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SUPPORTING THE CREATIVE PROCESS IN A PERSONAL CONSTRUCT FRAMEWORK USING REPERTORY GRID TECHNIQUES AND TOOLS

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Abstract: One of the first psychologists to consider the relationship between the convergent and divergent knowledge processes of creativity within a cognitive framework was George Kelly whose personal construct theory presents a person as exploring his or her environment, collecting data about the world and constructing a personal reality from which to view it. Kelly analyzes the dynamics of change in a person's construct system in terms of a *creativity cycle* in which convergent and divergent thinking alternate. A system of personal constructs is not fixed, but may vary from one occasion to another. Kelly sees convergence/divergence as a sequence of loosening and tightening of constructions. A person who uses only tight construing may be very productive but cannot be original. On the other hand, loose construing is characterized by a person's "preposterous thinking" which is unformulated and often preverbal. The structured alternation of these processes is what we perceive as the creativity underlying intelligent behavior. This paper reports some initial experiments on the application of repertory grid tools to support first year graduate students in establishing their own research directions and identities.

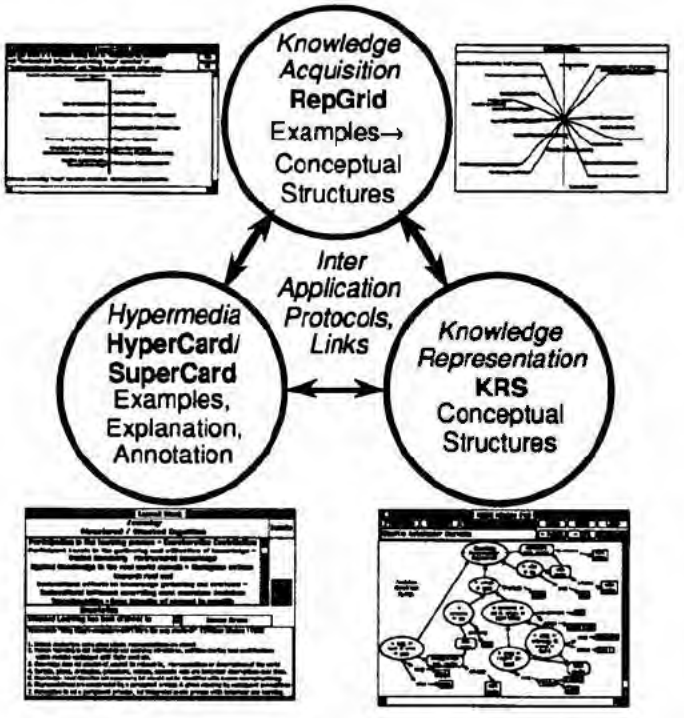
Concept elicitation and structuring:

• Semi-formal elicitation and structuring through hypertext and hypermedia
— to capture raw concepts at the pre-computational stage

• Direct editing of concepts in a semantic network, frame, rule, representation
— for overt concept structures directly available from person

• Indirect elicitation through critical elements described in relevant constructs
— when the person can provide elements for a repertory grid

• Inductive derivation of concepts from cases of varying quality
— when the person can only give access to substantial databases of lower quality data



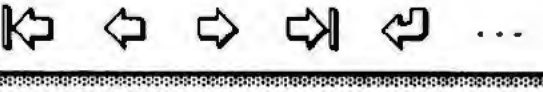
MLGS-II:1990project:Paradigms Stack

One inference that can be made from the John, Tang, Brill, Young, & Ono (1986) study is that any paradigm which places a high value on neurological plausibility should also assume a distributed representation of knowledge though the converse would not necessarily be true. I examined the paradigms Display to confirm this. At first, this was difficult because the directions of these two attribute scales did not coincide. Once I 'flipped' the neurological plausibility scale, it was obvious that this inference was confirmed. While I was at it, I flipped several of the other scales to conform to my intuition of more reasonable orientations.

Next, I generated a Focus for this revised grid. I notices several interesting things about this Focus

a) the groupings amoung attributes which I thought were developing in the previous Focus have disappeared. In addition, all of the attributes have a relatively large value. I'm not sure what the scale represents but it suggests to me that the attributes are not likely to be redundant.

b) although there seems to be a slight grouping within some of the paradigms, generally the relationship between them seems to be fairly evenly distributed.



