

The GUIDE system

An example of a context-aware interactive system: Here we focus on the implications for HCI

What do we mean by Context-aware?

- The term has been defined as: "systems [that] adapt according to the location of user, the collection of nearby people, hosts, and accessible devices, as well as to changes to such things over time" [Dey and Abowd, 2000].

Dey A.K. and G.D. Abowd (2000) The Context Toolkit: Aiding the Development of Context-Enabled Applications. Workshop on Software Engineering for Wearable and Pervasive Computing, Limerick, Ireland.

Intro...

- Cheesy video...

Obtaining GUIDE Requirements...

- Requirements Capture (Lancaster TIC)
 - Observing information needs of visitors
 - Semi-structured one-to-one interviews
- What other methods could have been used?

GUIDE Requirements...

- Four main requirements
 - Flexibility
 - e.g. Guidebook vs. tour guide vs. just wander...
 - Support for dynamic information
 - e.g. Castle opening times
 - Context-aware information
 - e.g. adaptive tours (cf castle opening times)
 - Support for interactive services

Initial Configuration...

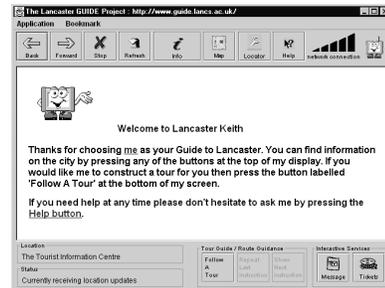
The screenshot shows a dialog box titled "GUIDE System Preferences" with two tabs: "User Preferences" and "System Preferences". The "User Preferences" tab is active. It contains the following fields and options:

- "Please tell me your name:" with a text input field containing "Fadh".
- "How can you change the name of your group:" with a dropdown menu showing "Grammar School".
- "How old are you?:" with a spin box containing "10".
- "Please specify your preferred language:" with radio buttons for "English" (selected), "French", and "German".
- "Are you interested in:" section with radio buttons for "Yes" and "No":
 - "Lancaster Architecture?": "Yes" selected
 - "Maritime Related Information?": "Yes" selected
 - "Lancaster's History?": "Yes" selected
 - "Vegetarian Food?": "No" selected
- "Save" and "Advanced" buttons at the bottom.

Issues ??

- What are some of the issues with associated with this stage??

Welcome to GUIDE...



First attempt at Context-aware behaviour...

Pressing the info button...

General Information



Issues??

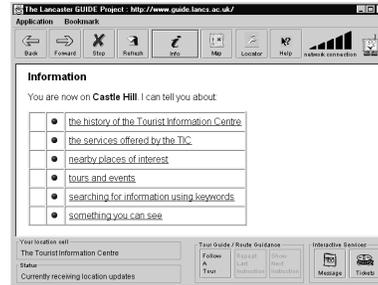
Issues??

- User may not want this information!!!

Second attempt at Context-aware behaviour...

Give user more of a choice...

Interacting with GUIDE: The 'pull' based approach...

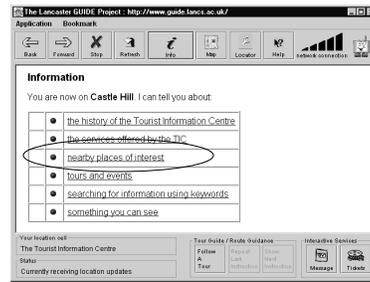


So what's the benefit?

- In this domain there is a considerable of information that the user would need to navigate through...
- System automatically 'Indexes' (into the information database) based on the current location,
 - E.g. the fact that the user is located near to the Tourist Information Centre...
- Effectively tries to 'home in' on the more likely information requests to be made by the user

Cheverst, K. and G. Smith, Exploring The Notion Of Information Push And Pull With Respect To The User Intention And Disruption, in *Proc. of International workshop on Distributed and Disappearing User Interfaces in Ubiquitous Computing*, pp. 67-72. April 2001.

Interacting with GUIDE: The 'pull' based approach...

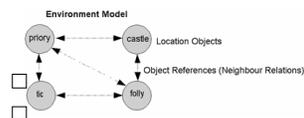


Nearby places... Adaptive Hypermedia



So what's happening now...

