1. Foundation of VISS

1.1. Creativity Support Tools
a) Framework for Mega-Creativity (Shneiderman)

Collect	• Learning from other works (libraries, internet, …) • Search and browsing in digital medias • Visualize data and processes to understand and discover relationships
Relate	• Consult peers and mentors for support
Create	• Explore, compose and evaluate possible solutions • Think by free association to make new combinations of ideas (brainstorming, lateral thinking, …) • Explore solutions – what-if tools and simulation models • Compose artifacts (e.g. UML-Diagrams) and performances (Requirement-analysis) step by step • Review and replay session histories to support reflection
Donate	• Disseminate the results to gain recognition and contribute to libraries, the Web, etc.

- Example: GENEX http://www.cs.umd.edu/hcil/pubs/presentations/genex/index.shtml

b) Knowledge Crystallization Operators

Acquire information	• Monitor, Search, Capture
Make sense of it	• Extract information • Fuse different sources • Find and recode information into schema
Create something new	• Organize for creation • Author
Act on it	• Distribute, Apply, Act

c) Knowledge Media Workbenches

= Couple of creativity support-tools for users of Digital Libraries:

- **Visual information seeking** with search, watch, bookmarks and news functions
- **Information Workspace** to store different spheres of interest and knowledge artifacts
- **Media Warehouse** that fuses different sources, offers integration of data support and sharing
- **Media Editors** to create and present new knowledge artifacts; offer integration of actions and consistent terminology; support higher level of actions like "collect-explore-visualize"
- **History tool** for reviewing and replaying session histories
- **E-Mail, Website, CSCW** functionality
- **Zoomable User Interfaces**
- **…**

*Design Principles for a Knowledge Media Workbench:*

1. Comprehensive visual support for all activities of creative work
2. Searching and browsing of digital libraries
3. Rich representation of information (multimedia) from different information sources
4. Keeping and managing information needs, search results, knowledge artifacts
5. Support the creation of knowledge artifacts
6. Support reflection based on the interaction history
7. Variety possibilities to disseminate knowledge artifacts
8. Smooth integration across windows/applications

1.2. Visual Information Seeking Systems

- **VISS supports the task "searching and browsing"**
- Key is the enormous capacity for human visual information processing
- Presenting information visually and allowing dynamic user control through direct manipulation UI
- Displays of textual and numeric information can be extended to incorporate spatial displays in which related information is clustered in 2-dimensional higher spaces
- Examples: Google (Miniaturansicht), grokker.com, kartoo.com, liveplasma.com

a) Definition:

