"At first, this idea sounds ridiculous. But if you really think about it, you begin to realize that it makes no sense whatsoever."
1982-85 NRC
Cognitive Modeling
Nuclear Plant Control Room Operators
Erik Hollnagel & David Woods

"Cognitive Task Analysis"

1985 NATO Process Control
Gunnar Johanssen

"micro-operational situations"
(manual and supervisory control)
versus
"macro-operational situations"
(goal-setting, planning)
<table>
<thead>
<tr>
<th>Level</th>
<th>Concerns/Focus</th>
<th>Examples/Contexts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Micro</td>
<td>&quot;Mechanisms of intelligence&quot;</td>
<td>Laboratory studies of memory, problem-solving</td>
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<tr>
<td></td>
<td>Theories of specific phenomena</td>
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<tr>
<td></td>
<td>Emphasis on experimental control</td>
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<tr>
<td>Macro</td>
<td>Cognition in realistic tasks</td>
<td>Process control</td>
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<td></td>
<td>Performance under actual working conditions; human interaction with the real environment</td>
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</tbody>
</table>
History

Elementarism
Structuralism
Wilhelm Wundt
Edward B. Titchener

Holism
"Act Psychology"
Franz Brentano
Oswald Kulpe
Max Wertheimer
Wolfgang Kohler

← Not exactly chums →
"Which of the two books holds the key to a science of psychology?"

(Titchener)

<table>
<thead>
<tr>
<th>Ontology</th>
<th>Elementarism Structuralism Wundt 1873</th>
<th>Holism Act Psychology Brentano 1874</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Subject Matter</strong></td>
<td>All mental phenomena are reduced to associative combinations of two things: sensations and affects.</td>
<td>All mental phenomena are reduced to ideations, which have both content and direction. Emphasis on mental acts and <em>psychischen Phaenomene</em>. Use verbs, not nouns.</td>
</tr>
<tr>
<td><strong>Epistemology</strong></td>
<td>Sensations integrate into ideas by means of &quot;psychical synthesis.&quot; Mill-Locke associationism, brain model.</td>
<td>Empirical study of the richness of the phenomena of consciousness without merely attempting to analyze it into components. Acts can be the object of other acts (hence, knowing, believing, mental representations, etc.).</td>
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</tbody>
</table>
"[To Structuralists] a river consists of nothing but pailsfull, spoonsful, barrelsfull and other molded forms of water."  (James' critique of Wundt)

"[Structuralists] fell into the mistake of supposing that psychology is nothing more than applied logic" (Titchener's critique of Wundt)

"Wundt tries to reduce the mind to its lowest terms" (Titchener's critique of Wundt)

"The stressing of experimentation leads to blindness for main issues" (E. G. Boring, 1950)
"Brentano's psychology is essentially a matter of argument."

"[Brentano] appeals but rarely, and then only in general terms, to facts of observation."

"I know of only three corrections that Brentano has made to his psychology… There would, no doubt, if the book were re-written, be many other modifications of detail."

"[Brentano] appeals to his reader by way of illustrative example."

"We will always have psychologists of Brentano's stripe; these men will give us psychologies, not (as Brentano hoped) psychology."
Pendulum Swing, with a Twist

"Remember that Old Theory of Memory? Well, forget it!"
James J. Jenkins 1974

"You Can't Play a Game of 20 Questions With Nature and Win"
Alan Newell 1973

"Dismembering Cognition"
George Miller 1986
Measurement Issues

John Henry vs the Steam Shovel

Conceptual measurables →

Conceptual definitions →

Operational definitions →

Convergence
# Classes of Measurables

<table>
<thead>
<tr>
<th></th>
<th>Classical HF</th>
<th>System View / Human-Centered View</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Accelerations</strong></td>
<td>Raw performance (productivity, efficiency)</td>
<td>Achievement of expertise</td>
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<td>Enhanced intrinsic motivation</td>
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<td>Resilience</td>
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<td><strong>Avoidances and Reductions</strong></td>
<td>Errors</td>
<td>Automation surprises</td>
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<td>Make-work, kluges</td>
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<tr>
<td></td>
<td></td>
<td>Negative hedonicity</td>
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