

The Co-Space Project: Designing Novel Collaborative Workspaces

Yvonne Rogers
Open University
(formerly Indiana/Sussex
Universities)

Apologies...

- This is not a Wines project
- It follows on from talk I gave at first UK-UbiNet Workshop in 2003
- Focus is on human aspects of UbiComp
- Won't be presenting a research agenda
- But small-scale, empirical studies

Co-space

- Designing shared spaces for collaborative activities in co-located settings
- How best to combine and design shared surfaces, mobile devices and physical artifacts
- Goal is to encourage more equitable working



The tabletop as the hub

- Tabletops are ideally suited to information manipulation activities
 - visualizing, arranging and comparing
- Small groups can sit/stand around a tabletop and ‘dive in’
 - Point at and select information
 - Read and pass information to one another
- Take turns or interact simultaneously
- Support a natural way of collaborating
 - surface invites people to reach out and touch it

QuickTime™ and a
TIFF (Uncompressed) decompressor
are needed to see this picture.

A simple shared app: design

- MERL's DiamondTouch and DiamondSpin application
- Prototype surface for selecting, comparing and positioning images on a calendar cover

User study on collaboration

- Tabletop became largely invisible to task
- Evidence of all group members taking part in discussion and design task
- Much turn-giving, inviting and handing over



Turn-giving by 'finger talk'

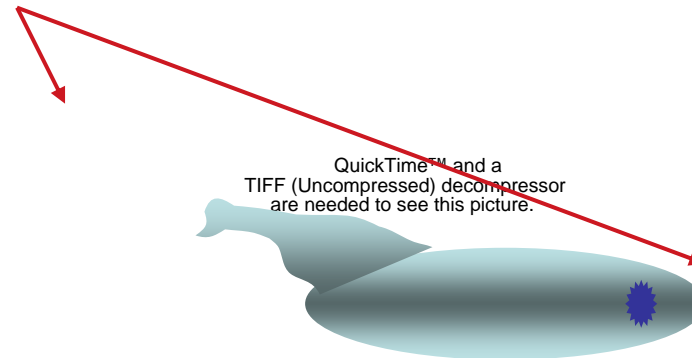
- Fingers used to support or replace face-to-face talk, e.g.,
- **Offering and inviting**
 - Moving an image out of one slot to the side, inviting another to try out an alternative
- **Making a suggestion**
 - Moving an image to the center, swiveling it toward another to make a comment
- Tabletop enables easier and new ways for group members to contribute and collaborate

Good for other types of task?

- Tasks where physical layout and arranging are critical, e.g.,
 - Garden design
 - Kitchen and home improvement design
 - Digital shopping
 - Selecting candidates for job/school
- But what about other tasks?
 - When there are many options it may be less easy to collaborate using a tabletop display

Make the tabletop bigger?

- Would a bigger display be the solution?
- How would people at opposite ends collaborate?
- Would it encourage individual working?



Research challenge

- How can we extend the collaborative workspace?
- Combine tabletop with other surfaces and physical representations
- Identify tasks that are well suited to tabletop interactions
 - placing, arranging, visualizing
- Identify those that are less suited
 - multiple menu selection
 - opening of many windows
 - scanning through and selecting from large sets of options

Additional surfaces

- Physical surfaces (e.g., walls, shelves, table) and physical tagged objects
- Can bring physical objects placed on these to the tabletop surface and transform to digital representations
- Exploiting the properties of both physical and digital worlds
- Support the moving and mingling of group members in the extended space

