Materializing the Query with Facet-Streams

A Hybrid Surface for Collaborative Search on Tabletops

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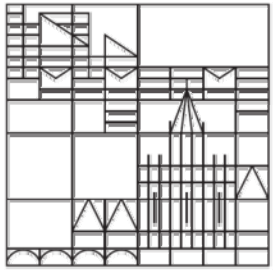

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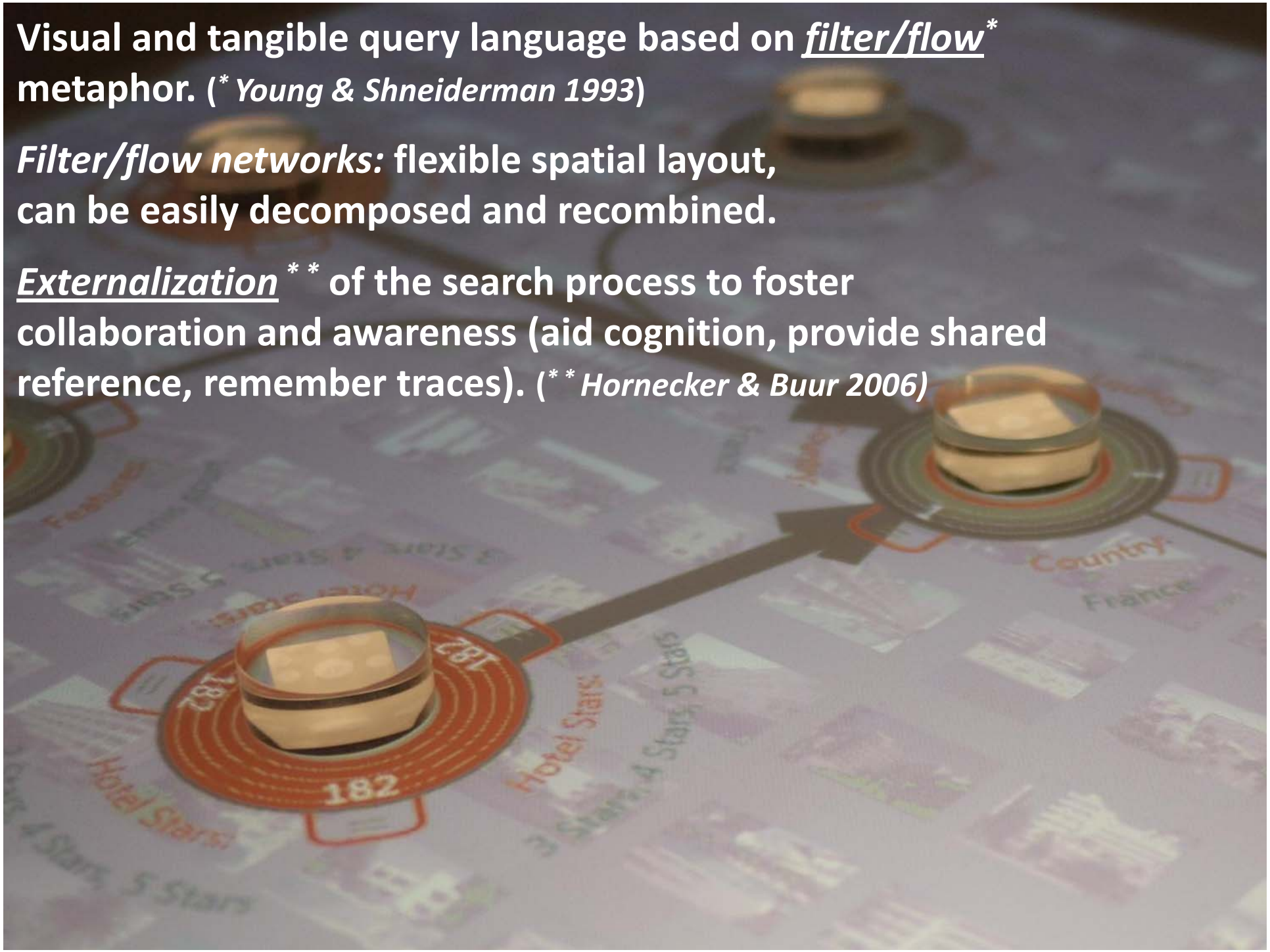
Tabletop for multi-user collaborative product search:
support multiple users in searching and agreeing on a product from a product catalog.
Combination of information visualization, multi-touch and tangible interaction.