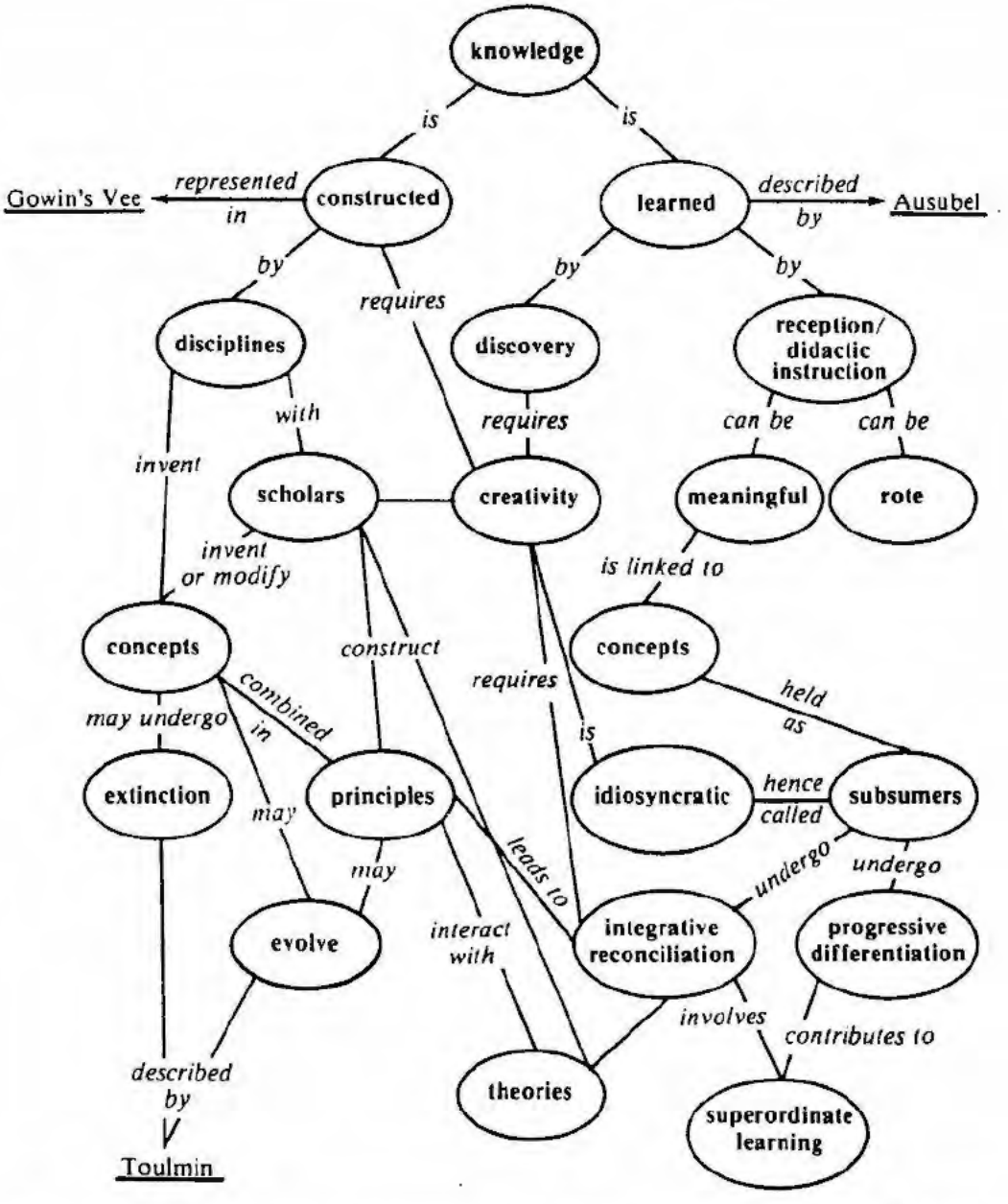
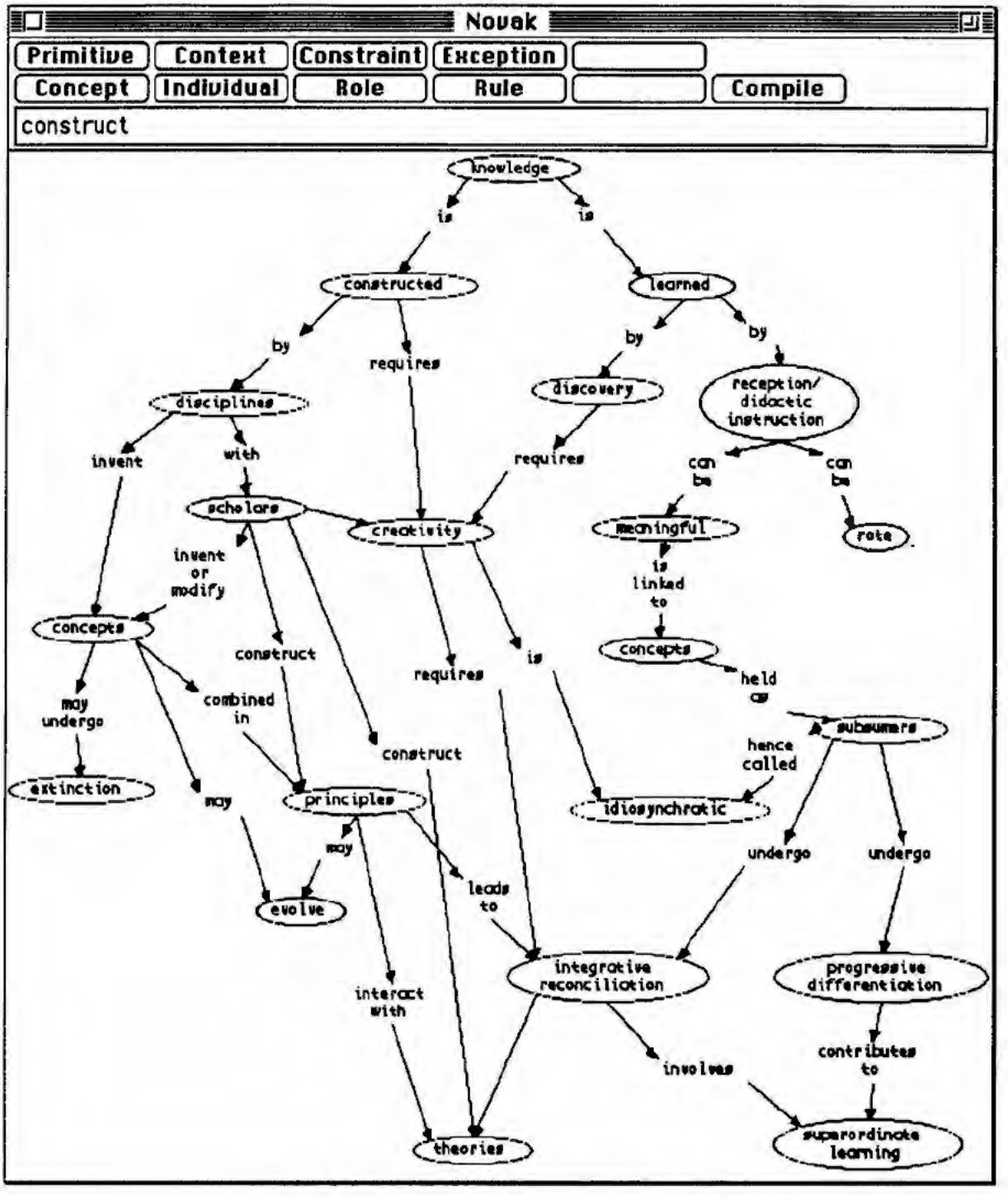
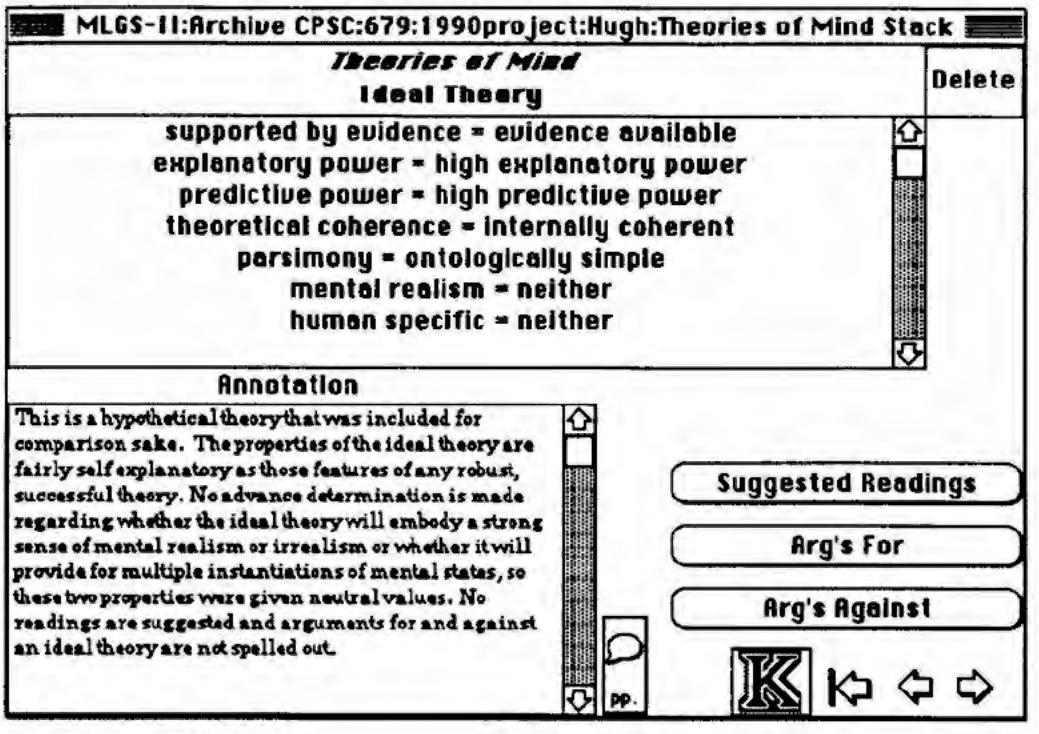
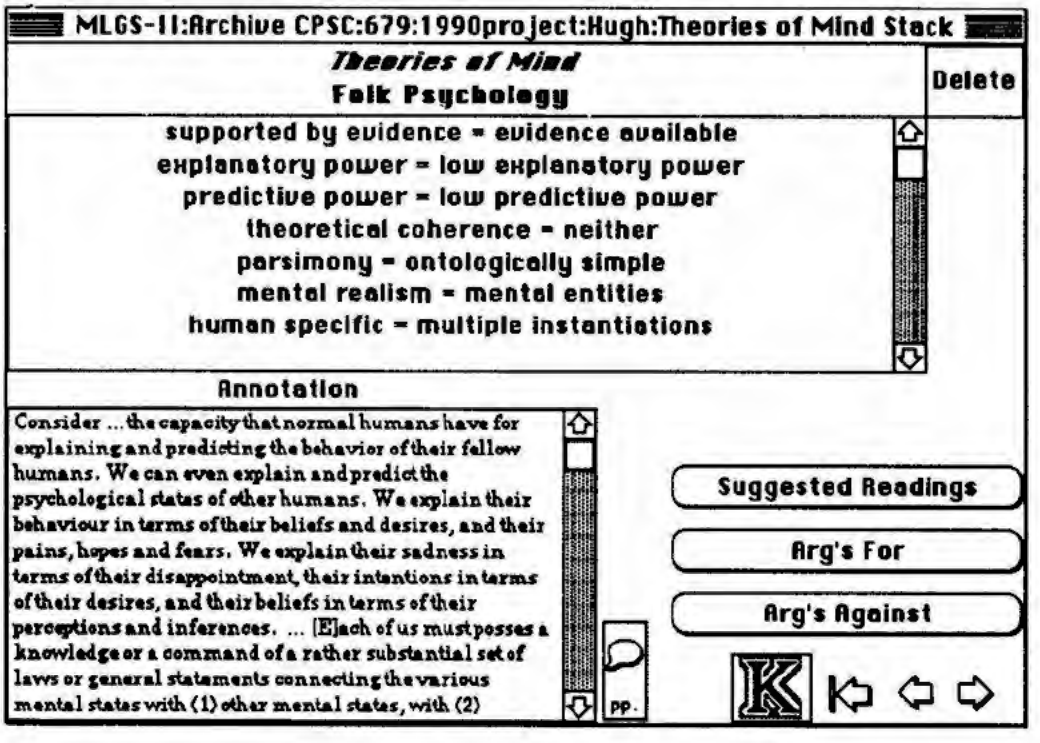


