

## Users in IR Context

Information Seeking & Retrieval - Models and Perspectives

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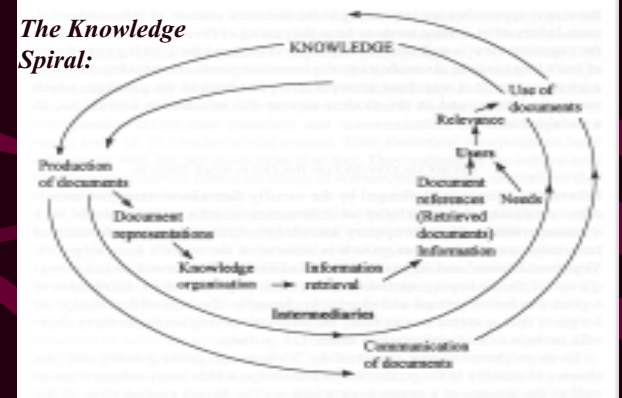
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The communication system for information science.  
Ørom, A. in: J. Documentation, 2000, p. 12-26

### The Knowledge Spiral:



## Users in Context - the disturbing variable in experimental IR - 1

- Experimental IR:
- Non-interactive - system-driven - algorithmic
  - Goal: relative performance of engines
  - Means: one-run experiments; sets of queries; mono-dimensional assessor judgements of pooled objects

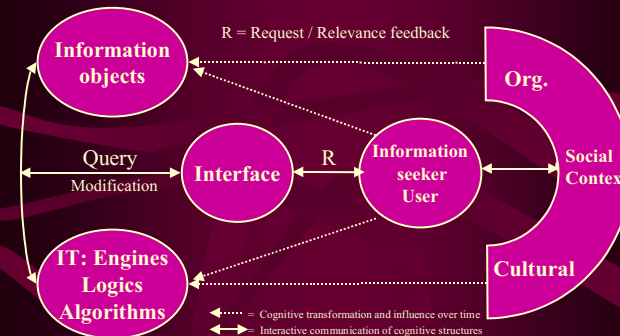
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## Simplistic model of longitudinal IS&R

The Turn. P. Ingwersen & K. Järvelin. Klüver, 2004 (forthcoming)

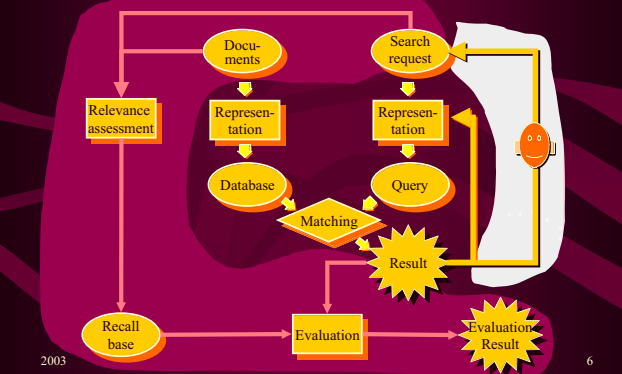


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## The Laboratory Model 2 (Kalervo Järvelin)



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## Users in Context - the disturbing variable in experimental IR

- Interactive IR - cognitive - user centred
  - Goal: understanding which engines, information structures & interface functionality that best suit/support information seeking behaviour in work (task) contexts
  - Means: iterative or longitudinal experiments; sets of simulated work task situations/real needs; multidimensional relevance assessments by users; info. needs are variable over session

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## II Retrieval models - overview 1

- IIR in context of Information Seeking Behaviour and Work Task Situations:
  - e.g. as part of **scientific communication**
  - or solving a (work / interest) problem
- Information seeking models:
  - T.D. Wilson's models (1981...1996...1999)
  - Dervin & Nilan: sense-making (1986)
  - Kuhlthau's phenomenological stage model (1991)
  - Byström & Järvelin, 1995 – Vakkari, 2000

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## II Retrieval models – overview 2