What is special about collaborative product search?
Example: *finding a holiday hotel*.

- Must support more than **logical AND** of all personal criteria.
- **Iterative exploration** to support **negotiation** and **decision making.**
- Not **keyword search**! Process of **iterative filtering** of a catalog using **faceted metadata*** until result set becomes **small enough to review and decide.** *(*Hearst et al. 2002)*
- Phases of tightly-coupled **collaboration** and loosely-coupled **parallel work** *(Morris et al. 2009)*.

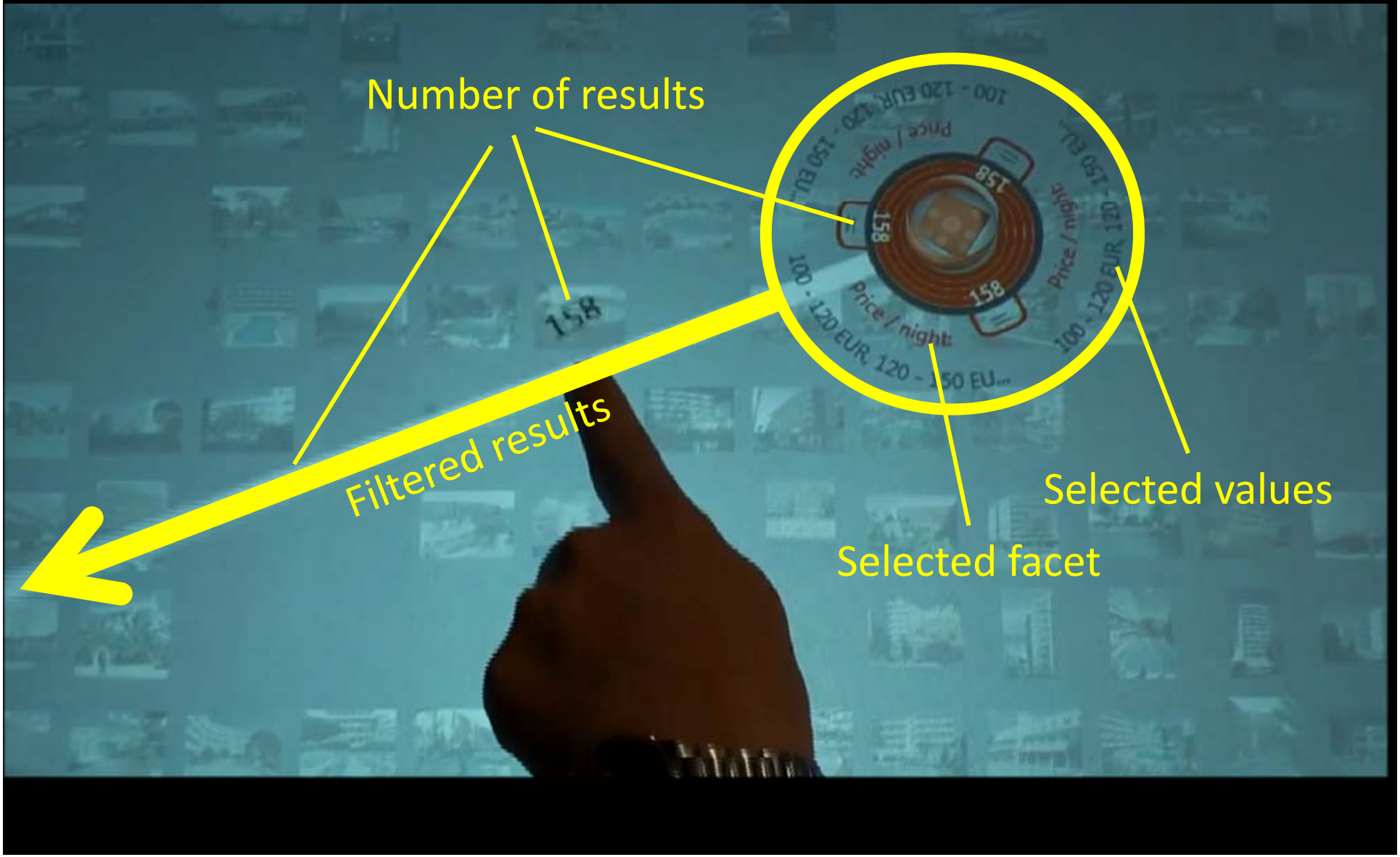


Visual and tangible query language based on *filter/flow metaphor. (* *Young & Shneiderman 1993*)**

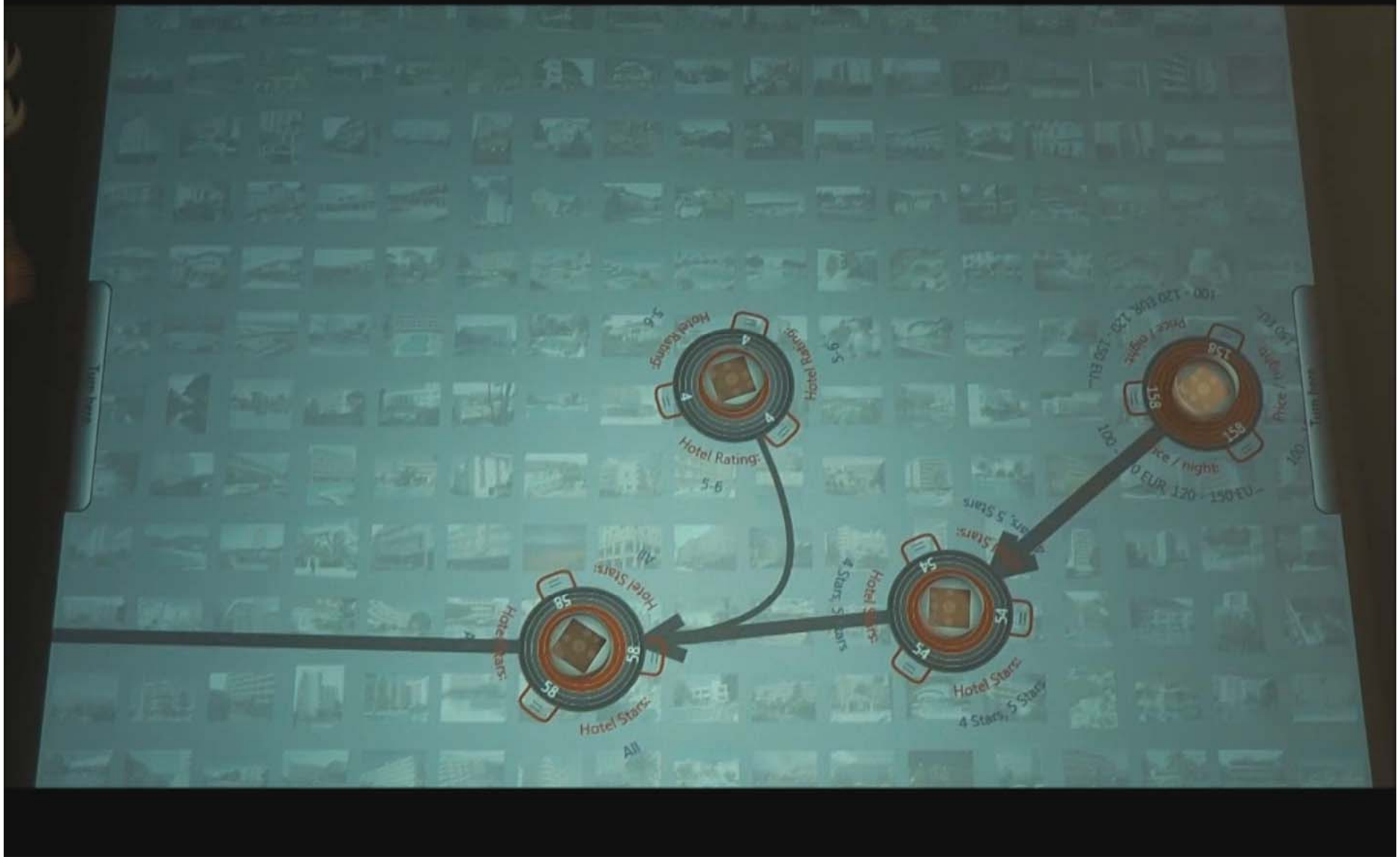
Filter/flow networks: **flexible spatial layout, can be easily decomposed and recombined.**