Extending the workspace

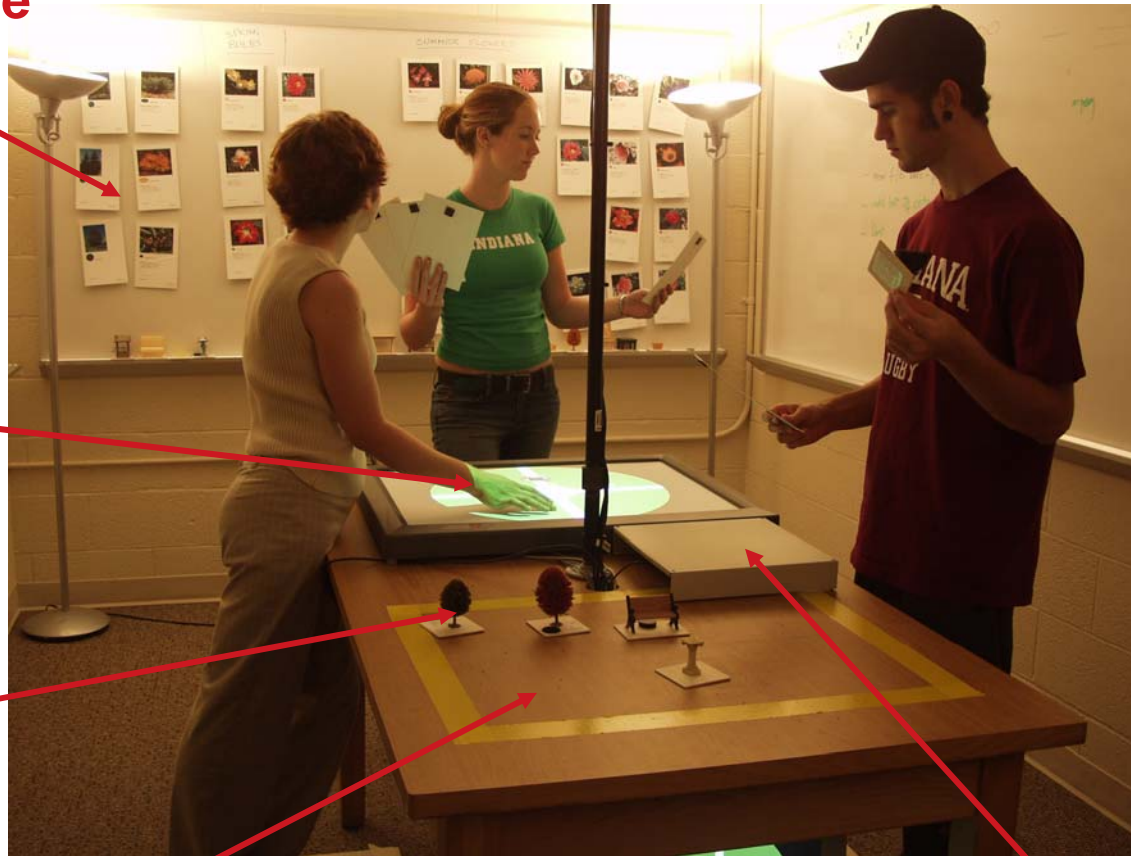
Selection space

Digital layout space

Physical models

Transform space

Holding space



Physical models and paper cards

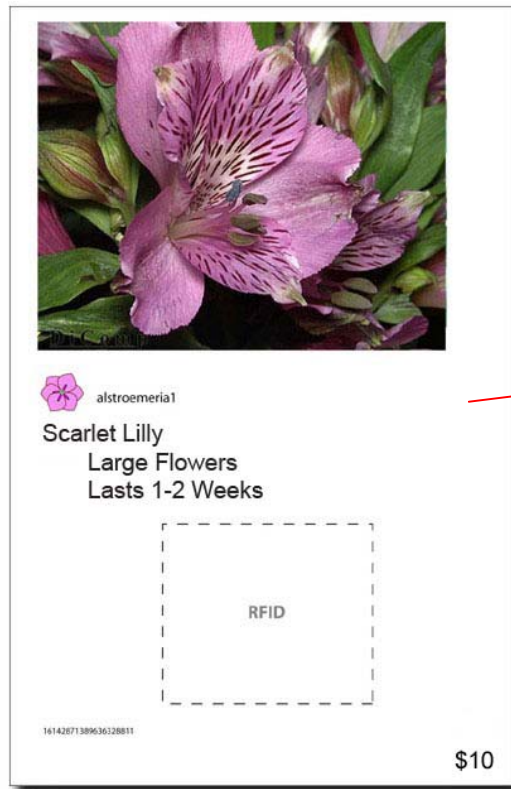
- Provide persistent, high resolution information about the details, shape, texture and proportion of objects
- People can hold them, pass them, rapidly browse and compare them
- Can act as thinking props and demand attention



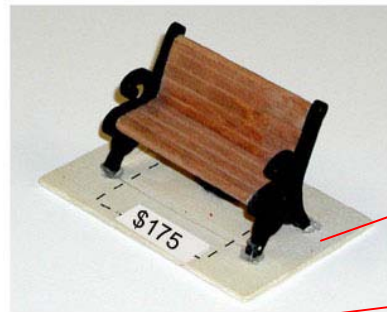
Digital representation



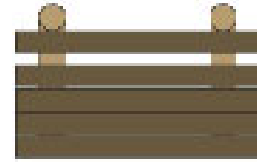
Transforming the physical objects into digital icons



(a)



(b)



The physical-digital bridge

- When tagged objects are placed on the 'transform space' they 'magically' appear on tabletop as digital icons
- Enables the users to spatially layout using a bird's eye view of the design
- Digital augmentation for each item
 - pop-up menu of price, name, attributes and realistic image

The object icon menu



The user study

- Compared tabletop (D) with extended tabletop (D+P) condition
- Six groups of 3 participants per condition
- Asked to design a layout for a public space as part of university building
- In D+P condition tagged physical models and cards on shelves and walls
- In D condition digital icon piles of objects on tabletop
- The hub of the digital workspace is the DiamondTouch surface