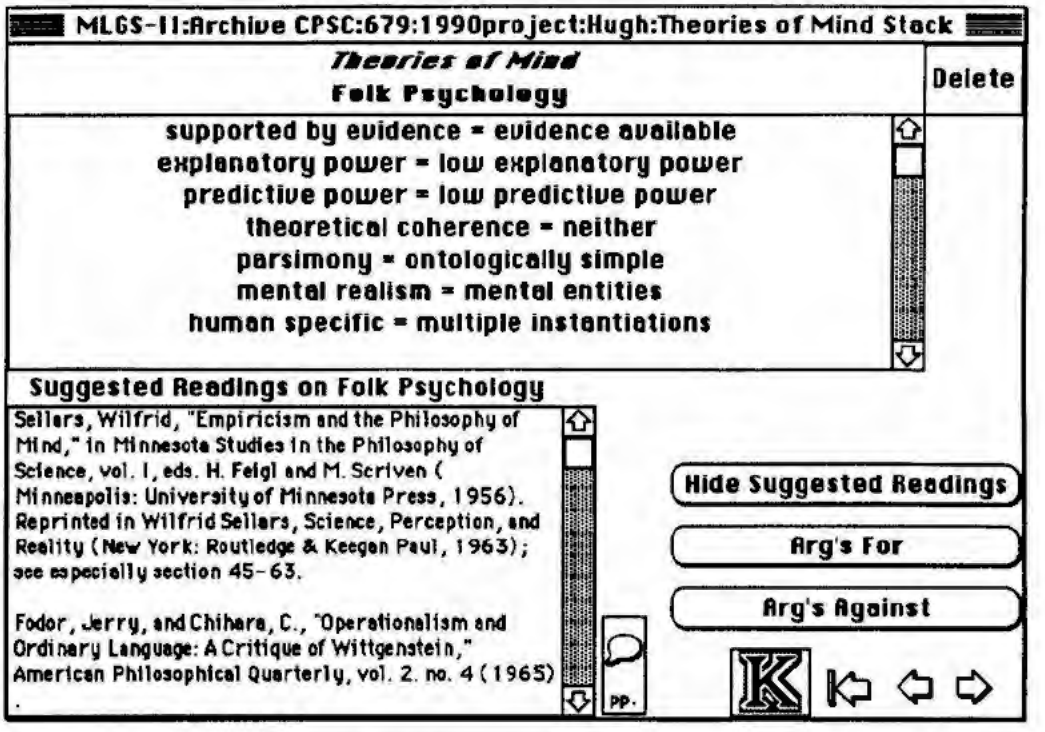
Figure 1.1 A concept map showing the major ideas presented in this book regarding acquisition and construction of knowledge. Key concepts are shown in ovals; appropriate linking words form key propositions.

We provide both practical advice and theoretical perspective, stressing that people think with concepts and that concept maps serve to externalize these concepts and improve their thinking. In Chapter 3, we show that Vee diagramming based on epistemological study of an event is a simple and flexible way to help students and teachers


Novak
Primitive
Context
Constraint
Exception
Concept
Individual
Role
Rule
Compile
construct
knowledge
is
is
constructed
learned
by
requires
by
by
disciplines
discovery
reception/
didactic
instruction
invent
with
requires
can
be
can
be
scholars
creativity
meaningful
rote
invent
or
modify
is
linked
to
concepts
concepts
held
by
construct
requires
is
may
undergo
combined
in
subsumers
hence
called
construct
extinction
may
principles
idiosynchratic
may
undergo
undergo
leads
to
evolve
integrative
reconciliation
progressive
differentiation
interact
with
involves
contributes
to
theories
superordinate
learning


MLGS-II:Archive CPSC:679:1990project:Hugh:Theories of Mind Stack
Theories of Mind
Ideal Theory
Delete
supported by evidence = evidence available
explanatory power = high explanatory power
predictive power = high predictive power
theoretical coherence = internally coherent
parsimony = ontologically simple
mental realism = neither
human specific = neither
Annotation
This is a hypothetical theory that was included for comparison sake. The properties of the ideal theory are fairly self explanatory as those features of any robust, successful theory. No advance determination is made regarding whether the ideal theory will embody a strong sense of mental realism or irrealism or whether it will provide for multiple instantiations of mental states, so these two properties were given neutral values. No readings are suggested and arguments for and against an ideal theory are not spelled out.
pp.
Suggested Readings
Arg's For
Arg's Against
K


MLGS-II:Archive CPSC:679:1990project:Hugh:Theories of Mind Stack
Theories of Mind
Folk Psychology
Delete
supported by evidence = evidence available
explanatory power = low explanatory power
predictive power = low predictive power
theoretical coherence = neither
parsimony = ontologically simple
mental realism = mental entities
human specific = multiple instantiations
Annotation
Consider ... the capacity that normal humans have for explaining and predicting the behavior of their fellow humans. We can even explain and predict the psychological states of other humans. We explain their behaviour in terms of their beliefs and desires, and their pains, hopes and fears. We explain their sadness in terms of their disappointment, their intentions in terms of their desires, and their beliefs in terms of their perceptions and inferences. ... [E]ach of us must posses a knowledge or a command of a rather substantial set of laws or general statements connecting the various mental states with (1) other mental states, with (2)
pp.
Suggested Readings
Arg's For
Arg's Against
K