- Combines the functionality of retrieval systems with the possibilities of information visualization systems
- Important aspect is their possibility to visualize a great variety of document attributes allowing the user to choose the most appropriate for his task
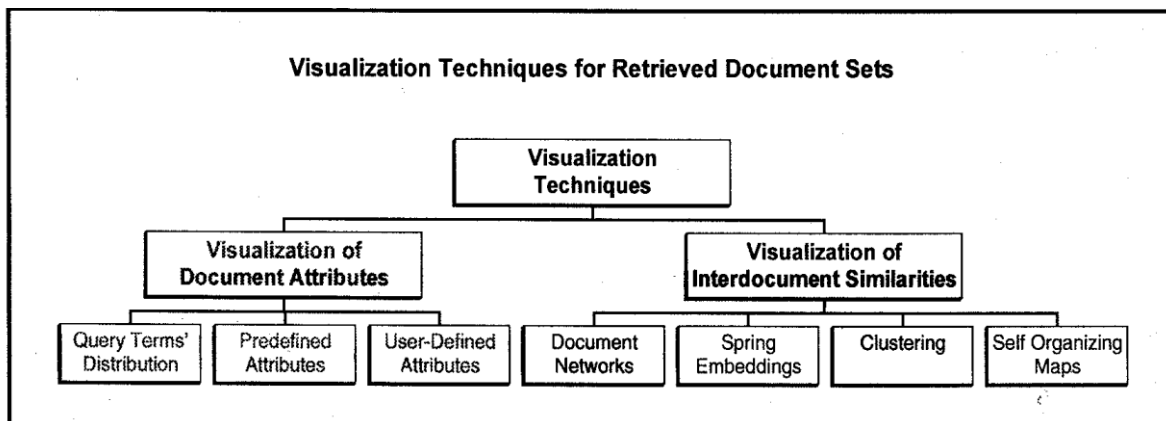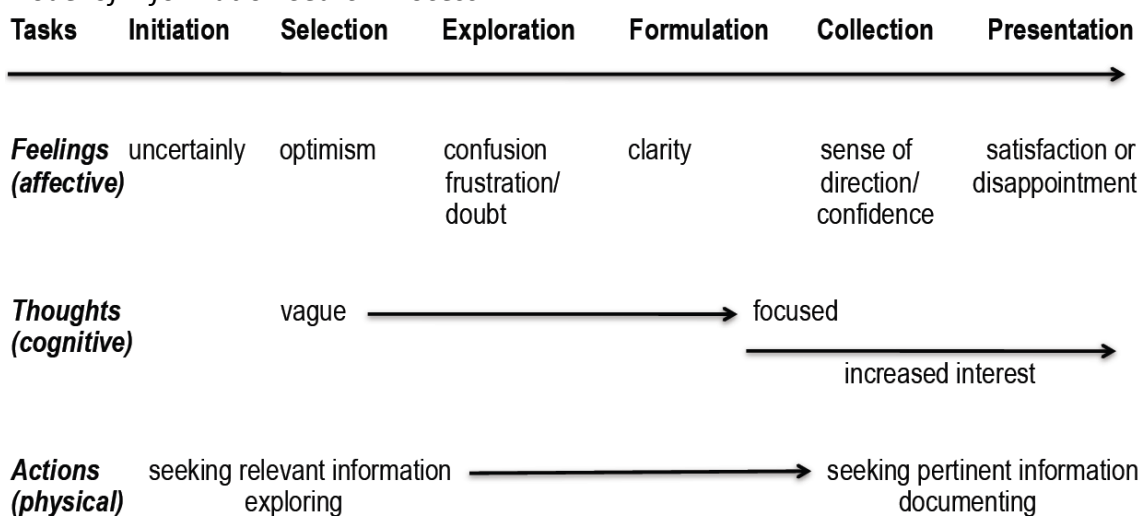

- Examples: Slides 15-28 and INSYDER (32-49), INVISIP (50), VisMeB (51/52), ZUIScat (73-77), BEST, MedioVis (53-57), Blended Library

b) Steps during Information Seeking

Formulation: Expressing the search	Search form (simple, extended, visual); phrases; variants; size of result set
Initiation of action: Launching	Search button; dynamic queries
Review of results: Reading messages and outcome	Overview, zoom and filter, details on demand; clustering; change sequencing; visualizations
Refinement: Formulating the next steps	Meaningful messages; support changing of search parameters; relevance feedback
Use: Compiling or disseminating insight	Saving and annotating of results; sending via e-mail; input other tools

- *Model of Information Search Process*

Tasks	Initiation	Selection	Exploration	Formulation	Collection	Presentation
Feelings (affective)	uncertainly	optimism	confusion frustration/ doubt	clarity	sense of direction/ confidence	satisfaction or disappointment
Thoughts (cognitive)		vague ⟶		focused		
					increased interest ⟶	
Actions (physical)	seeking relevant information ⟶ exploring				seeking pertinent information documenting	

c) User Interface Design Principles for VISS

- *Goals (by Ahlberg and Shneiderman):*
  - Reduce the user anxiety about the flood of information
  - Find needles in haystacks
  - Support exploratory browsing to develop intuition
  - Find patterns and exceptions
  - Even make browsing fun

