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What Conditions Srould a Theory Of Consciousness Meet?

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What conditions should a theory of
consciousness meet?

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This paper is written in the conviction
that theories of consciousness today are in the
same situation that semantic theories were in a
decade ago. At that time there was a widespread
belief that semantics was an essentially insoluble puzzle, that much more data would have to
be collected to constrain adequate theory. In
the event, it turned out that the real obstacles
were conceptual rather than empirical. Once the
actual conditions to be met by an adequate
semantics are specified, the theoretical options
are vastly reduced. Further, conditions on semantic theory were not difficult to find: all such
theories must be able to handle discourse reference, paraphrase generation, question answering,
the detection of anomaly and contradiction, and
the ability to resolve ambiguities at all levels
of analysis. Until people looked at these actual
constraints, no progress could be made, and the
problem was treated as insoluble. Similarly,
until we actually look at widely-accepted constraints on theory of consciousness, the topic
will be treated as fuzzy, mystical, and insoluble.

What are the conditions for an adequate
theory of consciousness? First, we can specify
some pre-theoretical criteria:

1. An adaptive construct . Consciousness
should be treated as a cognitive construct much
like any other, with an adaptive information-
processing function.

2. Relationship to other constructs . The
proposed construct should be distinct from
others, but explicitly related to perception,
memory, intentionality, executive functions,
automaticity, availability, the "internal mono-
logue", the subjective observer, and especially
attention.

3. What is UNconscious? A theory of con-
sciousness should give a (principled) explanation
of the difference between conscious and uncon-
scious processes.

4. Respect for common-sense psychology .
There is a world of difference between bootstrap-
ping one's way beyond common sense and blindly
ignoring it. Common sense is our starting point,
and we cannot even ask about the nature of
consciousness without it.

5. Empirical reference . Finally, a clear,
empirically-based domain should be specified.
Tables 1 and 2 show a number of contrasting pairs
of claims about similar conscious and unconscious
processes. These claims command a wide consensus
among psychologists. The job of theory is then
to fit some explanatory model to the constraints
in the simplest possible way.

Table 1: Capability Constraints
on a theory of conscious contents.

Conscious Processes vs. Unconscious processors

1. Computationally inefficient.	Highly efficient in specialized tasks.
2. Great range, & relational capacity.	Limited domains & relative autonomy.
3. Apparent unity, seriality, & limited capacity.	Very diverse, parallel, and together have great capacity.

Table 1 shows some Capability Constraints ,
which indicate the capacities and limitations of
conscious vs. unconscious phenomena. For example,
if we use the term "computational efficiency" to
mean the ability to work out some algorithm
quickly and without error, it is clear that wholly conscious processes are not computationally
efficient. Even simple addition or subtraction
is performed slowly and with a good chance of
error. It appears that the great bulk of fast
and efficient processing is done by a large set
of specialized processors. There is much neuro-
physiological evidence to this effect as well
(Geschwind, 1979).

The great range and diversity of conscious
contents seems to compensate for these efficiency
limits. People can be conscious of virtually any
energy pattern impinging upon any sensory system,
down to single photons hitting single visual rece
tors. By means of conscious biofeedback, one can
gain voluntary control over the actions of two-
neuron spinal motor units. Etc. Or one can be
conscious of events that require enormous coopera
tive activity between many millions of neurons.

Further, conscious contents always appear
internally consistent at any one time, even if
this consistency is spurious. This is in agreemen
with the fact that conscious capacity is limited
and that the contents of conscious ness appear
serially . These facts belong together: If there
must be internal consistency at any one time,
then there is a clear capacity limit for incorpo-
rating mutually inconsistent contents, and such
mutually exclusive contents must also appear
serially.

In contrast to conscious processes, there is
reason to think that unconscious processors can
operate autonomously in their specialized domains
without difficulty, because they are isolated
from each other. They seem to be highly diverse,
operating fast, efficiently, and in parallel.
Taken as a whole, the set of all unconscious
special-purpose processors has a very great
capacity indeed.

These Capability Constraints have led me to
associate consciousness with a well-known
information-processing configuration: A global
data-base, operating in a very large, distributed
system. The global data base is essentially a
central information exchange which permits
otherwise autonomous specialized processors to
interact with each other. Representations in
the global data base are globally distributed,
so that any one of a myriad specialists can
respond to the global information, and some set
of specialists can cooperate in return to create
another global representation.

In this system, global processes are
inefficient, slow, and error-prone because they
require cooperation between different sets of
specialists. Yet global information will have
great range, diversity and context-sensitivity
precisely because it involves interaction between
many specialized processors in the system. Global
information will show apparent unity, because
inconsistent global representations will lead to
competition between mutually exclusive special-
ists, which will cause the global representation
to become rapidly unstable. There will thus be a
narrowly limited capacity to display mutually
competitive contents at any one time, and these
will have to be displayed serially. In this
way, all the Capability Constraints of Table 1
can be shown to apply to global representations
in a distributed system. But this is not the
whole story.

