

IR - explained as a cognitive process

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Information Retrieval (IR) can be thought of as a cognitive process because it involves various mental activities related to how individuals seek, process, and retrieve information from external sources. Below is an explanation of **IR as a cognitive process**:

1. Perception of Information Needs

- **Cognitive Activation:** The retrieval process starts when a person realizes a gap in their knowledge, a need for information. This is influenced by their prior knowledge, expertise, and goals. The cognitive process of *recognizing a need* triggers the search.
- **Mental Models:** Individuals have mental models or schemas about the information they need, based on their experiences and understanding of the domain. These models help them mentally frame the type of information they are looking for.

2. Formulating Queries

- **Cognitive Load:** Formulating a query requires cognitive effort. Users translate their internal information need into external terms (keywords or phrases). This process is influenced by their *cognitive resources* (e.g., attention, working memory) and the complexity of the information needed.
- **Heuristics and Prior Knowledge:** People rely on cognitive shortcuts (heuristics) and their past experiences when selecting terms. For example, if someone is looking for research on a particular topic, they may use broad terms or recall terminology they've encountered before.

3. Searching & Decision Making

- **Attention and Focus:** Once the query is entered into the IR system, the user selectively attends to specific information. Cognitive science highlights how users prioritize their attention on the most relevant documents or parts of a search result page.
- **Satisficing:** Due to cognitive limitations like time constraints, individuals often do not search exhaustively but settle for the first satisfactory result. This is known as satisficing—choosing an acceptable option rather than the optimal one.
- **Relevance Judgments:** Cognitive science explains that humans assess relevance based on both objective features of information (e.g., keywords or metadata) and subjective features (e.g., personal relevance, cognitive biases). The process is dynamic and influenced by factors like familiarity and emotional response.

4. Evaluating and Interpreting Results

- **Cognitive Evaluation:** Once results are retrieved, individuals evaluate their usefulness based on their mental model. This involves *matching* the retrieved information with the *mental representation* of what they were expecting.

- **Heuristic Evaluation:** Cognitive science explains that people may use shortcuts (e.g., checking document titles or abstracts) to assess relevance quickly, rather than reading the entire document.
- **Cognitive Biases:** The process can be affected by biases, such as confirmation bias (preferring information that supports prior beliefs) or anchoring bias (relying too heavily on the first piece of information retrieved).

5. Cognitive Load and Memory in IR

- **Working Memory:** When searching for information, the user's working memory is involved in holding the search query and evaluating results simultaneously. Cognitive load is an important factor that determines how many results can be processed at once.
- **Long-Term Memory:** Users often rely on long-term memory to recognize relevant information from previous searches or prior knowledge. Long-term memory guides query formulation and provides context for understanding results.
- **Information Recall:** The ability to recall prior searches or relevant documents impacts the retrieval process. If a user remembers where they previously found useful information, they may refine their search based on that recall.

6. Information Synthesis & Integration

- **Cognitive Synthesis:** After retrieving relevant documents, users mentally synthesize the information by integrating it with their existing knowledge. This cognitive process helps users form a coherent understanding or solve the problem at hand.
- **Constructing Mental Models:** As new information is integrated, users update or refine their mental models to better understand the topic. This dynamic process shows how IR is connected to learning and knowledge-building.

7. Refining and Iterating the Search

- **Metacognition:** Users engage in metacognitive processes to evaluate whether their search is successful or if further refinement is needed. They may reflect on the effectiveness of their search strategies, the accuracy of the results, and adjust their queries accordingly.
- **Search Repetition:** Cognitive science explains that individuals often perform multiple rounds of searching, refining their queries based on feedback (results) and shifting their strategies to overcome cognitive barriers (e.g., too many irrelevant results).

8. Cognitive Friction & Challenges in IR

- **Cognitive Friction:** The IR process can create cognitive friction, where the searcher becomes frustrated due to mismatches between their expectations and the retrieved results. Cognitive science studies help in understanding the mental discomfort caused by information overload, irrelevant results, or ineffective search interfaces.
- **Information Overload:** The vast amount of available data can overwhelm users' cognitive capacities, leading to decision fatigue and suboptimal retrieval choices.