- Ingwersen's model for IIR (1992/96)
- Saracevic' stratified model for IIR (1996)
- Ingwersen/Järvelin cognitive model (2004)

– **The relevance connection - and the association to information use - in**  
• **SITUATED CONTEXTS**

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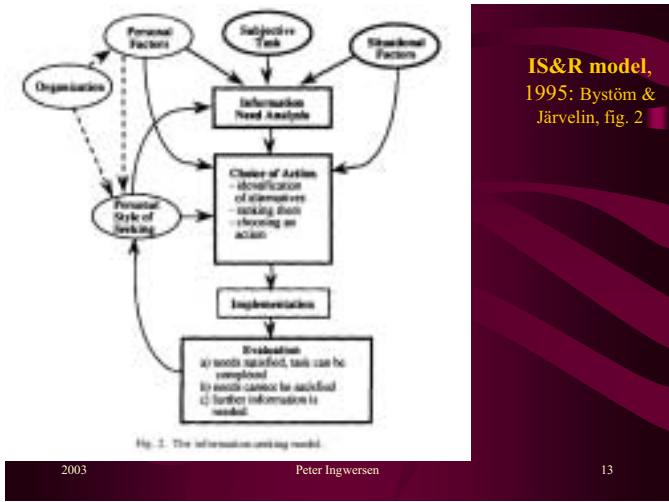
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# Wilson's 1981 model of Information seeking

```

graph TD
    IU[Information user] --> N[Need]
    N --> ISB[Information-seeking behavior]
    ISB --> IE([Information exchange])
    ISB --> DIRS[Demands on information systems]
    ISB --> DIS[Demands on other information sources]
    DIRS --> S[Success]
    DIS --> F[Failure]
    S --> IS[Information use]
    F --> IS
    IS --> ISAT[Satisfaction or non-satisfaction]
    ISAT --> N
    IS --> IT([Information transfer])
    IT --> OP[Other people]
    OP --> IE
  
```

The diagram illustrates Wilson's 1981 model of information seeking. It shows a flow from an information user to a need, which leads to information-seeking behavior. This behavior results in information exchange and demands on both information systems and other information sources. Success or failure in these demands leads to information use, which then leads to satisfaction or non-satisfaction, feeding back into the need. Information use also leads to information transfer, which involves other people, who then participate in information exchange.



# Dervin & Nilan's sense-making (1986)

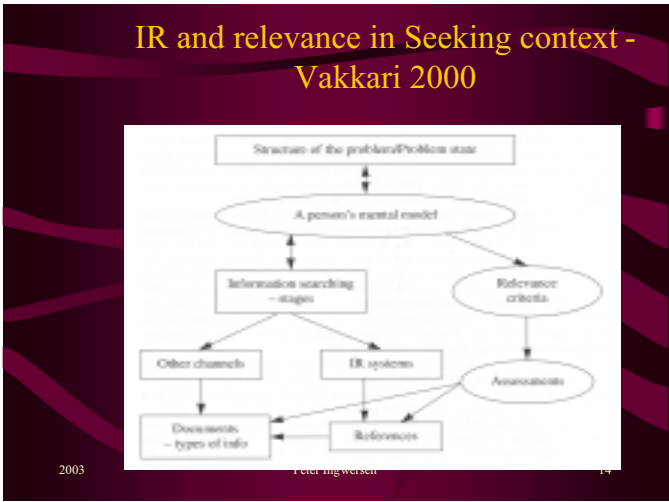
Diagram illustrating Dervin & Nilan's sense-making (1986) model:

The model shows a horizontal line labeled "Bridge" connecting two circles. The left circle is labeled "Situation" and the right circle is labeled "Outcome". Below the line, the text "time/space" is written above "Gap".

