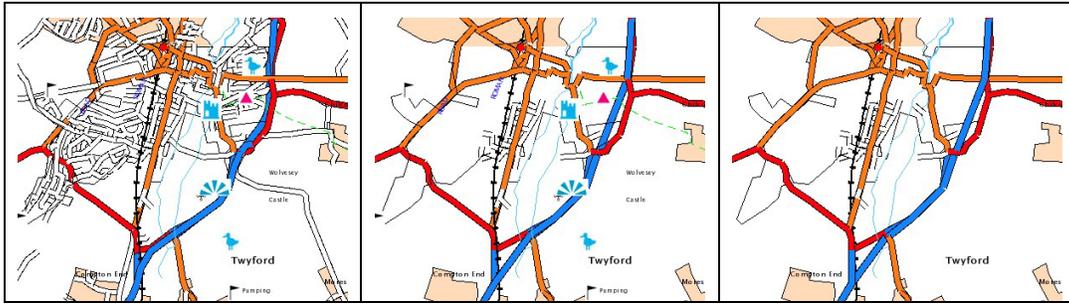
# Contextual Mediation Enables Appropriate Data Selection

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**Mobility produces a wide range of context, which has a significant impact on users' experience of computing. Some solutions exist for issues such as small screens and low bandwidth, although these generally offer rather indiscriminate modification of data and support only a small range of devices. At Imperial College London we have been investigating a more sensitive approach: causing a selection of data in response to a wide range of contexts.**

Context aware computing refers to the treatment of the user's environment in system behaviour. Aspects of context are wide-ranging: location, speed of travel, noise levels, device in use, task engaged in etc, and mobile computing exposes users to the effects of these. Context has many uses in mobile computing including: description of context to the user, e.g. location notification; context-sensitive resource use, e.g. location aware printing; contextual annotation of data, e.g. noting other people present as meta data to meeting minutes. At Imperial College we have been developing techniques to specify *contextual mediation*. This is the use of context to modify the data selected amongst the data offered, in order to make the best presentation of information to the user given for context of use. Techniques include: scaling graphics and summarising text to fit documents within a screen; limiting the quality of images to reduce data size when using a slow network; including or highlighting data describing required facilities such as induction loops for the deaf; omitting attractions which are closed when presenting a map of a tourist site. Some of these techniques have been deployed in isolation, often hard-coded into applications and targeted towards a few specific devices – the effect often being unsubtle and failing to capture all the user's needs. Our research provides a general way to associate a description of needs and limitations with the context of use – and use this to select the best available combination of data.

Our work initially focused on maps. Map data may be large in size, causing long delays on slow networks and it may include a level of detail, which cannot be interpreted on low-resolution displays. Vector map data lends itself to partial presentation and processing of different elements. We were able to use this to allow the prioritisation of data according to its semantic types, e.g. roads, rivers, buildings, distance from location of interest; and its properties, e.g. different scale representations of the same feature. In this way mode of transport affects the priority of representations of roads, railways, footpaths etc. Speed affects inclusion of distant or small features. Task (work, leisure etc.) affects inclusion of tourist symbols. We also describe limits over managed resources in order to constrain the selection. Screen resolution and available bandwidth affect the combination of data selected, in order to meet specified goals: time to download may depend on speed, drawing complexity may depend on vibration. Note that the selection of data to display considers the combined effect of all the data in the selection, rather than processing data on an element-by-element basis.



**Figure 1 (left to right):**  
**Unmediated map, all features included.**  
**Mediated for tourist in a car, less peripheral detail.**  
**Mediated for worker in a car, note omission of tourist sites, golf courses, footpaths etc.**

Contextual mediation is illustrated in figure 1. The left-hand map shows the complexity resulting from no mediation. The mediated maps are for navigating in a car at 30 to 40mph, hence the concentration on major roads and the omission of minor roads away from the immediate vicinity (the centre). The data was loaded within a 25s deadline over a simulated GPRS network. The difference between the tourist and worker's maps is subtle, but helps the worker to scan the map without distraction. Where features have hyperlinks from them, e.g. describing tourist attractions or access to delivery points, the ease of selecting links also improves. In tests we found the resulting maps to be more predictable in their download time than unmediated maps. Predictable delays have been shown to be a key factor in user satisfaction in the web. The omission of unnecessary detail was shown to provide improved clarity and faster navigation in user tests.

Our approach is applicable to other semantically rich data intensive applications. We are now investigating applying this approach to collaborative tools such as message services, shared whiteboards, engineering and maintenance plans and web based documents. In collaboration with the University of Southampton we have been investigating the mediation of hyperlinks and the use of mediation in pervasive information systems. There is also related work starting on Ubiquitous Computing for Healthcare in the Community, which will be focusing on monitoring of patients with clinical conditions as they go about their normal activity.

**Web link:**

<http://www-dse.doc.ic.ac.uk/Research/ubicomp.html>

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