Externalization **** of the search process to foster collaboration and awareness (aid cognition, provide shared reference, remember traces). (** *Hornecker & Buur 2006)***

Formulating a single filter criterion.



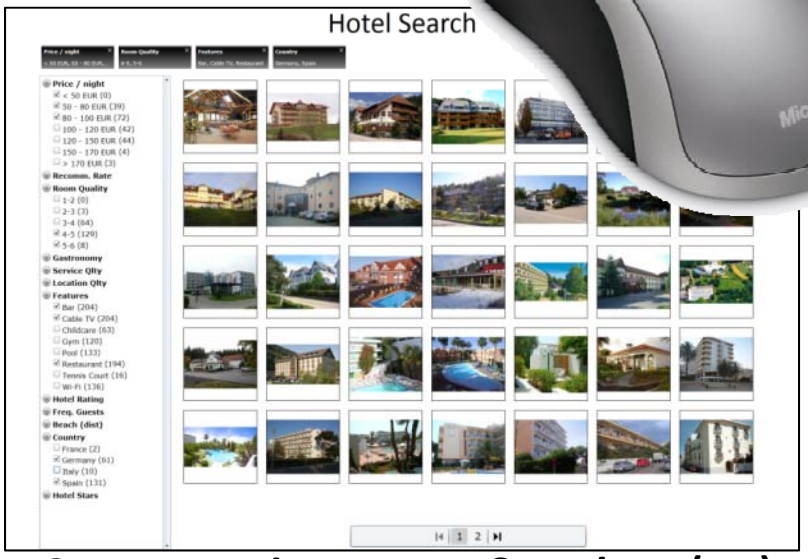
Design goal: *Fluid Interaction* and *Low Viscosity*. *(*Blackwell & Green 2003)*



Design goal: *Parallel, Around-the-table Interaction*.

Study 1 - Collaborative Use

12 groups using Facet-Streams (FS)



12 groups using mouse & Web UI (WI)