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Stages	Initiation	Selection	Exploration	Formulation	Collection	Presentation
Feelings	Uncertainty	Optimism	Confusion, frustration, doubt	Clarity	Sense of direction, confidence	Relief, satisfaction or disappointment
Thoughts	Vague			Clearer	Increased interest	Focused
Actions	Seeking background information		Seeking relevant information		Seeking pertinent information	
Appropriate tasks	Recognize	Identify, investigate	Identify, investigate	Formulate	Gather	Complete

**Cognitive Model of Information Transfer – Ingwersen, 1996**

**INFORMATION OBJECTS**

- Text/Knowledge representations/ thesaural nets
- Full text, pictures/ passages
- ↓ Models →

**Interface / Intermediary**

Query ← functions → Request

< Models >

**Individual user's COGNITIVE SPACE :**

- Work task/Interest
- Current Cognitive State
- ◀ Models ▶
- Problem/Goal
- Uncertainty
- Information need
- Information behaviour

**Soc./Org. environm .**

- Domains/Goals
- < Models >
- Tasks
- Preferences

**IR SYSTEM SETTING**

- Retrieval engine(s)
- Database arch itecture
- Indexing rules/ comput . logic
- ↓ Models →

◀ :cognitive transformation and influence  
 ↔ :interactive communication of cognitive structures

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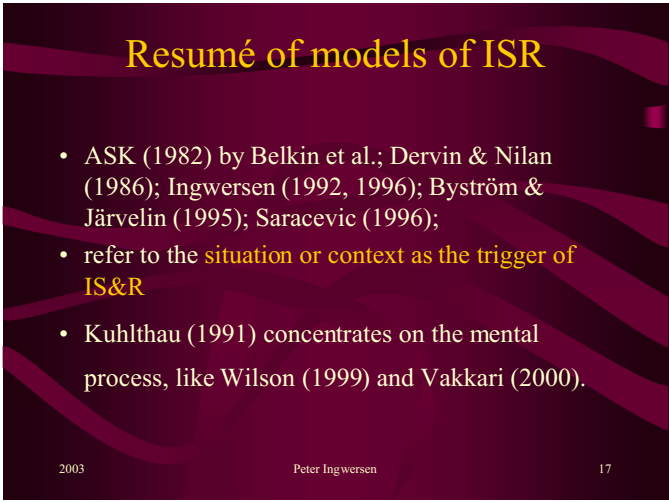
# Saracevic' stratified model for IIR (1996)

The diagram illustrates Saracevic's stratified model for IIR (1996). It consists of seven rectangular boxes arranged in a staircase pattern, representing different layers of the model. The layers, from bottom-left to top-right, are: Informational resources, Computational resources, Interface, Query characteristics, User knowledge, etc., Situation, and Environment. Three diagonal arrows are present: one labeled 'Interaction levels' pointing from the bottom-left towards the top-right; one labeled 'Adaptation' pointing from the top-right towards the bottom-left; and one labeled 'Information use' pointing from the bottom-left towards the top-right.

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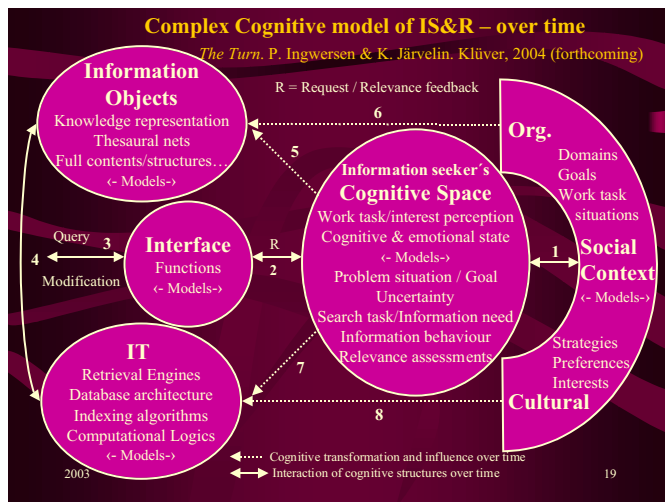