- The system or 'agent' performs an 'intelligent' retrieval...
 - Interrogates the city information model
 - Includes geographic information/relationships and opening time of attractions
 - Context-used: Location + Time + User Model (More later)



Problem – from HF perspective...

- System could over-constrain (filter) based on context, e.g. open/closed, previously visited etc.
 - "But I just would have still liked to have seen the priory building – open or closed doesn't matter"
- System is trying to simplify for the user the task(s) that he/she needs to carry out in order to achieve (what the system thinks...) is the his/her current goal.
 - Mismatch between user's goals and system behaviour – more on this in Suchman (1987)

Suchman, L. Plans and Situated Actions: The Problem of Human-Machine Communication, Cambridge Univ. Press. (1987).

Reducing complexity?

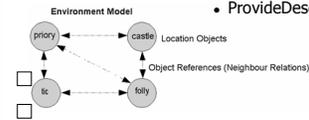
- "In effect, such systems migrate complexity away from the user to some form of intelligent agent" (Cheverst, 2001)
- Adaptation to context can be used to simplify a user's understanding of, and interaction with, interactive systems – but when system attempts to pre-empt user's goal, this is where difficulties can arise.
- Benefits of information visualisation vs filtering

Cheverst, K. *et al.* "Using Context as a Crystal Ball: Rewards and Pitfalls", *ACM Personal Technologies*. 3(5), pp. 8-11, Springer-Verlag. 2001.

The Adaptive Hypermedia Bit...

How does this AH bit work?

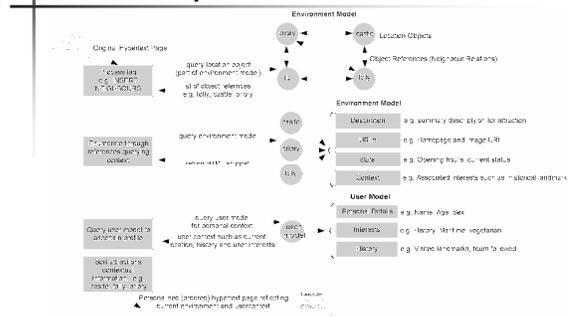
- Incorporation of GUIDE tags
 - Enables pages to query Information Model
 - Processed by GUIDE filter component
 - Example (nearby places)
 - <GUIDETAG INSERT NEIGHBOURS>
 - Filter calls methods...
 - ReturnNeighbours()
 - ProvideDescription() and ProvideImage()



Generating the AH (2)

The screenshot shows a web browser window displaying a tourist information page. An AH bit is overlaid on the page, showing HTML code for a GUIDETAG. The code includes a font tag, a GUIDETAG INSERT FULLUSERNAME tag, a paragraph of text, a GUIDETAG INSERT POSITION tag, a BR tag, and a GUIDETAG INSERT NEIGHBOURS tag. The browser interface shows the URL 'http://www.guide-hans.ac.uk/' and various navigation buttons.

Summary of mechanism...



More on the User Model...

The User Model...

- Visitor profile, including:
 - name
 - group name (if applicable)
 - age
 - dietary preferences, e.g. vegetarian food
 - specific interests, e.g. maritime history
- current (or virtual) location
- list of attractions already visited
 - "Welcome back..."

Updating the User Model (1)

- Pages can be tagged in order to enable the 'Interests' part of the User Model to be updated...
- For example, if user requests information from pages with a high history content then 'History' rating could be increased.
- Issues??

```
<GUIDETAG INTEREST (HISTORY GREATER 0)>  
-- Additional History Text --  
</GUIDETAG>
```

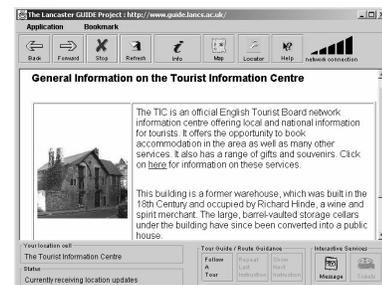
Updating the User Model (2)



With Low History Interest...