Table 2: Boundary constraints onn tre
contents of consciousness.

Conscious phenomena	Unconscious phenomena
Simultaneous cases:	
1. Percepts.	Context needed to organize percepts.
2. Input consistent with context.	Input inconsistent with context.
Diachronic cases:	
3. Percepts.	Pre-perceptual processes.
4. Any change in a habituated stimulus.	Habituated percept.

Consider the conscious-unconscious contrasts in
Table 2, entitled Boundary Constraints --- a
well-known set of facts about perception. Percepts
are conscious, but the rapid pre-perceptual
hypothesis-testing that is needed to establish the
conscious percept is unconscious. Furthermore,
the physical stimuli that lead to the conscious
percepts are only conscious if they are defined
within a stable set of contextual constraints.
These contextual constraints are needed to pro-
vide the presuppositional background for the
percepts, and they are not conscious. The physi-
cal stimuli themselves are not conscious either
if the appropriate contextual background is
missing. Further, percepts that are thoroughly
analyzed drop out of consciousness (habituation
and automaticity).

These facts imply that conscious contents
involve more than just global information. They
need to be stable and coherent , to accommodate
the fact that rapid pre-perceptual processing
is not conscious. Further, for a global represen-
tation to be conscious, it must be able to trigger
widespread adaption in the nervous system ---
once this adaptation has occurred, the conscious
percept becomes unconscious, presumably because
it has now become a part of the stable, presup-
positional background. To put it all together,
then: conscious contents must be global,
coherent, and informative .

A first approximation to a system that fits
these constraints is shown in Figure 1.

Figure 1

Globally Distributed Information:

Speciali zed   Systems
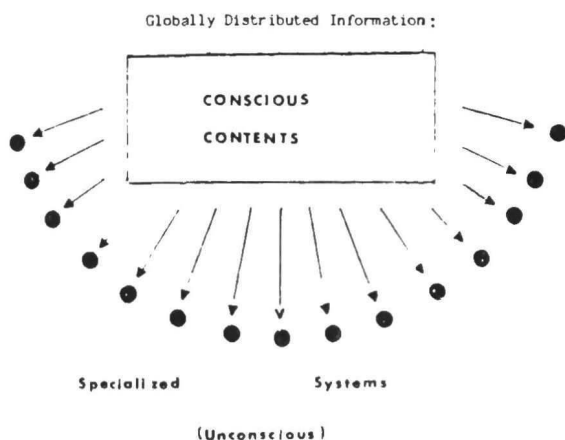
(Unconscious)

Note that conscious contents are globally
available, but most detailed information process-
ing is performed locally by a large set of
specialized, distributed processors. The special-
ized processors maintain the processing initiative.

Conscious contents are not only global, but als
coherent, because internally inconsistent contents
would imply competition between different sets of
specialists. Any active competition would rapidly
remove the incoherent representation from the
global data base.

Figure 2 presents a more refined system to
fit the constraints set out in Tables 1 and 2.

Figure 2.

ENERGY PATTERNS

Stable Contextual Specialists
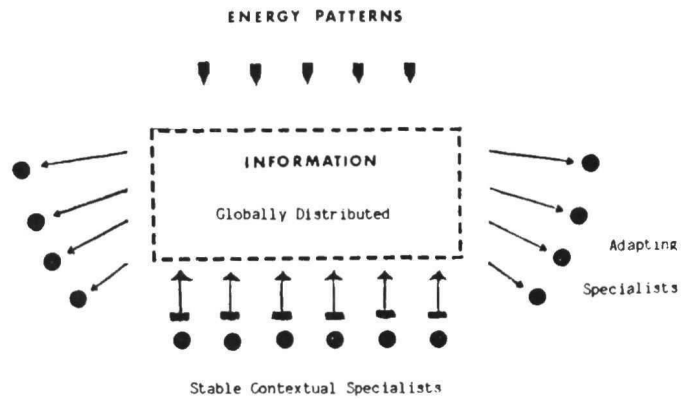
The global representation is now shown to be
bounded by a set of stable contextual specialists
which provide the presuppositions within which the
global representation is defined. However the
contextual specialists are not themselves conscious.
Other specialists are in the process of adapting
to the global representation. Once adaptation is
complete, the global representation fades from
consciousness; it becomes part of the contextual
background, though it continues to constrain
other conscious contents.

This final model can handle all the major
empirical constraints on theory listed above:
Conscious contents must be global, internally
coherent, and informative (i.e., able to trigger
widespread adaptation).

This theoretical approach is treated in much
greater detail in Baars (in press) and Baars and
Mattson (in press).

Baars, B.J. Conscious contents provide the
nervous system with coherent, global information.
In R.J. Davidson, G. Schwartz, and D. Shapiro
(eds.) Consciousness and self-regulation Vol.
III , NY: Plenum, in press.
Baars, B.J. and Mattson, M.E. Consciousness
and intention: A framework and some evidence.
Cognition & Brain Theory , in press.
Geschwind, N. Specializations of the human
brain. Scientific American, 241 (3) .1979,180-201.