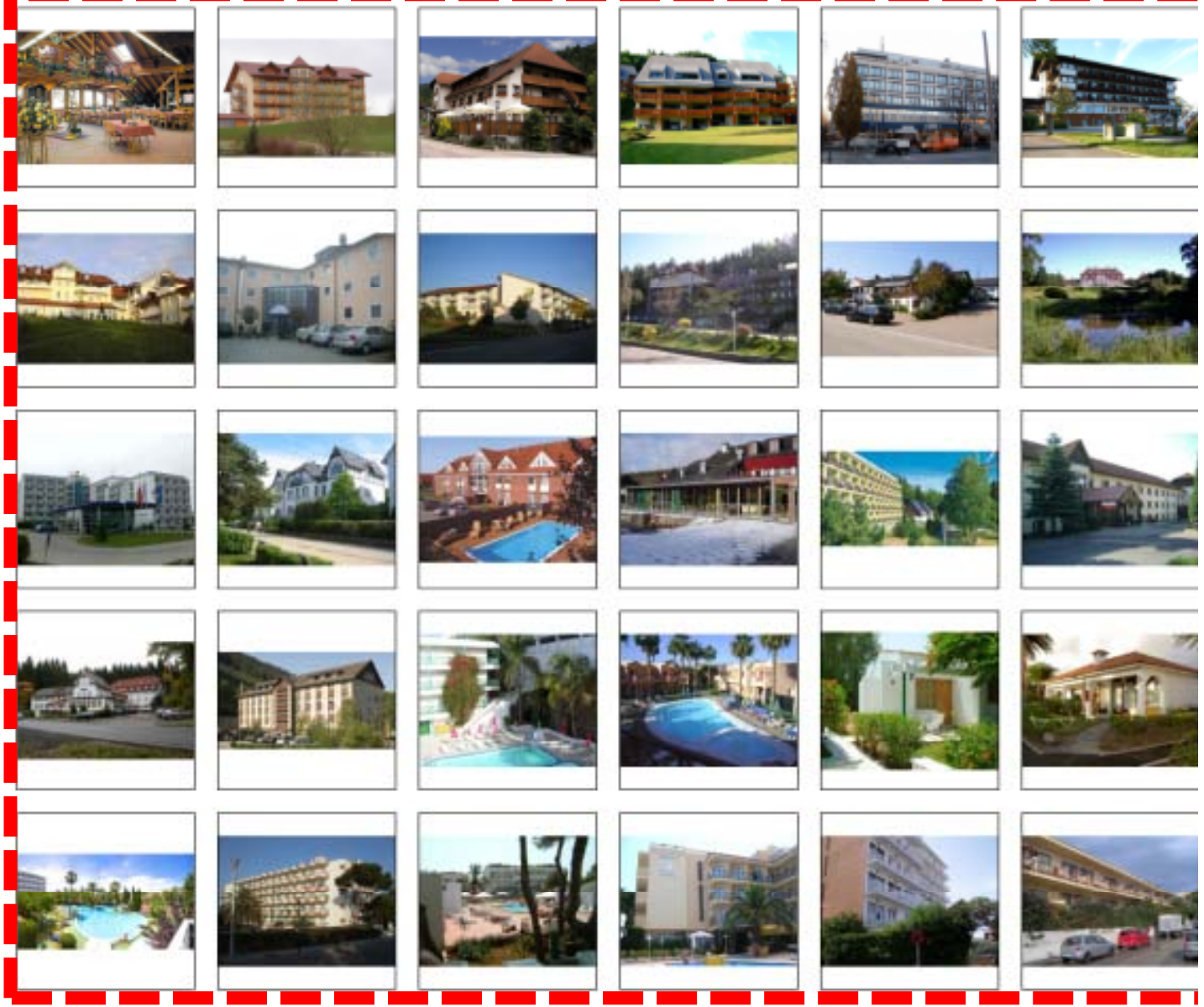
- Goal: Contrasting user behaviour, awareness and strategies during controlled group search tasks. UX questionnaires.
- 72 participants in 24 groups of 3 (between subjects).
- Participants were students from a variety of fields and administrative staff (only 2 computer science students).

