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GPS and historical maps on hand-held computers: potential use in urban morphology

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High grade global positioning systems (GPS) have a number of urban morphological applications; for example in surveying and analysing the built form of medieval settlements.[1] There is, however, potentially interesting work that can be undertaken using the considerably cheaper, though less accurate, forms of GPS which are now starting to become common in everyday life, particularly through satellite navigation systems. The range of maps on proprietary satellite navigation systems is quite limited, but the new generation of personal digital assistants (PDAs) has moved from being little more than electronic diaries, to full blown mini-computers, and many come with navigation-grade GPS, or can have this facility added via an inexpensive expansion card. ESRI, the makers of one of the most widely used geographical information systems (GIS), have produced ArcPad, a stripped down version of their main mapping software, specially for use on small hand-held computers.

At the School of Geography, Earth and Environmental Sciences at the University of Birmingham we have recently acquired a number of Fujitsu-Siemens PDAs as part of a teaching project developing course materials using mobile GIS.[2] A series of campus maps has been uploaded to these machines, spatially referenced such that when the GPS units are activated, students are placed 'in' the correct location on the maps. This has a number of potential applications. It allows data collected in the field to be entered directly into a GIS. This can then be easily processed when back in the office.

A major element in urban morphological fieldwork, particularly among Conzenians, is to enter the spaces under consideration, armed with a series of historical plans, to gain an understanding of the changing plan form.[3] While this is a highly effective technique, in the field it can be quite awkward switching between large paper plans and locating oneself in certain areas where landmarks have changed. This can be a particular problem for less experienced fieldworkers.

Spatially referenced historical maps and plans can be put into the ArcPad system as easily as contemporary maps and this offers very interesting possibilities to urban morphologists. The user can be placed 'in' an historical landscape on the screen while walking around the contemporary city. With a series of historical maps loaded into the PDA it is possible to walk to a particular part of a site tracked by the GPS. This allows the user to very quickly orientate and then switch between a series of different historical 'layers' to examine the changes to an area over time. The effect of walking around a site whilst watching your position move within a historical map[4] on the PDA screen can be a little eerie, in part because it helps to generate something akin to an embodied understanding of a space that does not now exist.

As experienced urban morphologists we sometimes take for granted the ability to look at a series of maps and work out how the different spaces fit together with the currently existing landscape. Some people do, however, find it difficult to orientate themselves spatially within two-dimensional maps of the contemporary landscape,[5] let alone historical maps. The use of a GPS enabled GIS in the field therefore offers a tremendous teaching tool to urban morphologists, removing one of the barriers to people making the connection between a map space and a physical space. Of course there are technical limitations. The screen size of PDAs is too small to see larger

urban areas at a detailed resolution. Clearly this can be overcome through the use of larger tablet-type PCs although these can be quite expensive, as well as being somewhat unwieldy (and indiscreet) in an urban context. Navigation-grade GPS is only accurate to a few metres, which is acceptable for most uses, but patchy reception when standing close to buildings can reduce this. Maps scanned or downloaded[6] need to be geo-referenced to the correct spatial co-ordinates to work with the GPS. This can be a fiddly process, as can be setting up the PDAs with the appropriate layers of data. The technology is, however, becoming more accessible year-on-year and a little patience setting up the PDA back in the office means that the experience for the user in the field is quite straightforward. Ultimately this combination of GPS and historical maps has great potential for helping to foster the deeply personal engagement with past urban forms that is such a critical part of urban morphology.

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Notes

1. Lilley, K., Lloyd, C., Trick, S., and Graham, C. (2005) 'Mapping and analysing medieval built form using GPS and GIS', *Urban Morphology* 9, 5-15.
2. Kingston, D. (2007) 'Integrating flexible e-learning and mobile technologies in geography', unpublished paper presented to The University of Birmingham Annual Learning and Teaching Conference, 28 February.
3. Lilley notes the importance of walking through urban spaces, as well as tracing them on maps, as part of an iterative process, developing the necessary subjective engagement with an area to undertake an effective town-plan analysis. See Lilley, K. (2000) 'Mapping the medieval city: plan analysis and urban history', *Urban History* 27, 5-30.
4. Or, for that matter, an unbuilt development plan.
5. A problem explored by Presson, C., Delange, N. and Hazelrigg, M. (1989) 'Orientation specificity in spatial memory: what makes a path different from a map of the path', *Journal of Experimental Psychology – Learning Memory and Cognition* 15, 887-97.
6. Subscribers in the UK can download historical geo-referenced Ordnance Survey maps from an extensive collection held by the Edina data archive. Unfortunately before these can be used within ArcPad in combination with GPS, additional processing within ArcGIS has to be undertaken to define the geographical projection and resolve issues of colour depth.

The potential for Chinese urban morphology

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The article by Whitehand and Gu (2007) on the plan analysis of Chinese urban form prompted me to consider the broader possibilities for the application of urban morphology to Chinese cities. As Whitehand and Gu have so aptly observed (see also Whitehand and Gu, 2006), the shortage of 'true plans' in the Chinese historical record makes a Conzenian approach difficult in the Chinese context. Their admirable effort, and the fact that in their own research, they had to switch from their first-choice city to a second choice that had better ground plans, illustrate these difficulties. Yet there is a particularly rich historical record available for the analysis of Chinese cities within their own context. With both Whitehand and Gu's efforts and the recent Viewpoint published in this journal on 'Stepping outside the comfortable confines of the West' (Sobti, 2007) in mind, I would like to offer some thoughts on the potential for Chinese urban morphology.

As Whitehand and Gu note, one of the primary challenges presented by the application of the Conzenian approach in cross-cultural contexts is that Conzen's method is most effective in conjunction with certain types of data and historical records – particularly historical ground plans which indicate plot boundaries and the block plans of buildings. The limitations in the source material for Conzenian analyses of Chinese cities have been explicated by Whitehand and Gu (2006, 2007), by