1. **Easy to use** system; supports the users work in an effective and efficient manner. UE
2. **Easy to learn** system; shows the user its possibilities during the interaction with it. HCI
3. Support by **formulating the query**; allow user to express the right information needs. IR + InfoVis
4. Quick and insightful **overview** about all search-results; find needles in haystacks. InfoVis
5. Right **amount of information in the context**, where it is needed. InfoVis
6. Different **aspects of interest at the same time**; information comparing and/or to get more information. InfoVis
7. Possibilities to **restrict** the amount of **information**; selecting of topics of interest. InfoVis
8. **Customize the system**; reflecting the user's personal needs. HCI

d) Related Research Disciplines

- HCI and UE
- Design
- IR and Data Mining
- Business Intelligence and Data Warehouse
- Knowledge Management

- *Information Visualization:*
    - Visualize nonphysical information
    - Abstract data (no natural or obvious representation exists)
    - Key problem: discover adequate (expressive and effective) visual metaphors to make information more accessible
    - Example: FilmFinder (63/64)
    - Uses References Models for raw data for example data tables, visual mapping and view transformations (Zoom, Detail pop-ups, Fisheye, Magic Lenses and movable filters)

e) Context of Use influencing the Success of Visualizations (5T-Environment)

1. **Target user group:** e.g. interpersonal differences in information perception and processing, which influences the way people think (spatial dimensions or abstraction)
2. **Task to be done:** e.g. knowledge worker: monitor, detect, search, extract information, fuse different sources, find and recode information into schema, organize, compare, simulate, decide, distribute
3. **Type and number of data:** e.g. text or numeric data; hierarchy in the data; number of documents or data items
4. **Technical possibilities:** e.g. site of monitor, memory size, processor power, available input/output devices
5. **Training:** find the right balance between learnability and efficiency or between simplicity vs. power; long term benefits must out weight the amount of training

- User-Centered Design makes use of the following **Usability Engineering techniques:**
    - Factors of "5-T Environment" have to be considered during **Requirements Engineering** using techniques like contextual task analysis and user profiles
    - **Prototyping** or different visualization ideas offer a rich design space
    - Formative and summative **evaluation** techniques during the whole development process to "proof the concepts"
    - **Iterative** process model (e.g. Usability Engineering Lifecycle) allows consideration of evaluation results

- **Visual-information-seeking-mantra (by Shneiderman)**: "Overview first, zoom and filter, then details on demand."
    - Scatterplot with zoom and filter functionality for overview
    - Table for details on demand
    - Zoomable User Interfaces offering semantic zooming (TableZoom, RowZoom, Cell Zoom)

2. Post-WIMP-Search

1.1. User Interfaces

a) 1st generation user interfaces

- Behind the screen is **invisible world of business logic, data objects, relations, results**, …
- Input and output language is **very programming-like**
- User has a **conversation about an assumed, but not explicitly represented world**
- **Conversational Metaphor**

b) 2nd generation user interfaces

- Visual **representation or simulation of a model-world**, that **contains business logic**
- Direct **manipulation** of the model-world **without languages as intermediary**
- **GUI with Model-World Metaphor**

c) 3rd generation user interfaces

- User is **"off-the-desktop"**
- **Physical and social world** becomes entirely **augmented with information technology**
- Users can **switch between** their **real-world skills and** their **virtual superpowers**
- ➤ **Embodied or Reality-Based Interaction**

