Stackables:
Combining Tangibles for Faceted Browsing

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Motivation

- Decision making
  - Buying computer equipment, choosing books for a library...
  - Need to balance rich set of options
  - Collaborative process in small groups
  - People with varying priorities and skills involved
Motivation

- Faceted Browsing & Search
  - Looking at data from different conceptual dimensions
    - Technical attributes, author, price, ratings, book genre ...
  - Incremental refinement by restricting facet values

- Challenges of faceted information seeking UIs
  - Decision makers start with private exploration and selection
  - Need to communicate facets to collaborators
  - Fluidly share, transfer, and manipulate them
  - Work in closely/loosely coupled way
  \(\rightarrow\) individual + collaborative information seeking UIs needed

- Idea: explore tangible interaction
STACKABLES

- Make facets & values graspable
- Physical Widgets with controls for faceted browsing
- Stacking metaphor: build query
- Can be manipulated, shared, transferred
- By individuals and groups
- Used for negotiating results

STACKABLES
Our Proposed Solution: Stackables

Result presentation (e.g., display, screen)

Workplace (e.g., office desk)
Our Proposed Solution: Stackables

Individual facet tokens

Combined facet tokens (on ground plate)
Our Proposed Solution: Stackables
Related Work: Web-based Faceted Browsing
Related Work: Web-based Faceted Browsing
Related Work: GUIs for Faceted Browsing & Search

- 20 years of research in interactive query refinement
  - Filter/Flow [Young & Shneiderman 93] facets as water filters
  - ...
- FindFlow [Hansaki et al. 06]
Related Work: GUIs for Faceted Browsing & Search

- **Zoomable UIs**
  - FacetMap [Smith et al. 2006]
  - FacetLens [Lee et al. 09]
  - TimeSlice [Zhao et al. 12]
  - FacetZoom [Dachselt, Frisch & Weiland 08]
Related Work: Tangibles for Information Seeking

- **Navigational Blocks** [Camarata et al. 02]
  - Early tangible faceted browsing interface

- **Tangible Query Interfaces** [Ullmer, Ishii & Jacob 03]
  - Physical widgets for attribute control

- **Venice Unfolding**
  - Tangible UI for faceted geo-spatial data [Nagel & Heidmann 11]
Related Work: Tangibles for Information Seeking

- **Cartouche** [Ullmer et al. 10] →
  - A generalization of tangible menus
- **FacetStream** [Jetter et al. 11] ↓
  - Collaborative usage of tangibles
Related Work: Combing and Stacking Tangibles

- **Horizontal combination**
  - Siftables [Merrill, Kalanithi & Maes 07]
  - Sifteo Cubes ([www.sifteo.com](http://www.sifteo.com))

- Video Editing [Zigelbaum et al. 07]
Related Work: Combing and Stacking Tangibles

- **Vertical combination**
  - Stacks on the Surface [Bartindale & C. Harrison 09]
  - Lumino [Baudisch, Becker & Rudeck 10]
  - CapStones and ZebraWidgets [Chan et al. 12]
  - Tangible Programming Bricks [McNerney 2000]
  - TimeBlocks [Hayashi et al. 12]
Stackable Facet Tokens

- Main building blocks are stacked to form queries
- Similar abstract box shape for all facets (numerical + categorical)
- Facet type can be re-assigned, values adjusted at any time
- Arbitrary number of facets and facet values
- Color display + 2 input wheels + touch button
Facet Selection
# Interface Design: Categorical Facets

## Genre
- Children's literature
- Comic science fiction
- Chivalric romance
- Conspiracy
- Comedy
- Crime fiction
- Comic fantasy
- Cyberpunk
- Comic novel
- Dark fantasy

## Author
- Disch, Thomas
- Divakaruni, Chitra
- Dixon, Larry
- Doctorow, Cory
- Doctorow, E. L.
- Dokey, Cameron
- Donaldson, Stephen
- Douglas, Drake
- Douglas, Lloyd C.
- Douglass, Sara

## Awards
- Academy Honor Books
- Anisfield-Wolf Book Awards
- Alex Awards
- Anthony Award
- Ambassador Book Awards
- Henry W. and Albertina W. Halvorsen Award
- American Book Awards

## Language
- American English
- Bokmal
- Chinese
- English
- French
- German
- Hebrew
- Italian
- Japanese
Interface Design: Numerical Facets

Pages

288

Year

1934 - 1937

Nr. of Awards

2

Price

10,00 - 11,99
Adjusting Facet Values – Single and Range Selection
Single Facet Value Selection: with Upper Wheel

Facet selection
press button to switch between facet/value selection
Single Facet Value Selection: with Lower Wheel

Value selection
upper wheel is used for single step navigation
Value Range Selection: Categorical Values

activate range selection by twisting wheels apart
Value Range Selection: Numerical Values
Value Range Selection: Numerical Values
Issuing a Query: Stacking facets (AND)
Dynamic Change of Facet Value Availability
Issuing a Query: Stacking facets (Negation)
Issuing a Query: Stacking facets
Result Visualization on a Distant Display
The Visualization Application
Iterative Design Process & Technical Realization

Usability study ➔ paper
Penultimate Design
Developing the Improved Design
Developing the Improved Design
Stackables: Latest Version
Stacking Recognition: Reed Switches & Magnets
Stacking Recognition: Reed Switches & Magnets
Stacking Recognition: 4 Switches + 4 Magnets / each Side
Communication

A -- UDP -- B

XBee

C

D
Some power is also needed...
Stackables @ CHI 2012 as Interactivity
Interactivity @
STACKABLES

- Tangible solution for faceted information seeking
  - Tangibles for representing & adjusting arbitrary facets & values
  - Can be manipulated, shared, transferred

- Visualize queries in a physical form by vertical stacking
  - Physical manifestation of result of information seeking process
  - Minimized footprint, several towers for multiple queries

- Individual and parallel interactions in a co-located setting
  - Negotiation of results

- Technical solution with potential for generalization
Conclusion

- **Limitations**
  - Size still too large, stack sizes limited
  - Display angle, focus switch
  - Technically complex

- **Future Work**
  - Further look into collaboration issues
  - Tackling the visualization challenges
  - Generalization for other types of applications (e.g. games)
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References I


References II

References III


