Suggestions for Visualising Physical Hyperlinks

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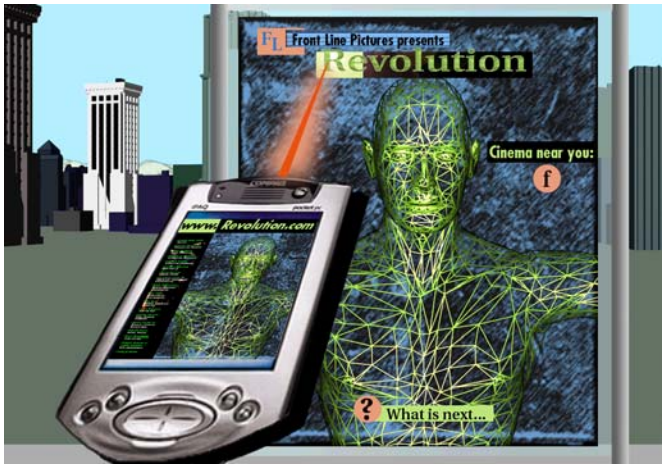
Physical Browsing and Selection

- Physical Browsing
  - Access information and services by physically selecting the target object
  - Mobile terminal, for example a mobile phone
  - Tags, for example RFID tags
  - The user selects a link, the terminal reads a tag
  - Selection → Action



- Physical Selection
  - Touch, "this one here"
  - Point, "that one there"
  - Others, like Scan, and tag or terminal initiated selection methods
  - Analogous to "clicking a link" in a web page

Challenges Related to Visualisation of the Links

- How can the user know
  - Is there a link in the environment?
  - Where is it?
  - How can it be selected?
  - What action will be triggered?
  - Will the action cost something?
  - Are remote connections used?
  - …
- In our evaluations, the users preferred the interaction as simple as possible without *unnecessary* confirmations or interruptions

Visualisation Chain

1. Visualisation in the environment and physical objects (the main topic of this presentation)
2. Hovering
   - Show some information about the link before it is actually selected
   - Similar to hovering cursor over desktop WWW link
   - Demonstration at the end or during breaks
3. Visualisation in the GUI of the terminal
4. Confirmations
5. The action itself as a response
   - Something happens in the terminal
   - Something happens in the physical environment or other devices

Links in Desktop WWW 1/2

- What can we learn from existing links in desktop WWW?

- Link visualisations
  - Underline and colour recommended
  - Visited links shown differently from unvisited
  - Text links, image links, buttons
- Visualising actions
  - Typically a new page is opened and most actions can be handled inside browser
  - Some actions open new applications and change the UI: email, PDF, vCalendar entries, … → confusing and irritating to the user if not marked clearly

Links in Desktop WWW 2/2

- Context of the link
  - Link is a part of a page or a site
  - Commonly used and learned locations and actions for links, for example navigation bars

  → the context helps user to guess the action of a link
- Can we use these lessons in physical hyperlink visualisations as well?
  - Show the location of the link
  - Show what it does
  - Context will help here too, physical objects have usually a purpose of their own and the link will typically have something to do with that purpose
  - Perceived affordances of the object may support the visualisation

Visualisation and Selection

- Some implementation technologies allow only some selection methods:
  - Short-range RFID can only be touched
  - Normal Bluetooth can only be scanned
  - Long-range RFID with photosensitive sensor can be touched, pointed, scanned, …

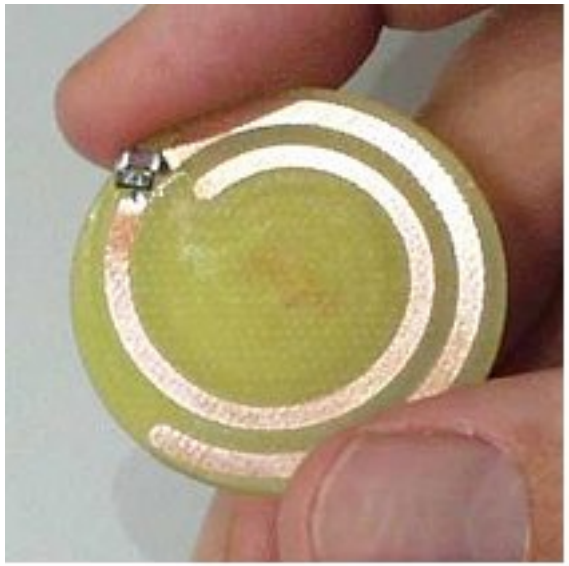
  → The selection method should be included in the visualisation
- Current visualisations are technology-centred:
  - NFC symbols
  - Bluetooth symbols 
  - Commercial venture symbols