# The cognitive approach to IIR

- Ingwersen's cognitive communication model (1996), based on Belkin (ASK) (1982) and earlier alike but simpler models
- 5 major components that act as context for one another during IIR
- Two kinds of tasks: **WORK & SEARCH**
- Two kinds of knowledge: **DOMAIN & IR**
- **Work task perception as trigger for search task performance, incl. information need perception**

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### Work Task vs. Search Task

*The Turn. P. Ingwersen & K. Järvelin. Klüver, 2004 (forthcoming)*

- WORK TASKs** or (socio-cultural) **Interests** may exist **objectively** (in environment) or **subjectively** (in the mind of the actor)
- Nonetheless: they **are perceived by actor** to be fulfilled or solved – **by MEANS** of action, i.e.
- SEARCH TASKs** – instruments – the way ... *as means to an end*
- Search tasks are initiated by a perceived **information need / gap & the searching process**

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### Knowledge types in task performance

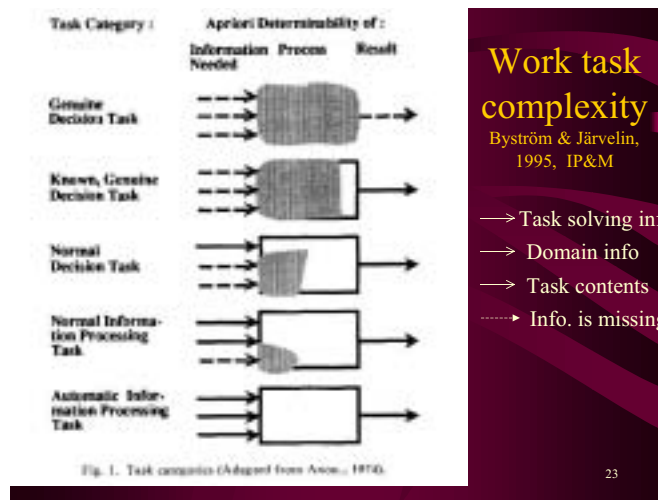
*The Turn. P. Ingwersen & K. Järvelin. Klüver, 2003 (forthcoming)*

Perception Task type	.. of <i>passive</i> features of task	.. of <i>activity</i> features of task
<b>Work task or interest</b>	Cognitive & emotional task knowledge (1)	Problem & task solving knowledge (2)
<b>Search task – interactive IS&amp;R</b>	Information source & system knowledge (3)	IS&R process & activity knowledge (4)
<b>Search task – inter personal communication</b>	Person & group knowledge (5)	Social interaction skills (6)

### Work & Search Task Categories

- According to **COMPLEXITY** in 3-5 categories:
- **Decision tasks** (genuine or known)
- **"Normal" tasks** (decision or info. processing)
- **Routine / automatic tasks** (information processing)
- **Complexity depends on amount/type of information required on:**
- Task contents - domain knowledge - task solving**

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### Situational context > Work task / Interest > Perception > Uncertainty > Information Need

- The more complex** the situation and work task - the greater the uncertainty and knowledge gap (Byström & Järvelin, 1995);
- The information need becomes increasingly ill-defined – people required as sources
- Impact on **search task complexity & behaviour** - **relevance assessments**: systems design should support cognition

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### 8 types of intrinsic information needs

*The Turn. P. Ingwersen & K. Järvelin. Klüver, 2003 (forthcoming)*

IS&R goal Known data type	Searching for information source contents as	Searching for informative data entity(ies) as	Quality of prior knowledge
<b>Passive IS&amp;R knowledge</b> (e.g. structured bibliographic or relational data)	<b>Known item</b> (1) <b>Muddled item</b> (5)	<b>Known data element</b> (2) <b>Muddled data element</b> (6)	<b>Well-defined</b> vs. <b>Ill-defined</b> (exploratory)
<b>Active/passive work task knowledge</b> (e.g. aboutness or contents data)	<b>Known topic or contents</b> (3) <b>Muddled topic or contents</b> (7)	<b>Factual</b> (4) <b>Muddled factual</b> (8)	<b>Well-defined</b> vs. <b>Ill-defined</b> (exploratory)