Filtering History

Hotel Search

Price / night × < 50 EUR, 50 - 80 EUR,... | Room Quality × 4-5, 5-6 | Features × Bar, Cable TV, Restaurant | Country × Germany, Spain

Results



Facets

- **Price / night**
  - [x] < 50 EUR (0)
  - [x] 50 - 80 EUR (39)
  - [x] 80 - 100 EUR (72)
  - [ ] 100 - 120 EUR (42)
  - [ ] 120 - 150 EUR (44)
  - [ ] 150 - 170 EUR (4)
  - [ ] > 170 EUR (3)
- **Recomm. Rate**
- **Room Quality**
  - [ ] 1-2 (0)
  - [ ] 2-3 (3)
  - [ ] 3-4 (64)
  - [x] 4-5 (129)
  - [x] 5-6 (8)
- **Gastronomy**
- **Service Qlty**
- **Location Qlty**
- **Features**
  - [x] Bar (204)
  - [x] Cable TV (204)
  - [ ] Childcare (63)
  - [ ] Gym (120)
  - [ ] Pool (133)
  - [x] Restaurant (194)
  - [ ] Tennis Court (16)
  - [ ] WI-FI (136)
- **Hotel Rating**
- **Freq. Guests**
- **Beach (dist)**
- **Country**
  - [ ] France (2)
  - [x] Germany (61)
  - [ ] Italy (10)
  - [ ] Spain (131)
- **Hotel Class**

Controlled Group Search Task

- Each participant was assigned a role (e.g. *family father*) and distinctive personal criteria to search for…

Features: **Cable-TV, Childcare, Restaurant** ***Location Qlty:*** **4-5, 5-6** ***Gastronomy:*** **4-5, 5-6**	***Hotel Rating:*** **4-5, 5-6** ***Price/night:*** **bis 100 EUR (inkl.)** ***Service Qlty:*** **4-5, 5-6**	***Hotel Stars:*** **4,5** ***Beach (dist.):*** **50m, 100m, 150m** ***Room Quality:*** **4-5**

- Instruction:
  Decide on one optimal hotel for **ALL** group members, BUT make as **few** personal concessions **as possible**!
- What they didn‘t know: there was no hotel suiting all criteria…

Effectiveness & UX

- Both systems: No group gave up. No group failed to agree.
- Groups‘ results with Facet-Streams of equal objective quality as with Web interface (*discussion in the paper).*
- Better subjective UX with Facet-Streams (scale 1:“not true“, 7:“true“)
  - **“fun working with the system”:**
    FS significantly higher (6.69 > 5.69, t(23) = 4.716; p < 0.001).
    Quotes: “Nice game!”, “This is so much fun”. At end: “What a pity!”
  - **“the system is very innovative”:**
    FS significantly higher in. (6.38 > 3.61, t(23) = 8.444; p < 0.001).
    Between-subjects design.
  - **“the system supported me in solving my task.”:** No significant difference, but high average for both systems in (6.13 > 5.86).
    Both systems did their job. Fair comparison.

Increased Awareness using Facet-Streams

1. **Awareness of the system state and search process:**
   - Users knew which facets are already filtered or which criterion is still missing. Users could attribute tokens to their “owners”.
   - ***Web Interface*:** Much more verbal communication to become aware of system state. Much more verbal “noise”. Users could not attribute ticks in check boxes to their “owners”.
2. **Participants were aware of other participants’ criteria:**
   - Quote: “But you have to think of your children!”.
   - ***Web Interface*:** No indications for a stronger relation to their roles.
3. **Awareness of others’ interactions:**
   - Mutual support with handling the user interface (e.g. reaching over to help with a control). Collaboration not only on the primary task but also on the secondary task of handling the UI.
   - Some groups got into a kind of “flow” and handled UI very smoothly.
   - ***Web Interface*:** In one case frequent mistakes during (un)checking values were either not discovered or not communicated to the operator.