MLGS-II:Archive CPSC:679:1990project:Hugh:Theories of Mind Stack
Theories of Mind
Folk Psychology
Delete
supported by evidence = evidence available
explanatory power = low explanatory power
predictive power = low predictive power
theoretical coherence = neither
parsimony = ontologically simple
mental realism = mental entities
human specific = multiple instantiations
Suggested Readings on Folk Psychology
Sellars, Wilfrid, "Empiricism and the Philosophy of Mind," in Minnesota Studies in the Philosophy of Science, vol. I, eds. H. Feigl and M. Scriven (Minneapolis: University of Minnesota Press, 1956). Reprinted in Wilfrid Sellars, Science, Perception, and Reality (New York: Routledge & Keegan Paul, 1963); see especially section 45-63.
Fodor, Jerry, and Chihara, C., "Operationalism and Ordinary Language: A Critique of Wittgenstein," American Philosophical Quarterly, vol. 2. no. 4 (1965)
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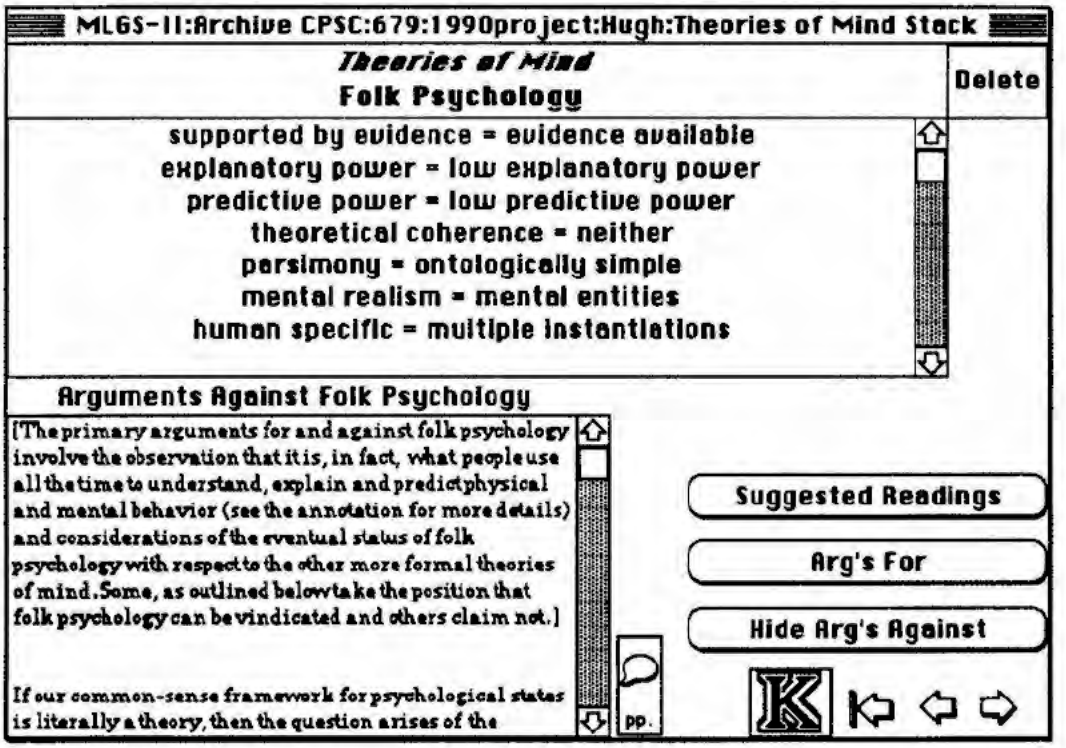
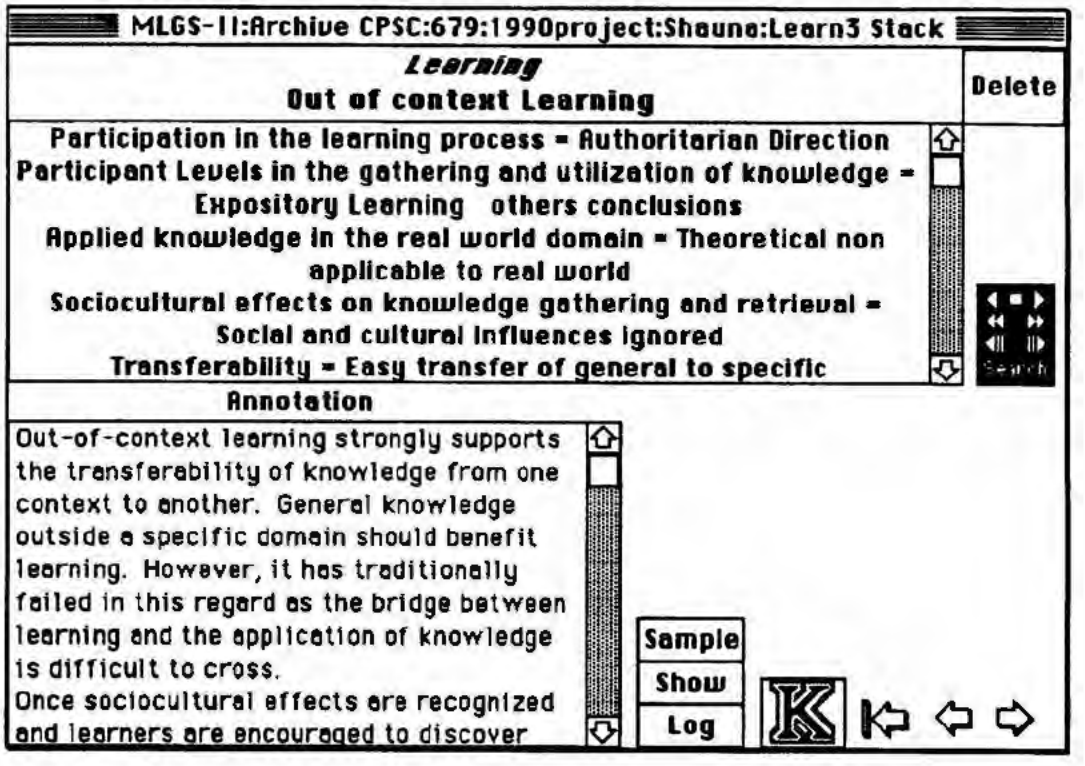
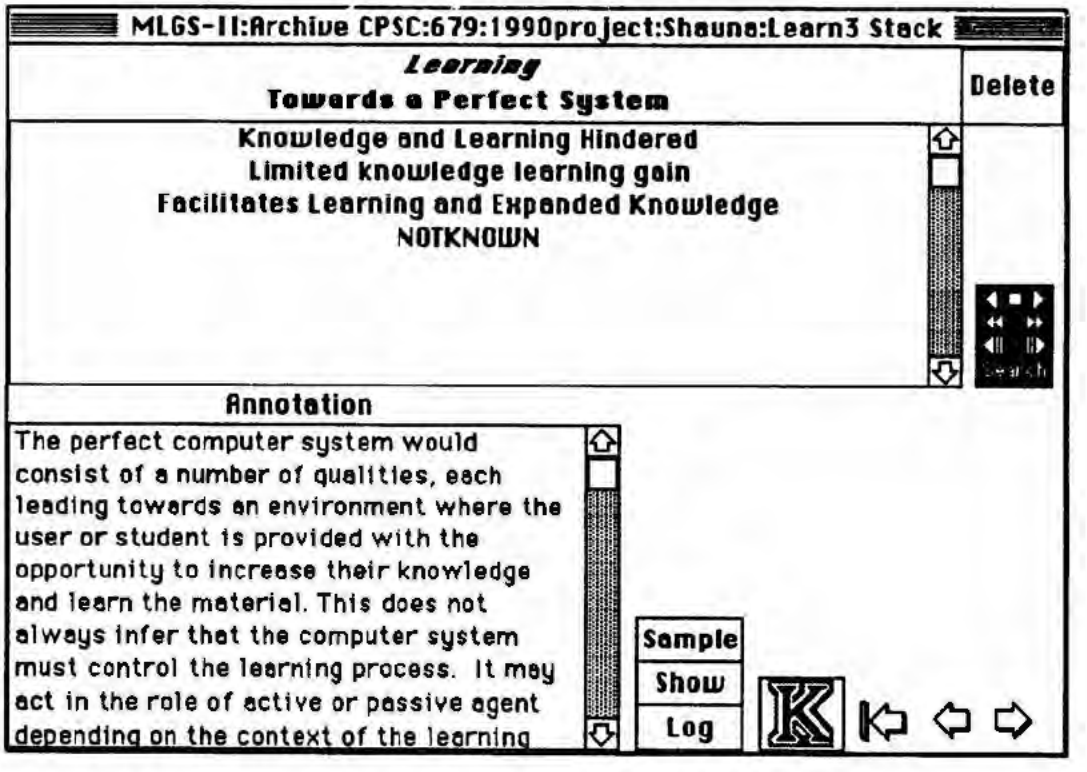
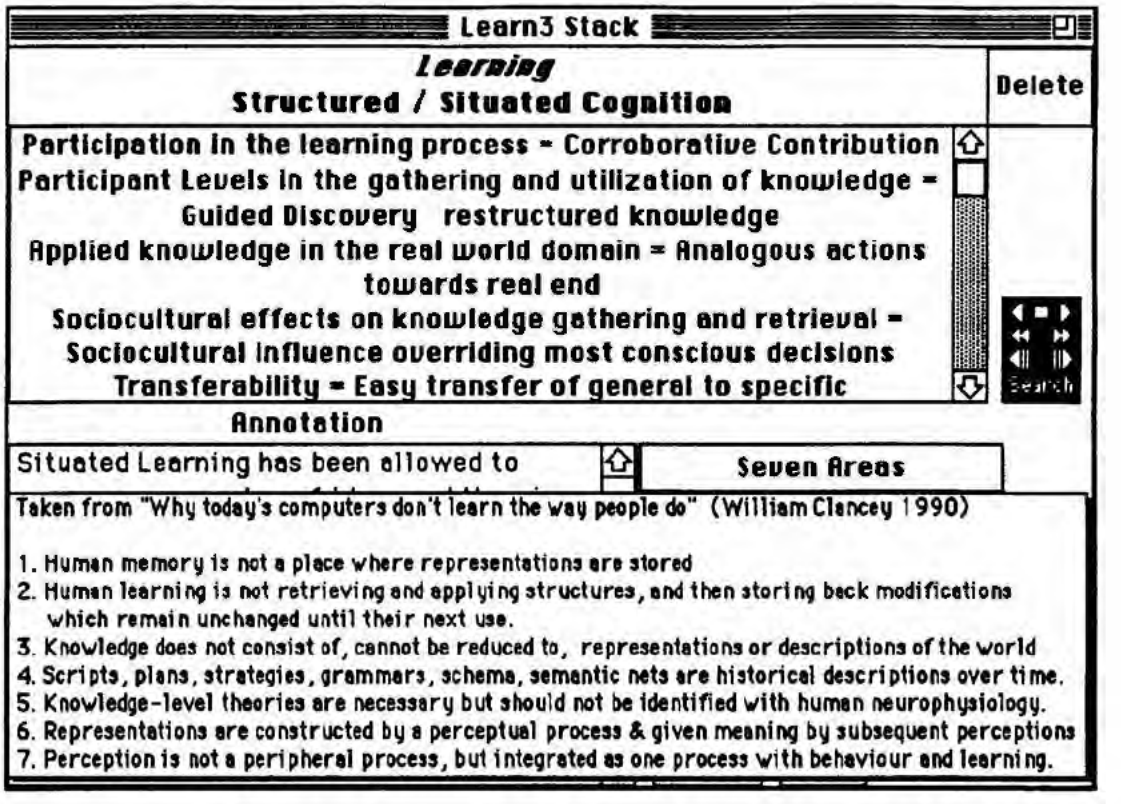
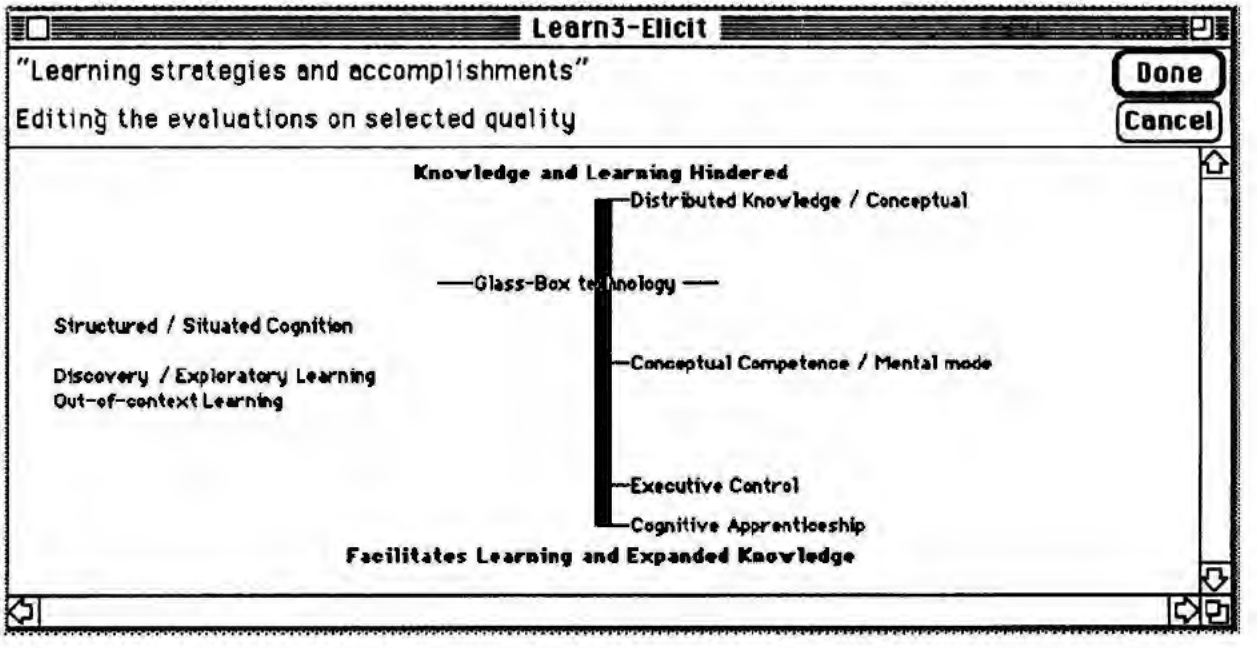
pp.
Hide Suggested Readings
Arg's For
Arg's Against