1.2. WIMP vs. post-WIMP?

- **WIMP = W**indows **I**con **M**enu **P**ointer
- **Post-WIMP =** novel interaction without **WIMP**
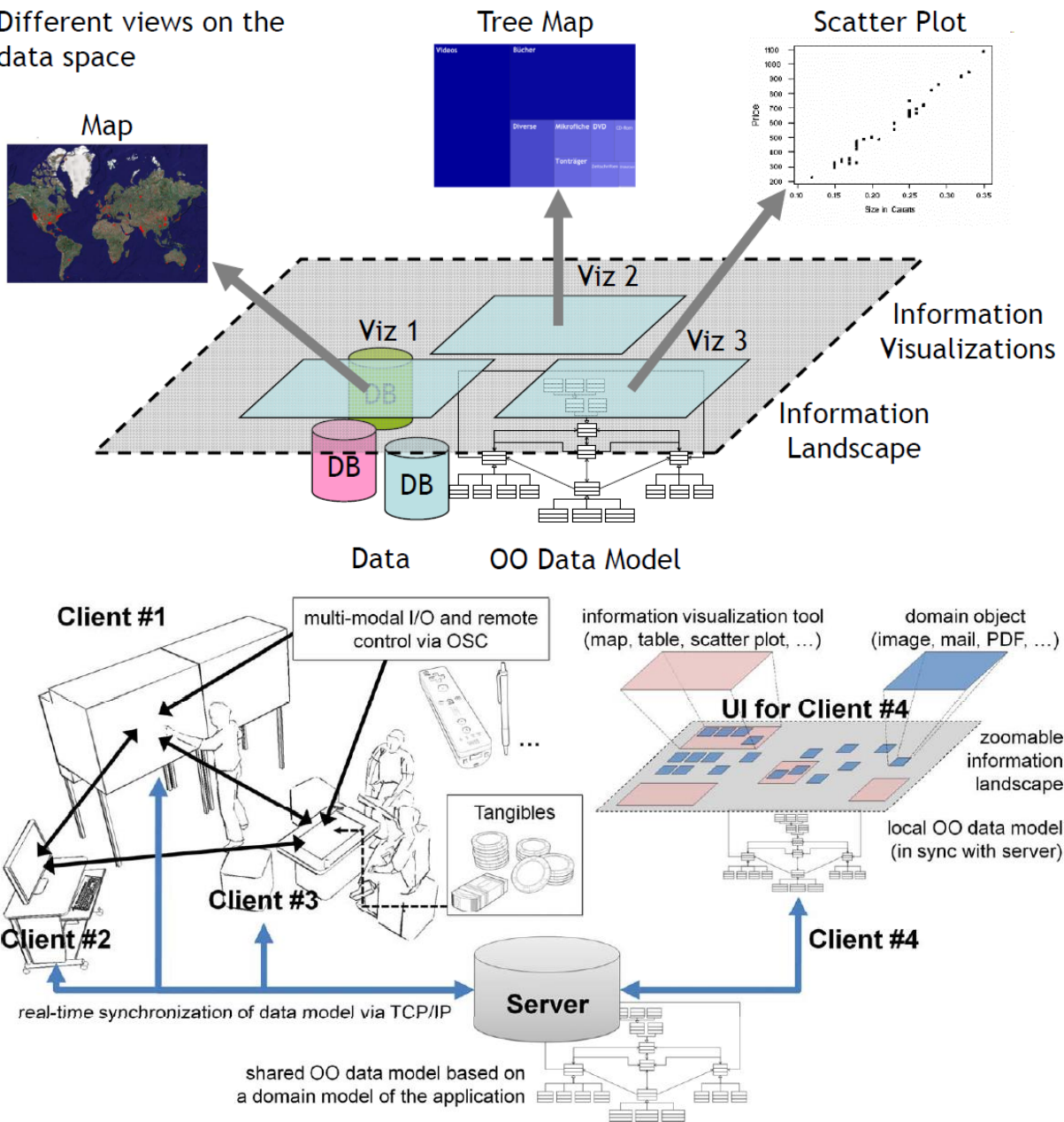
a) Embodied Interaction