  → The user should know how to activate the reader

  → Better visualise the selection method and not the technology

Actions in Physical Hyperlinks

- WWW links
- Phone calls
- SMS and email messages
- Sensor reading
- Download and install an application
- Connect to an external device or service
- Set the terminal state, for example silent mode
- Control an external device, for example turn lights on
- …and whatever you can imagine



Constructing visualisations

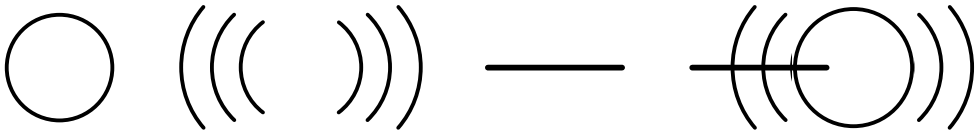
- Should show at least location (and thus existence), selection method and action
- Possibly also show price and local vs. remote connectivity
- Any visualisation will show the location
- Limited amount of selection methods
- Virtually unlimited amount of actions

→ In our examples, the icon is reserved for action and we visualise the selection method around the action

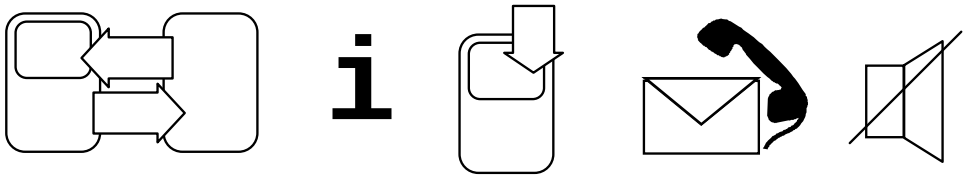
- Action icon precision:
  - One generic icon for everything (= no action visualised)
  - Action classes?
  - Separate icon for each action?

Some examples 1/2

- Remember that these are just examples to illustrate our views!



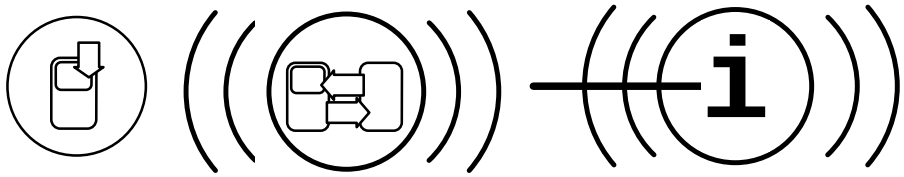
- Selection methods: Touch, Scan, Point, All three supported



- Actions: Connect, Information, Download, Messaging, Silent mode

Some examples 2/2

- Additive use of selection and action symbols



- Touch / Download
- Touch or Scan / Connect
- Touch, Point or Scan / Information

- Remember: just examples!

Summary

- Visualisation of links in physical objects is not much studied
- Lessons from WWW can be applied, but
- Different technologies and selection methods complicate the issue a bit
- It is better to visualise the selection method than the technology
- Visualising the action will probably help (results of Riekki et al., 2006 support this)

Questions? Comments?

Demonstration

- Hovering demonstration on a Nokia 3220 + NFC/RFID shell
- Single mode: display information about the link
  - Title or name
  - Content
  - Icon
- List mode: display less information but several links at the same time, also allows "collecting" links for further study
- Conclusion: hovering can possibly help with visualising the action, but preferably it is not a replacement for a good visualisation