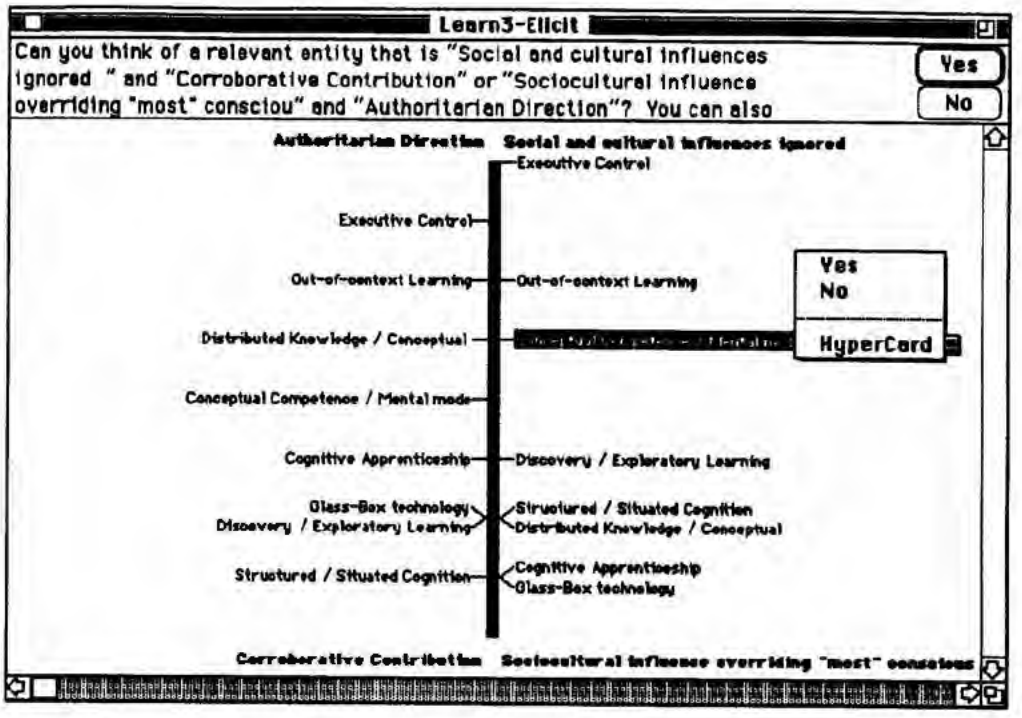

MLGS-II:Archive CPSC:679:1990project:Hugh:Theories of Mind Stack
Theories of Mind
Folk Psychology
Delete
supported by evidence = evidence available
explanatory power = low explanatory power
predictive power = low predictive power
theoretical coherence = neither
parsimony = ontologically simple
mental realism = mental entities
human specific = multiple instantiations
Arguments Against Folk Psychology
[The primary arguments for and against folk psychology involve the observation that it is, in fact, what people use all the time to understand, explain and predict physical and mental behavior (see the annotation for more details) and considerations of the eventual status of folk psychology with respect to the other more formal theories of mind. Some, as outlined below take the position that folk psychology can be vindicated and others claim not.]
If our common-sense framework for psychological states is literally a theory, then the question arises of the
pp.
Suggested Readings
Arg's For
Hide Arg's Against

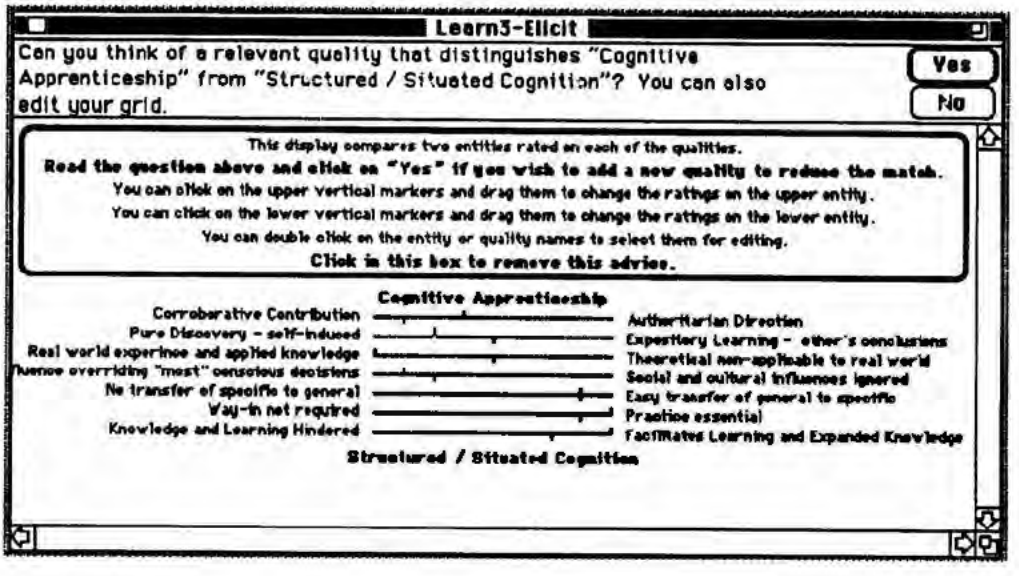

MLGS-II:Archive CPSC:679:1990project:Shauna:Learn3 Stack
Learning
Out of context Learning
Delete
Participation in the learning process = Authoritarian Direction
Participant Levels in the gathering and utilization of knowledge = Expository Learning others conclusions
Applied knowledge in the real world domain = Theoretical non applicable to real world
Sociocultural effects on knowledge gathering and retrieval = Social and cultural influences ignored
Transferability = Easy transfer of general to specific
Search
Annotation
Out-of-context learning strongly supports the transferability of knowledge from one context to another. General knowledge outside a specific domain should benefit learning. However, it has traditionally failed in this regard as the bridge between learning and the application of knowledge is difficult to cross.
Once sociocultural effects are recognized and learners are encouraged to discover
Sample
Show
Log