- **The body matters!**
  Tangible Computing: Make use of our motor & bodily skills and spatial awareness (bimanual multi-touch computing, tangible user interfaces, smart environments, …)
- **The social environment matters!**
  Social Computing: Make use of our social skills, design for social interaction and collaboration (Surface)

b) Reality-Based Interaction

- **Naïve Physics (NP):** People common sense knowledge about the physical world
- **Body Awareness & Skills (BAS):** Familiarity and understanding that people have of their own bodies, independent of the environment
- **Environment Awareness & Skills (EAS):** People have a physical presence in their spatial environment and develop many skills for navigating within and altering their environment
- **Social Awareness & Skills (SAS):** People are aware of the presence of others and develop skills for social interaction

c) Zoomable Object-Oriented Information Landscape (ZOIL)


Different views on the data space

Map

Tree Map

Scatter Plot

Viz 1 Viz 2 Viz 3

Information Visualizations

Information Landscape

Data OO Data Model

Client #1

multi-modal I/O and remote control via OSC

information visualization tool (map, table, scatter plot, …)

domain object (image, mail, PDF, …)

UI for Client #4

zoomable information landscape

Tangibles

local OO data model (in sync with server)

Client #2

Client #3

Client #4

real-time synchronization of data model via TCP/IP

Server

shared OO data model based on a domain model of the application

- **Semantic Zoom:**
    - Enables User to browse objects
    - Different visualizations serve as visual entry points
    - Exploration does not necessarily start with a keyword search
    - Entry points: media type, persons, floor-plan, country, town (MedioVis)
    - Magic lenses: flexible tool to define specific filter criterias
    - M3 Scatterplots
    - Search Tokens
    - Facet-Streams

d) Potential of Tabletops for Co-Located Collaborative Search

- Closer face-to-face collaboration and more equitable working style
- Increased awareness and better group work experience
- Horizontal form-factor whose affordances are well-suited to follow up activities (e.g. sorting, making purchasing decision)
- **Unexplored potentials:**
  - *Hybrid interaction:* Combining interaction with tangible interface elements and multi-touch interaction
  - *Faceted search:* iteratively filtering the whole information space based on metadata, instead of populating a result set based on keywords
- **Collaborative faceted product search:**
  - More than a logical AND of all personal criteria
  - It is decision making or negotiation based on iterations of softening criteria
  - Criteria are equivalents of complex Boolean expression
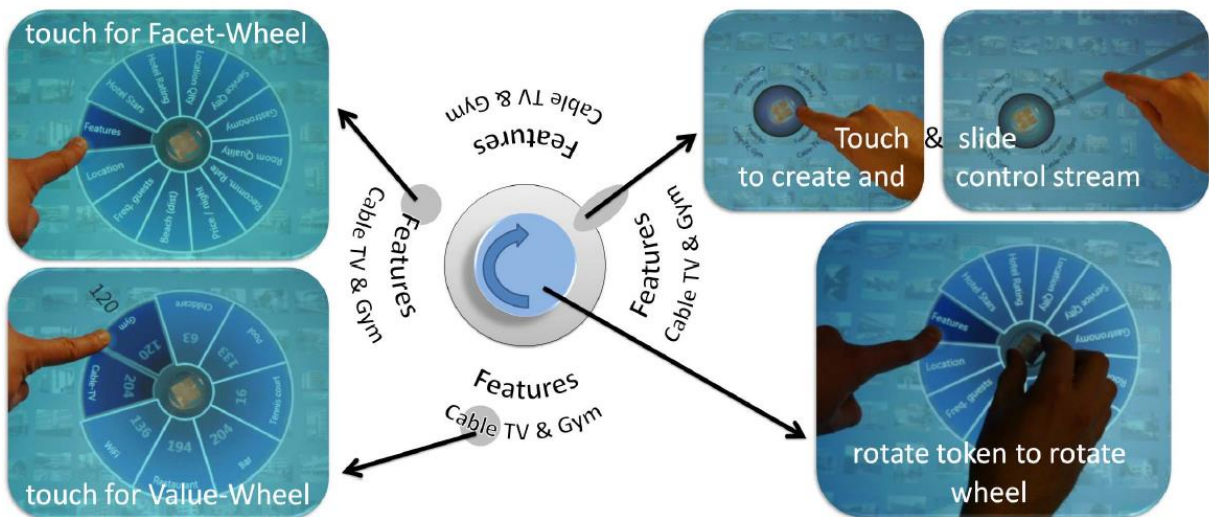
- **Conclusion of facet-stream studies:**
  - Facet-streams are equally effective as established web designs for faceted navigation (although it introduces novel an unfamiliar hybrid interaction techniques and visual metaphors)
  - Users perceived using facet-streams as fun experience and considered its design as innovative
  - Increased awareness and better mutual support among collaborators was observed
  - Variety of different searching strategies and collaboration styles could be realized with our design
  - Seamless transitions between tightly-coupled collaboration and loosely-coupled parallel work
  - Users were able to quickly learn and apply our visual metaphor for Boolean logic
 - Users succeeded in formulating complex Boolean queries based in natural language instructions