With High History Interest...

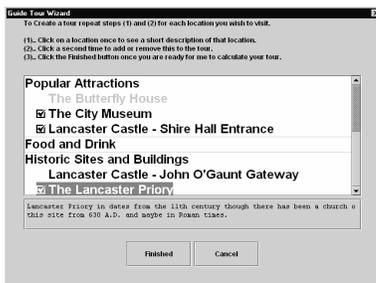


Issues ??

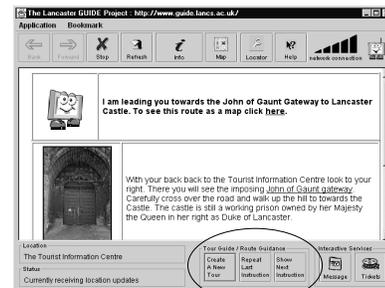
- Predictability??

The tour GUIDE part...

Picking a Tour...



Following a Tour...



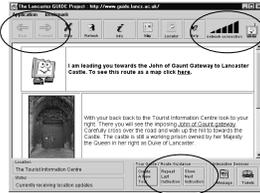
Issues ??

Issues...

- Virtual vs Real...
 - Allows me to virtually navigate but at what cost?
- Stepping back
 - What sort of 'interaction paradigm' does this reflect?
 - What are alternatives?

Metaphors used in the GUIDE UI

- GUIDE uses metaphors to leverage from anticipated familiarity/understanding of users
- Browser Metaphor
 - Benefits?
 - Drawbacks?
- Bars of Connectivity



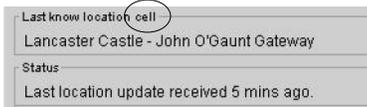
Implications of disconnection from the network...

- GUIDE units can lose network connectivity
- Certain functionality becomes unavailable
 - Reception of dynamic information, Bookings, etc.
 - Concern to reduce apparent anomalies in behaviour
 - Unpredictability could affect a visitor's trust of the system
 - Encourage an appropriate mental model for understanding the role of connectivity
- Leverage from common understanding of the mobile phone
 - Bars of connectivity metaphor

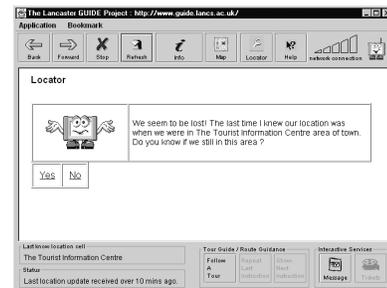


Conveying Uncertainty...

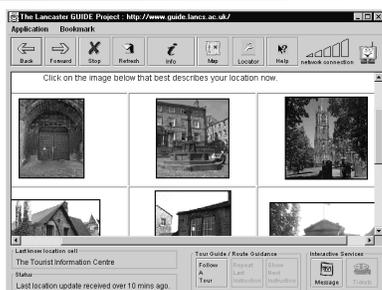
- Again linked to notion of helping user to appreciate that the system does not know 'exactly' where the user is.
- Why?
 - Implications for predictability/perceived reliability.
- What if time passes with no locations updates



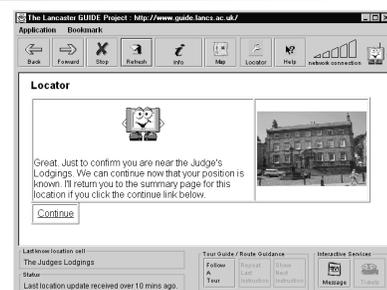
Solving Location Problems: A GUIDE and Visitor Partnership



Selecting from Thumbnails...



Found Again...



Evaluation...

How would you evaluate the GUIDE system?

Evaluation...

- Two approaches...
 - Expert Walkthrough
 - Field-Trial

Expert Walkthrough

- Crude first pass at usability
 - Experts asked to test functionality (in-the-field) using a talk-aloud protocol
 - They would effectively be performing their own heuristic evaluations while using the system 'as a typical user'.
- Findings
 - User interface
 - Consistency with other browsers
 - Position of buttons, feedback mechanisms
 - Appropriate mental model back/forward etc

Evaluation by Field-trial

- Aims
 - Validate (or improve) our initial requirements
 - Ascertain quality of the visitor's experience
- Constraints
 - Imposing upon leisure time of visitors
- Approach
 - Visitors free to use the system in their own way
 - Direct Observation
 - Time-stamped log of interaction
 - Subjective opinions
 - gathered using semi-structure interviews

Key Findings (1) ...