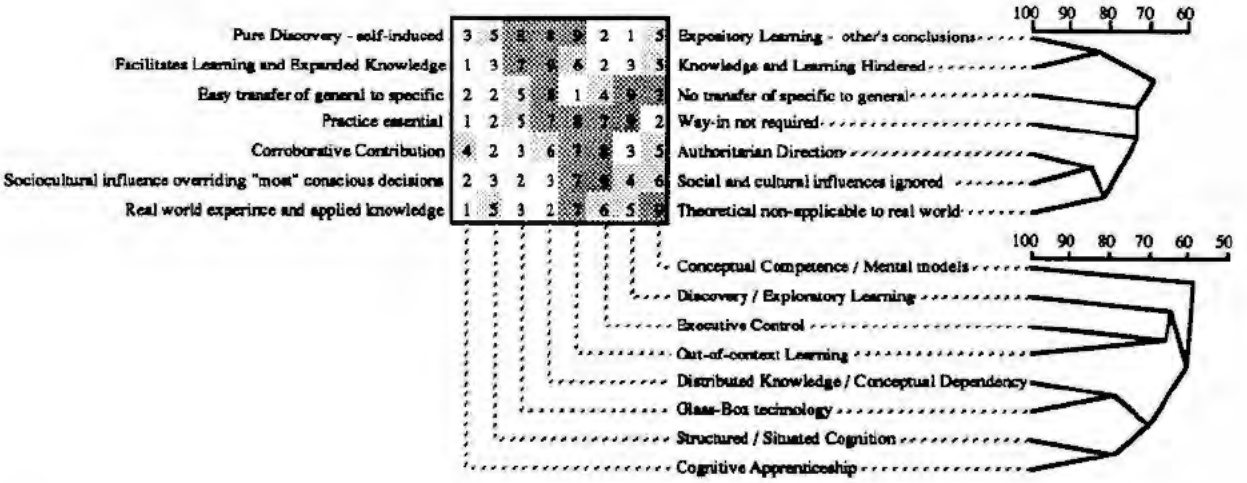

MLGS-II:Archive CPSC:679:1990project:Shauna:Learn3 Stack
Learning
Towards a Perfect System
Delete
Knowledge and Learning Hindered
Limited knowledge learning gain
Facilitates Learning and Expanded Knowledge
NOTKNOWN
Search
Annotation
The perfect computer system would consist of a number of qualities, each leading towards an environment where the user or student is provided with the opportunity to increase their knowledge and learn the material. This does not always infer that the computer system must control the learning process. It may act in the role of active or passive agent depending on the context of the learning
Sample
Show
Log

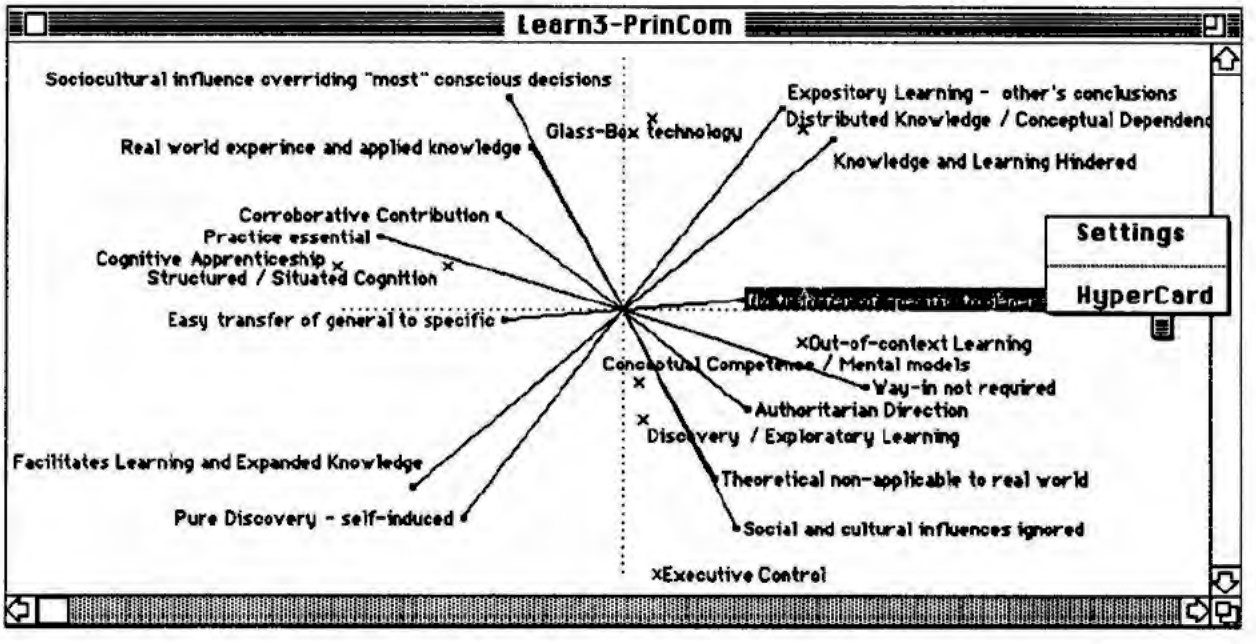

Learn3 Stack
Learning
Structured / Situated Cognition
Delete
Participation in the learning process = Corroborative Contribution
Participant Levels in the gathering and utilization of knowledge = Guided Discovery restructured knowledge
Applied knowledge in the real world domain = Analogous actions towards real end
Sociocultural effects on knowledge gathering and retrieval = Sociocultural influence overriding most conscious decisions
Transferability = Easy transfer of general to specific
Search
Annotation
Situated Learning has been allowed to
Seven Areas
Taken from "Why today's computers don't learn the way people do" (William Clancey 1990)
1. Human memory is not a place where representations are stored
2. Human learning is not retrieving and applying structures, and then storing back modifications which remain unchanged until their next use.
3. Knowledge does not consist of, cannot be reduced to, representations or descriptions of the world
4. Scripts, plans, strategies, grammars, schema, semantic nets are historical descriptions over time.
5. Knowledge-level theories are necessary but should not be identified with human neurophysiology.
6. Representations are constructed by a perceptual process & given meaning by subsequent perceptions
7. Perception is not a peripheral process, but integrated as one process with behaviour and learning.


Learn3-Elicit
"Learning strategies and accomplishments"
Editing the evaluations on selected quality
Done
Cancel
Knowledge and Learning Hindered
Distributed Knowledge / Conceptual
Glass-Box technology
Structured / Situated Cognition
Discovery / Exploratory Learning
Out-of-context Learning
Conceptual Competence / Mental mode
Executive Control
Cognitive Apprenticeship
Facilitates Learning and Expanded Knowledge


Learn3-Elicit
Can you think of a relevant entity that is "Social and cultural influences ignored " and "Corroborative Contribution" or "Sociocultural influence overriding "most" consciou" and "Authoritarian Direction"? You can also
Yes
No
Authoritarian Direction
Social and cultural influences ignored
Executive Control
Executive Control
Out-of-context Learning
Out-of-context Learning
Yes
No
Distributed Knowledge / Conceptual
HyperCard
Conceptual Competence / Mental mode
Cognitive Apprenticeship
Discovery / Exploratory Learning
Glass-Box technology
Discovery / Exploratory Learning
Structured / Situated Cognition
Distributed Knowledge / Conceptual
Structured / Situated Cognition
Cognitive Apprenticeship
Glass-Box technology
Corroborative Contribution
Sociocultural influence overriding "most" conscious