### INFORMATION NEED TYPES – 1

- Given a STABLE perceived TASK**
  - TO VERIFY/FIND **entire** INFORMATION OBJECTS WITH KNOWN (structured) DATA = “known item” retrieval
    - Full object: by known meta data
  - TO VERIFY/FIND data **elements** with known (structured) data
    - Bibliographic records – client address: by known meta data
  - Information need intrinsically **STABLE**

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### INFORMATION NEED TYPES – 2

#### CONSCIOUS TOPICAL or CONTENTs NEEDS

- TO CLARIFY, REVIEW OR PURSUE INFORMATION in known subject matter, **domain or content** (by unstructured data)
- TO FIND TOPICAL FACTS in known subject matter, **domain or content** (by unstructured data)

- WITH or WITHOUT "LABEL EFFECT"**
  - Information need intrinsically **STABLE** or **VARIABLE**

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## INFORMATION NEED TYPES – 3

### ILL-DEFINED or MUDDLED (TOPICAL or VERIFICATIVE) NEEDS

5-8) TO EXPLORE NEW CONCEPTS AND RELATIONS OUTSIDE KNOWN DATA STRUCTURES or SUBJECT MATTER or DOMAIN – **exploratory** information needs

- **ALWAYS "LABEL EFFECT"**
  - Information need intrinsically **VARIABLE**

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## The Label Effect

- Users DO NOT ACT RATIONALLY:
- People act more randomly, becomes uncertain, even when knowing about subject matter or contents – due to:
  - Previous search task expectations & assumptions
  - influence of the domain and situation in context
- short compromised statements - labels
- known empirically since 1982 - Web IR

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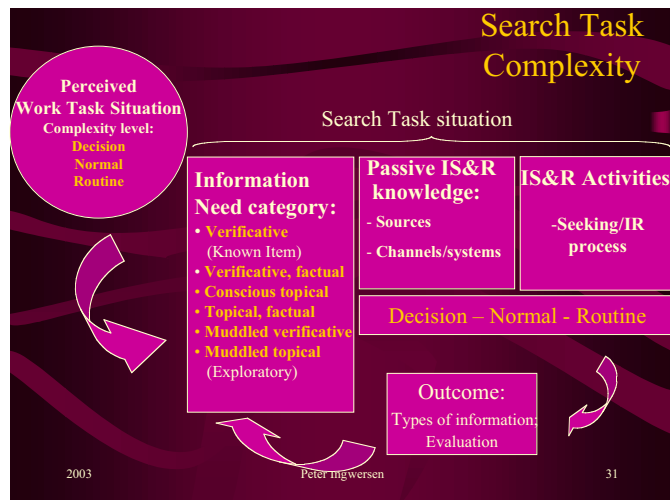
## Label Effect implications

- Labels do not provide context
- Labels are unsuitable for ranked IR
  - **relevance feedback** is hence **non-informative** or highly **uncertain** at initial stages of IIR
  - **query modification** may help machines, if user has a rich cognitive state
- Labels make distinction between well-defined and ill-defined needs difficult

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## Levels of Relevance Types - Saracevic, 1996

- **Lower order of relevance:**
- **System or Algorithmic relevance:**
  - query-object (objectivity)
- **Topical relevance:** aboutness relation of
  - query-object (interpretation/subjectivity?)

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## Levels of Relevance Types - Saracevic, 1996

- **Higher order of relevance:**
- **Pertinence:** perceived correspondence of
  - information need-objects
- **Situational relevance:** relation as perceived
  - between task, situation or problem and objects
- **Socio-cognitive relevance:**
  - group/peer perception of object (Cosijn & Ingwersen – 2000)
- **Affective relevance** (Saracevic '96): In all subjective assessments

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## System or Algorithmic relevance

- The ranked output of information objects - ranked by engine's relevance scores
- Commonly judged against expert assessor's binary relevance assessments of the pooled documents
- Assessor's judgement seen as topicality & objective - is of course intellectual (subj.)