Observed Search Strategies

Facet-Streams:

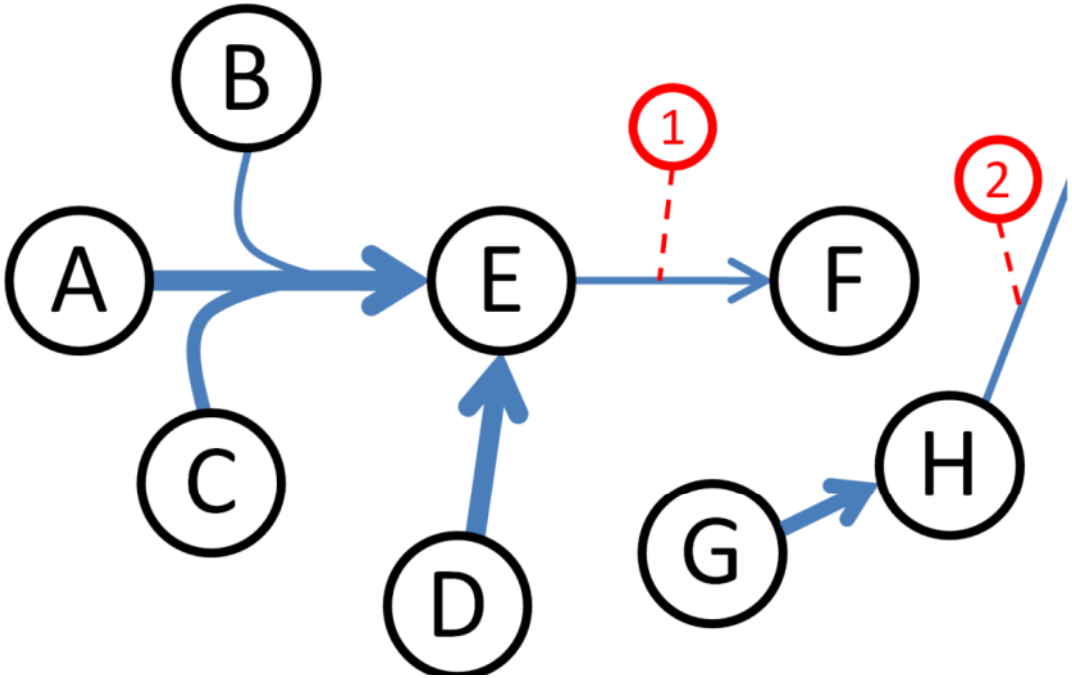
- Two different strategies in initial phases of query formulation:
  - Parallel-personal (26/33) vs. Sequential-collaborative (7/33).
  - But then: Many smooth transitions between tightly-coupled collaboration and loosely-coupled parallel work. *(we achieved our design goal)*
- Different “zero hit” strategies:
  - democratic approach: “now everyone looks for some category to soften“.
  - analytical approach: “whose criteria are the cause for zero hits?“

Web Interface:

- random or even chaotic sequences of entering criteria
- very early switching to browsing of results (still successful, because of more direct access to results!)
- → future work: better integration of query formulation and browsing in Facet-Streams!

Comprehensibility of Boolean Logic (Study 2)

- Users (n = 7) quickly learned to handle our equivalent to Boolean logic (without being exposed to Boolean symbols, Boolean operators or Boolean terminology).
- Very small error rate (7%) and 6 out of 7 participants could correctly construct a complex query from natural language .
- See details in paper.



Expression 1:
E AND ((A OR B OR C) AND D)

Expression 2:
G AND H

Conclusion

- Facet-Streams makes abstract concepts such as “queries”, “facets” and Boolean logic “graspable” (physically & cognitively).
- The visual and tangible representation of queries fostered collaboration, awareness and mutual support during search.
- Facet-Streams turned group search and decision making in a fun experience.
- My personal take home message:
  - Seemingly abstract concepts in IT and computer science (e.g. queries, facets, Boolean logic) can be made much more accessible to novices using new hybrid styles of interaction with multi-touch and tangibles.
  - Collaboration & awareness can greatly facilitate not only the primary task from the application domain, but also the secondary task of mastering the UI itself.

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