- In general, visitors enjoyed using the system...
 - Visitors appreciated location-awareness
 - Found navigation reassuring
 - Visitors trust of the system was dynamic
 - Increased when shown detailed descriptions e.g. 'watch the step when leaving the path'
 - Decreased when information could not be retrieved or appeared inaccurate/incorrect

Key Findings (2)...

- Some concern over missing information
 - Based on automated retrieval
- Majority appreciated system's flexibility
 - But for some 'Less is More' (Information Appliance)
- High acceptance for the end-system
 - Could be lighter...
- Young visitors revelled in the technology
 - Explored approximately twice as many links per minute as other age groups

Interaction Approaches...

Push vs. Pull

Cheverst, K. *et al*, "Exploring Context-aware Information Push". *ACM Personal and Ubiquitous Computing*. 6(4) pp. 276-281. Springer-Verlag. 2002.

Push vs. Pull

- Current emphasis is on user...
 - Trade-off between effort and control
 - Changing context... correctness of info?
- Investigating Push (really Push+Pull)
 - On approaching Castle user is automatically presented with info
 - Appropriate Notification, audio, graphic
 - Disturbance
 - Surprise vs. expectation
 - Reassurance
 - Overwriting current info



Investigating 'push'...

- Appropriateness of pushing info to tourists...
 - Situation of the user
 - Type of end-system
 - Teampad/iPAQ/Phone...
 - Quality of context used
 - e.g. location (place), preferences of user
 - Way in which information is pushed
 - e.g. notification techniques
 - What is pushed,
 - e.g. audio, graphics

Approach...

- Wizard of Oz type trials
 - Developed versions for Teampad and iPAQ
 - Currently no appropriate infrastructure
 - 20 visitors over 2 weeks
 - Problem imposing on visitor's time
 - Time given ranged from 10 mins to 1 hour
- Semi structured interviews
 - Allow user to suggest issues...

Findings...(1)

- In general visitors were very positive about the 'PUSH' approach
 - Emphasis on Ease-of-use
 - Reduced functionality, 'pick up and use'
 - But majority also wanted 'some' ability to pull
 - Surprise not mentioned as a problem
 - Disturbance...
 - Majority wanted ability to 'silence' the unit
 - Overwriting of info
 - Not a major concern...
 - 'Back button' one option

Findings...(2)

- Notification sound important
 - Not hard to find an acceptable sound
- All wanted 'pushing' of tourist related events
 - e.g. 'Punch and Judy - 3pm - Lancaster Priory'
 - Some wanted such info filtered to their profile, others didn't
- Pushing of non-tourist info
 - This was fine for some people if they could see a clear benefit

General Comments...

- "We are lazy"
- "Don't want hassle..."
- "Reassuring"
- "Let the system follow me"
 - Only tell me if I take a wrong turn!
- "I don't want to appear as a tourist in a non-tourist location"

Regarding the end-system...

- iPAQ form factor very popular
 - Splitting the screen
 - Map-based interface
 - "You are here..."
 - "Take me there..."
 - Ticker-tape like display
 - Audio capability
 - Users extremely positive about audio descriptions
 - Still wanted choice



Quality of Context

- Required location granularity varies...
 - "You are approaching Lancaster Castle"
 - Fine with current WaveLan cells
 - "This is one of the oldest signs in Lancaster"
 - Needs GPS, low-power/range transceiver etc.
- Future Work...
 - Create smaller cells, supplement with GPS

'Push' vs. 'Pull'...

- 'Context-aware Push' has great potential for reducing effort required by the user
- Work illustrated the need for successive user trials and the fact that assumptions/results of previous trials age rapidly!
- If 'push' is triggered by location then does the user's environment become the user interface for the user to 'pull' information.