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## Topical relevance

- Contains **interpretations**
- **Problem of nature of aboutness**
- Inconsistency among several assessors (yet: see Sigir 98 paper by Vorhees)
- Used for relative performance indications
- Why not simply apply the mean of the algorithmic output from sites (TREC) ?

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## Pertinence

- **Requires knowledge of intrinsic information need for an observer - difficult to obtain**
- **Is the domain of the seeker!**
- **May not be achieved in case of ill-defined needs**
- **Involves other facets of objects than simply topical ones (novelty – authorship – cognitive authority of journal/inst.)**

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# Situational relevance

- **Relates to the WORK TASK (interest) SITUATION ( e.g. a peer review task – or giving credit (references / links on a list of refs.) – expressing satisfaction - direction)**
- **Work tasks are NOT search tasks**
- **Individual relevance assessment in context**
- **Can be based on simulated work tasks (Borlund, 2002) - and observed**

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- 
- Information Science  
Author co-citation map
- White & McCain,  
JASIS, 1998  
MAP: 1988-95

# Affective/motivational Relevance

- **May be found in all subjective & higher order relevance types**
- **Motivational Relevance is rather an attribute to the other relevance types**

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- # Such presentation tools from informetrics and visualisation
- Useful as entry for IS&R in novel area to users
  - Providing relationships – knowledge sharing visualisation between:
    - **People** – experts – workers in knowledge-rich org.
    - **Journals** – and other carriers of information
    - **Institutions** within a region or country
    - **“Everything”** that can be represented by features
  - Can be made dynamic over real-time
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# Socio-Cognitive Relevance

- Proposed by Ørom (JoD, Jan. 2000) as associated to the social context.
- Discussed by Cosijn/Ingwersen (IPM, May 2000) as possibly related to organisational or social strategies, conventions & perceptions (group decisions = peer reviews (journal) & decisions at conference PC – or in domain over time)
- Can be observed and measured, e.g. by (author) co-citation analysis or inlinks over time.
- Can be used as a presentation tool of expertise:

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- ## Illustration of types of relevance:
- 
- The diagram illustrates the relationships between different types of relevance within a user's cognitive space. A large oval represents the 'Assessor/user' cognitive space. Inside, a smaller circle 'S' represents the 'Cognitive perception of W'. A box 'W' outside represents the 'Work task'. Arrows show the flow of information: from 'W' to 'S', from 'S' to 'I' (Information need version(s)), from 'I' to 'O<sup>1-n</sup>' (Information object(s)), and from 'O<sup>1-n</sup>' back to 'S'. A dashed arrow labeled 'R' (Relevance assessment(s) or interpretation(s)) points from 'O<sup>1-n</sup>' to 'S'. A dashed arrow labeled 'InT' (Intellectual topicality) points from 'O<sup>1-n</sup>' to 'I'. A solid arrow labeled 'T/A' (Topical/Algorithmic relevance) points from 'O<sup>1-n</sup>' to 'I'. A legend on the right defines the symbols: 'W' for Work task, 'S' for Cognitive perception of W, 'I' for Information need version(s), 'O' for Information object(s), 'r' for Request version(s), 'T/A' for Topical/Algorithmic relevance, 'InT' for Intellectual topicality, 'R' for Relevance assessment(s) or interpretation(s), a double-headed arrow for Transform., and a circle for User's cognitive space.
- Legend:**
- W: Work task
  - S: Cognitive perception of W
  - I: Information need version(s)
  - O: Information object(s)
  - r: Request version(s)
  - T/A: Topical/Algorithmic relevance
  - InT: Intellectual topicality
  - R: Relevance assessment(s) or interpretation(s)
- ↔ Transform.  
 ○ User's cognitive space
- Illustration of algorithmic relevance, intellectual topicality, situational and socio-cognitive relevance.  
 (Modified version of: Borlund & Ingwersen. Journal of Documentation, 1997).
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