3. Theory of Social Search

a) Definition

- **Search acts**, that make use of **social interactions with others**
- Utilize social and expertise networks
- Are done in shared social workspaces
- Or involve social data mining or collective intelligence processes to improve the search process
- Examples: del.icio.us, diigo

b) An Elaborated model of social search
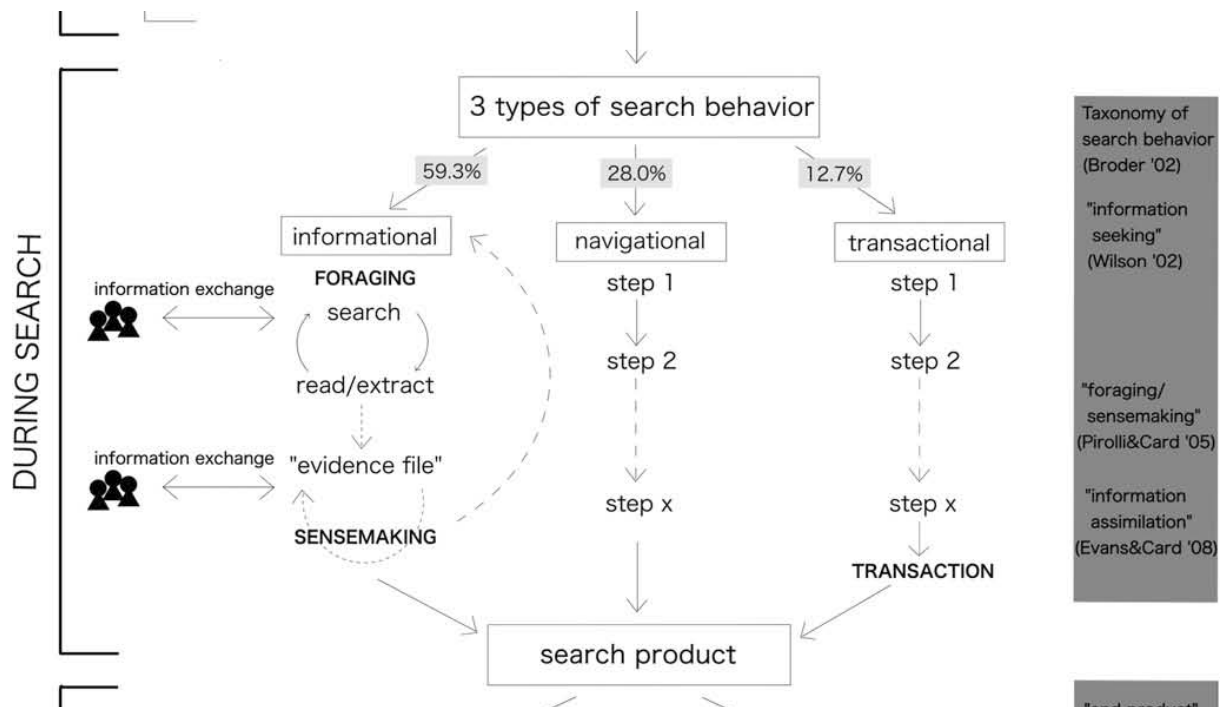
- **Before Search:**
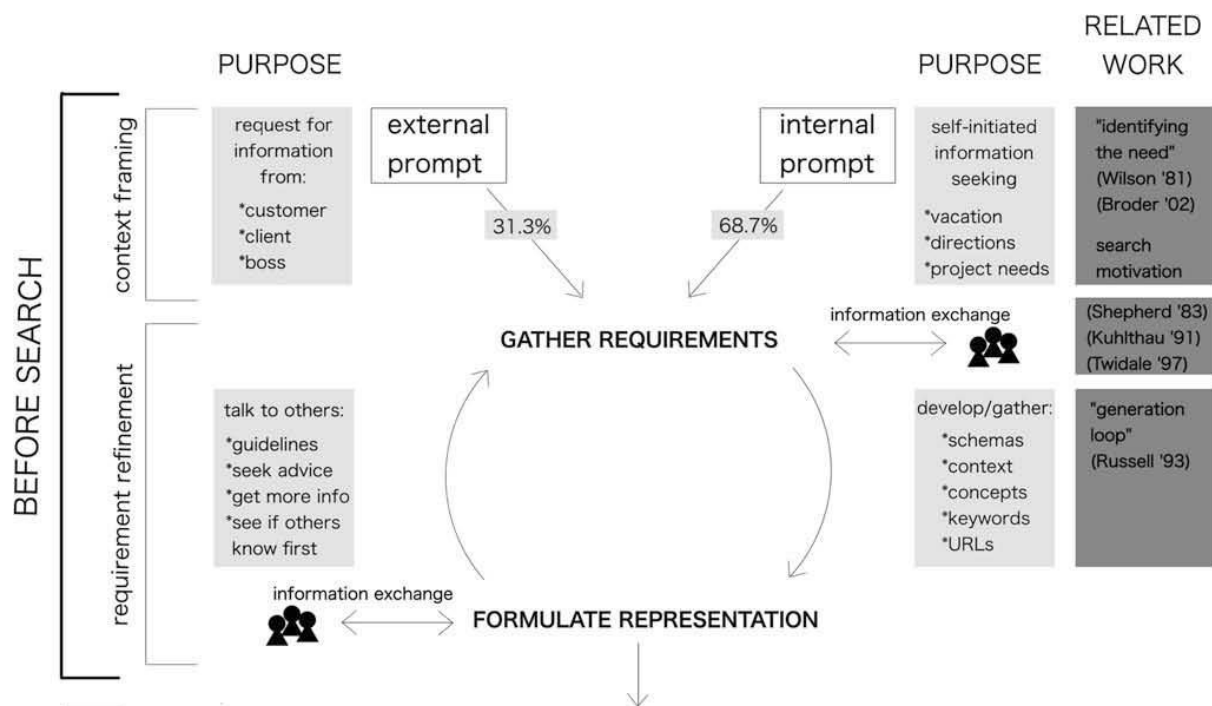
- Context Framing
    - External prompt (external request, motivated by external sources)
    - Internal prompt (self-initiated, to find information related to personal or work endeavors)
- Requirement Refinement
    - Gathering requirements and formulating relevant search schemas

- **During Search:**

- *Informational search:*
  - **Exploratory process of searching** for information that may or may not be familiar to the user
  - Completion of the task is not always clear, there is maybe no specific answer
  - **Foraging:** after a specific search, followed by skimming, reading, and extracting information, user may update and shift their search representations
  - In consequence, users update their "search schema"
  - **Sense-making:** after an initial pass at foraging, users my identify preliminary evidence files from which they can reflect and use them to further modify their search schema an query