Learn3-Elicit
Can you think of a relevant quality that distinguishes "Cognitive Apprenticeship" from "Structured / Situated Cognition"? You can also edit your grid.
Yes
No
This display compares two entities rated on each of the qualities.
Read the question above and click on "Yes" if you wish to add a new quality to reduce the match.
You can click on the upper vertical markers and drag them to change the ratings on the upper entity.
You can click on the lower vertical markers and drag them to change the ratings on the lower entity.
You can double click on the entity or quality names to select them for editing.
Click in this box to remove this advice.
Cognitive Apprenticeship
Corroborative Contribution
Pure Discovery - self-induced
Real world experience and applied knowledge
Influence overriding "most" conscious decisions
No transfer of specific to general
Way-in not required
Knowledge and Learning Hindered
Authoritarian Direction
Expository Learning - other's conclusions
Theoretical non-applicable to real world
Social and cultural influences ignored
Easy transfer of general to specific
Practice essential
Facilitates Learning and Expanded Knowledge
Structured / Situated Cognition


Pure Discovery - self-induced
Facilitates Learning and Expanded Knowledge
Easy transfer of general to specific
Practice essential
Corroborative Contribution
Sociocultural influence overriding "most" conscious decisions
Real world experince and applied knowledge
Expository Learning - other's conclusions
Knowledge and Learning Hindered
No transfer of specific to general
Way-in not required
Authoritarian Direction
Social and cultural influences ignored
Theoretical non-applicable to real world
100 90 80 70 60
Conceptual Competence / Mental models
Discovery / Exploratory Learning
Executive Control
Out-of-context Learning
Distributed Knowledge / Conceptual Dependency
Glass-Box technology
Structured / Situated Cognition
Cognitive Apprenticeship
100 90 80 70 60 50


Learn3-PrinCom
Sociocultural influence overriding "most" conscious decisions
Real world experince and applied knowledge
Corroborative Contribution
Practice essential
Cognitive Apprenticeship
Structured / Situated Cognition
Easy transfer of general to specific
Facilitates Learning and Expanded Knowledge
Pure Discovery - self-induced
Glass-Box technology
Expository Learning - other's conclusions
Distributed Knowledge / Conceptual Dependenc
Knowledge and Learning Hindered
Settings
HyperCard
Out-of-context Learning
Conceptual Competence / Mental models
Way-in not required
Authoritarian Direction
Discovery / Exploratory Learning
Theoretical non-applicable to real world
Social and cultural influences ignored
Executive Control

A single output variable was chosen:

Towards a Perfect System

from the construct

Facilitates Learning and Expanded Knowledge —

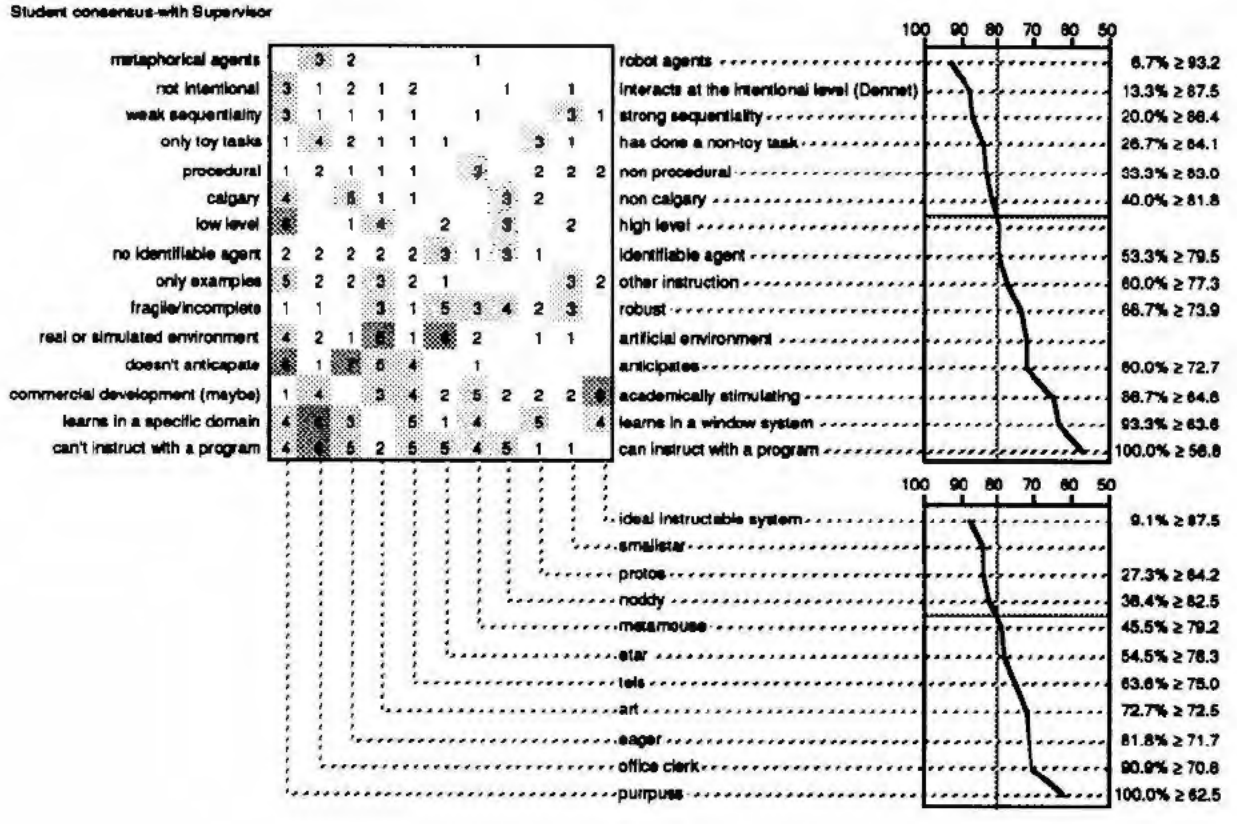
Knowledge and Learning Hindered

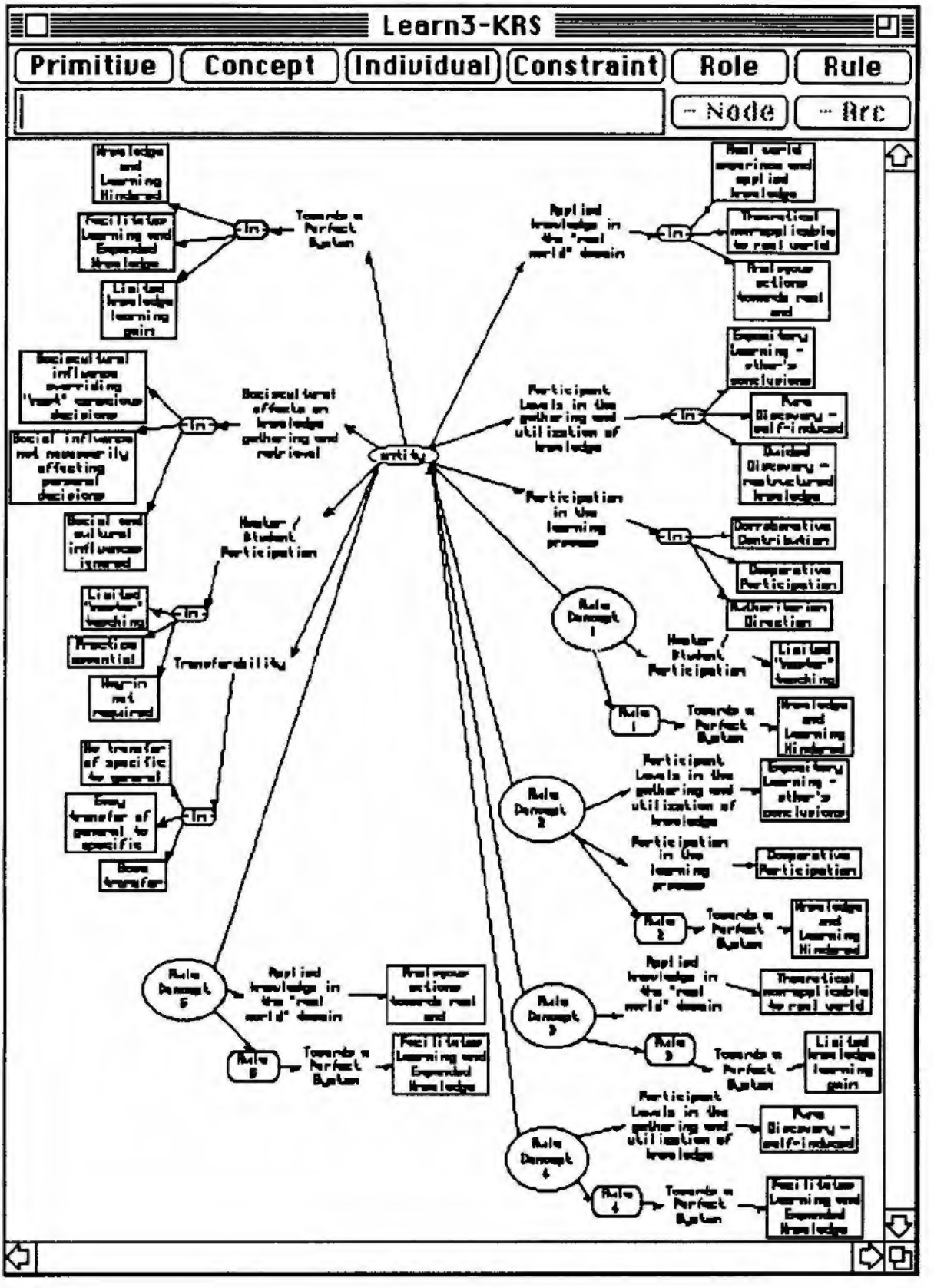
The middle point described as

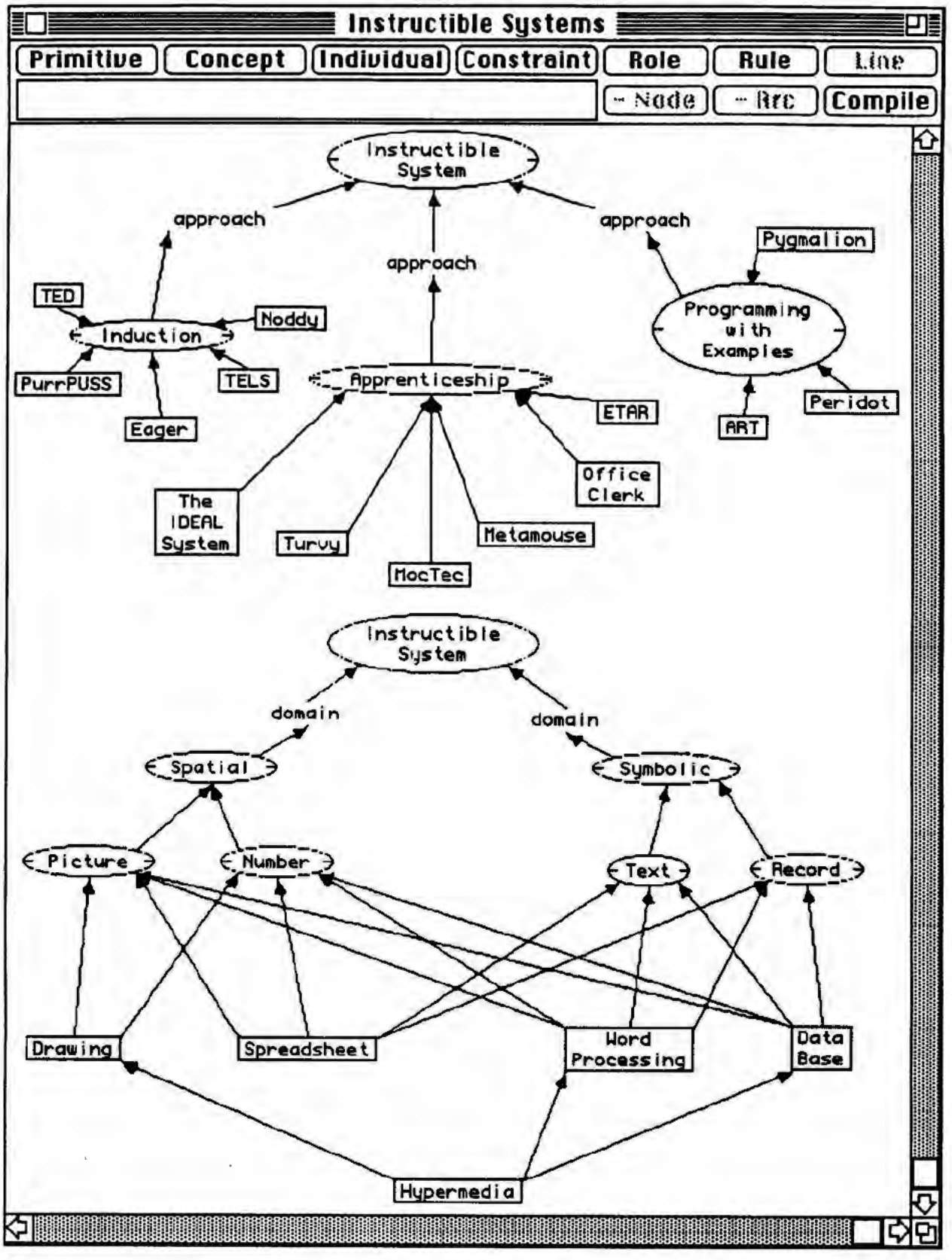
Limited Knowledge and Learning Gain.

Some of the conclusions produced by the induction system:

- Knowledge is hindered when there is limited master teaching
- Knowledge is hindered when there is both cooperative participation and expository learning
- Limited knowledge gain occurs in purely theoretical environments
- Pure discovery facilitates knowledge gain
- Analogous learning supported by applied practice facilitates learning




Learn3-KRS
Primitive
Concept
Individual
Constraint
Role
Rule
- Node
- Arc
entity
Towards a Perfect System
Knowledge and Learning Hindered
Facilitates Learning and Expanded Knowledge
Limited knowledge learning gain
In
Applied knowledge in the "real world" domain
Real world experience and applied knowledge
Theoretical non-applicable to real world
Real-world actions towards real end
Sociocultural affects on knowledge gathering and retrieval
Sociocultural influence overriding "best" conscious decisions
Social influence not necessarily affecting personal decisions
Social and cultural influences ignored
Participant Levels in the gathering and utilization of knowledge
Expository Learning - other's conclusions
Pure Discovery - self-induced
Guided Discovery - restructured knowledge
Participation in the learning process
Collaborative Contribution
Cooperative Participation
Authoritarian Direction
Master / Student Participation
Limited "teacher" teaching
Practice essential
Keyin not required
Transferability
No transfer of specific to general
Easy transfer of general to specific
Some transfer
Rule Concept 1
Rule 1
Rule Concept 2
Rule 2
Rule Concept 3
Rule 3
Rule Concept 4
Rule 4
Rule Concept 5
Rule 5


Instructible Systems
Primitive
Concept
Individual
Constraint
Role
Rule
Line
- Node
- Arc
Compile
Instructible System
approach
approach
approach
Pygmalion
TED
Noddy
Induction
PurrPUSS
Eager
TELS
Apprenticeship
Programming with Examples
ETAR
ART
Peridot
Office Clerk
The IDEAL System
Turvy
Metamouse
MocTec
Instructible System
domain
domain
Spatial
Symbolic
Picture
Number
Text
Record
Drawing
Spreadsheet
Word Processing
Data Base
Hypermedia

	Research Topic	Chosen Domain	Outcome	Student Comments
1	open	learning strategies	grid, knowledge structure, stack	
2	open	situated cognition	grid, knowledge structure, stack	
3	instructible systems	instructible systems	2 grids, exchange with Socio analysis, 7 knowledge structures, stacks	prefer KRS to an outliner for developing ideas
4	expository writing support tools	psychological paradigms	2 grids, knowledge structures, stack	presented results as a HyperCard stack
5	cognitive science	theories of mind	grid, knowledge structure, stack	would like to use this for my thesis
6	intelligent tutoring	Pascal statements	grid, stack	
7	open	computational learning	grid, knowledge structure, stack	
8	genetic algorithms	computer games	grid, knowledge structure, stack	
9	machine learning	induction systems	grid, knowledge structure, stack	learned a lot more about induction systems doing this sort of structuring
10	complexity of computation	fast food	grid, knowledge structure, stack	concepts in research field are already defined and not suitable

CONCLUSIONS

Hypermedia

Annotation — text, pictures, video, sound

Links to — elements, constructs, concept maps

System control — common user interface

Repertory Grids

Elicit — elements and constructs

Cluster — FOCUS, PrinCom

Compare — other students, supervisor

Links to — annotation in HyperCard

Export — knowledge structure in KDraw/KRS

Inductive Modeling

Relations — between constructs

Hierarchy — of constructs

Semantic Nets

ConMap — informal, for putting in concepts

KDraw — formal, for putting out concept relations

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