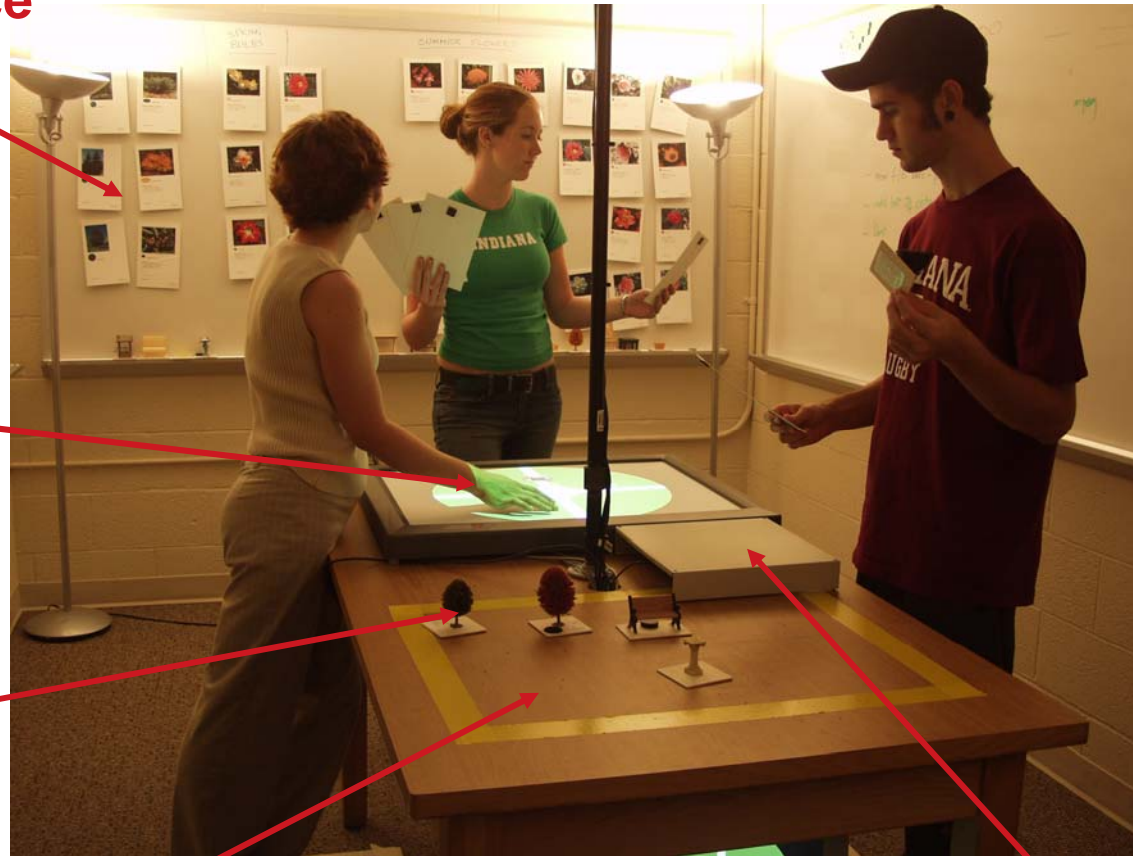
D+P condition

Selection space

Digital layout space

Physical models

Transform space



Holding space

Tabletop (D) condition



Main findings

- Little difference between number of utterances or physical actions for both conditions
- Both D and D+P completed task using a variety of criteria
- Much discussion and collaboration
- Where the two conditions differed was in the strategies adopted to select, share and compare options

(i) Browsing and selecting items

- D+P groups spent far more time scanning, comparing and discussing options
- More methodical in exploring all of the options
- In the D condition groups tended to discuss a criterion and then find an object to match
- Cumbersome to open up all of the icons in the D condition to find out about their details

(ii) Choosing options

- D condition
 - Focus was on matching objects categories (e.g., bench with a table)
- D+P condition
 - Brought together two specific models to see how they fitted together
 - Sometimes held a fan of cards in one hand as a temporary holding space
 - External representations offloaded cognition

(iii) Coordinating tasks

- In the D+P condition the groups evolved highly coordinated methods
 - One group member selected a physical model
 - Handed it to 2nd person who transformed it
 - 3rd person collected the digital representation and moved it onto garden plan
- In the D condition this rarely happened
 - Selection and design by same person in own space of garden plan

Implications

- New co-located workspaces can be designed that integrate different surfaces, devices and artefacts
- Rapid switching allows for problem space to be explored from multiple perspectives
- Physical representations:
 - Act as shared points of reference that demand attention
- Digital tabletop representations:
 - Support easy manipulation and positioning of selected images

Other shared spaces?

- In stores, e.g.,
 - Shoppers are provided with a bar scanner device
 - Browse physical store and scan a range of objects they like for their new garden/kitchen
 - Return to an in-store design studio and download
 - Work with sales rep to co-create new garden/kitchen
- In control centres
- In meeting rooms
- In hospital settings
- In classrooms...

QuickTime™ and a
TIFF (Uncompressed) decompressor
are needed to see this picture.

Summary

- Shared surfaces can be designed and combined in novel ways to invite co-located interactions
- Can encourage more equitable and comfortable ways of collaborating
- Future research is to develop conceptual frameworks

Acknowledgements

- Richie Hazlewood, Youn Kyung Lim, Troy Church at Indiana University
- MERL for donation of DiamondSpin and DiamondTouch
- Chia Shen and Kathy Ryall for feedback and support
- Ted Phelps for help with Elvin programming