- *Navigational search:*
  - **Users perform a series of actions** to identify content from a particular, often familiar, location. The **content is typically known in advance** or will be easily recognized once it is (re)discovered
  - E.g. look up for treatment for a specific drug in database
  - Establish search guidelines, improve search schemas
  - Brainstorm, seek coworkers opinions

- *Transactional search:*
  - Locate a source where they can subsequently perform a transaction or other "web-mediated activity"

- **After Search – End product:**
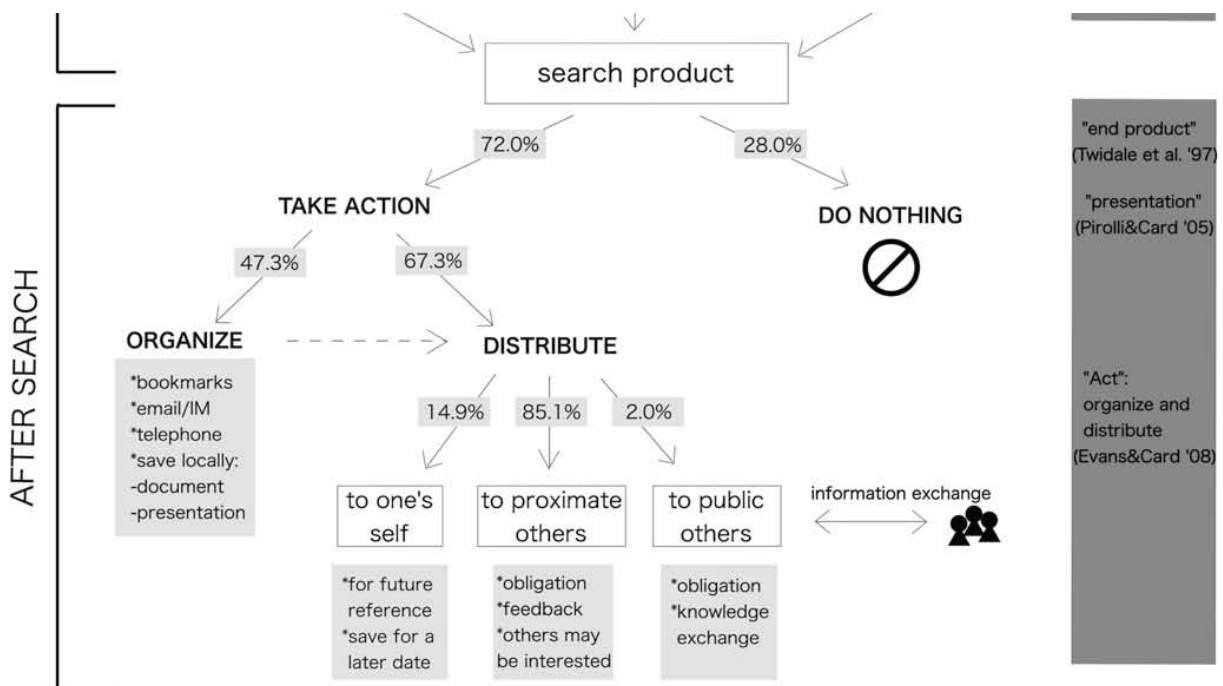
- Examples:
  - Next week's weather forecast
  - Latest news about autism
  - …
- Organize:
  - Printing results
  - Bookmarking
  - Creating a presentation
- Distribute:
  - … the search products to others
  - Users may serve as information filters for others
  - **Trustwothiness??**

c) *Systems supporting social search:*

- **Design principle:** Users need access to resources while preparing for search tasks.
  Aardvark: primarily searches for users in the friend list or the friend's friend lists for a user, which is suitable to answer the question. This one will be contacted.
  ChaCha Mobile: Search engine by sending a SMS to a number and get the answer.
- **Design principle:** User needs help evaluating and validating search results.
  Google: "Did you mean"