action. This formulation is congenial to the P&V project, but it is less extreme, because it allows for unconscious representation: R represents object O if, because of some appropriate isomorphism, it plays the role of O in a stimulated action (involving O, either consciously or preconsciously (e.g., habitually). Given this possible formulation, the P&V exclusion of nonconscious representation seems unnecessarily counterintuitive.

In standard computational views, unconscious representations undergo transformations, resulting in behavioral outputs. These transformations of the unconscious representations are what constitute the unconscious computations. Consciousness is merely an optional way to access the results of the computations. For many computationalists, this renders consciousness an epiphemomenon, whose only causal powers over behavior or thought would have to be illusory (Jackendoff 1987).

Even those convinced that consciousness is not merely the epiphemomenon of information processing, but also requires processing in the unique manner of an active, self-organizational system, should notice that P&V force a choice between extreme viewpoints and ignore much middle ground. One successful research program frequently touted as perfectly compatible with computationalism involves different layers of sensory cortex in occipital and temporal lobes performing computations on incoming perceptual signals (Hubel & Wiesel 1959; Richardson 1981). These transformations are obviously unconscious, because when there is virtually complete occipital activation in response to a completely unexpected stimulus (indicating that the transformations are virtually complete), the subject still lacks perceptual consciousness unless there also occurs a partial 300Hz electrical potential (Aurell 1983; 1984; 1989; McHugh & Balhall 1955; Srebro 1985; Wic-krantz 1986). Occipital and temporal lobes can do everything they normally do in processing the perceptual data, including the 100Hz occipital potential and the 200Hz "inrmatch negativity" without the subject having consciousness of the stimulus. (In ERPs, the numbers refer to milliseconds after presentation of the stimulus. Extensive processing occurs during the first 250 msec of processing, with or without the consciousness accompanying the 300Hz.) These unconscious ocipital transformations fit a computational paradigm: Cells in consecutive layers of sensory cortices analyze different features of perceived objects - lines, angles, shapes, colors, and so forth. These sequences of transformations are unimaginable on a conscious basis; we cannot imagine consciousness of color without shape or vice versa, yet our sensory cortices "compute" these properties separately and then recombine them.

Notice that the occipital transformations of perceptual signals are used to explain how a certain type of representation comes about in the first place. In one sense, we think of the pre-ocipital signal (as received in the thalamus, for example) as an "unconscious representation," which will then be combined with other signals and transformed into a more fully developed "representation" - a representation in a different sense. But this highlights the need to think more carefully about what constitutes a "representation": Newton's active, self-organizational view of representation would eliminate the problems just mentioned by treating occipital activities as "potential" representations - activities that will lead themselves to use by the organism in representational action if the occasion should arise. The same could be said for representations in memory, thought, unconscious emotions, and the like. Representations and computations can occur without all conscious processes reducing to them.

Natura non facit saltum: The need for the full continuum of mental representations

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Abstract: Natura non facit saltum (Nature does not make leaps) was the lovely aphorism on which Darwin based his work on evolution. It applies as much to the formation of mental representations as to the formation of species, and therein lies our major disagreement with the SOC model proposed by Perruchet & Vinter.

Perruchet & Vinter (P&V) admit, of course, that conscious representations emerge from an underlying neural substrate. But the type of emergence for which they argue seems to involve a sudden, quantum leap from the unconscious to the conscious. One moment, the representation of an object, a scene, or a situation is in the process of being generated and is of no importance whatsoever in any cognitive calculus; and then, suddenly, as if by magic, the representation bursts into consciousness, thereby becoming endowed with all the cognitive powers of conscious representations. P&V write:

mental life comprises only two categories of events: The conscious representations and the unconscious processes generating those representations. The two are linked like the head and tail of a coin... [the] processes and mechanisms responsible for the elaboration of knowledge are intrinsically unconscious, and the resulting mental representations and knowledge are intrinsically conscious. (target article, sect. 3.3.1)

It strikes us that a gradualist picture of representation-formation - for example, the classical Hebbian cell-assembly framework - would suffice - would, in one fell swoop, explain most, if not all, of the instances of unconscious influences on conscious processing that the authors work so hard to explain away within their no-unconscious-representations SOC framework. Further, this new framework would in no way undermine the associationist principles that drive their model (correctly, in our opinion). Accepting the existence of representations that run the gamut from the embryonic and unconscious to the fully formed and conscious in no way implies the need for a "sophisticated unconscious processor."

The authors accept the notion of graded and partial conscious representations. Within a simple neural network framework, there is no problem extending these notions to unconscious representations. As it stands, the authors would have a great deal of difficulty in their SOC framework in distinguishing between an unconscious representation and an "absent representation" (i.e., no representation), because they would maintain that both situations have no effect whatsoever on conscious perception. But, as we hope to show in the thought-experiment presented here, there must be a difference. This difference, if a real-world version of the thought-experiment were actually run, would presumably be able to be measured with appropriately sensitive instruments.

Suppose that two individuals, A and B, start with perfectly identical brains. Via a rigid, completely reproducible procedure, A learns the concept $\Omega$, and B does not. Now, presumably, learning $\Omega$ involves a physical (presumably, synaptic) modification of a specific set, $S_{A}$, of neurons in A's brain. The precisely corresponding set of neurons in B's brain, $S_{B}$, undergoes no such physical change. Presumably, P&V would say that the concept $\Omega$ is now physically represented in A's brain (whether active or not). Now, since they explicitly accept the concept of representational decay, we will suppose that the synaptic changes that constituted A's representation of $\Omega$ gradually decay in precisely the reverse order in which they were strengthened when A was originally learning the concept $\Omega$. Further suppose that we have a device capable of stimulating the neurons in $S_{A}$ (and only those neurons). At some point during this decay toward the original state of the neurons before A learned $\Omega$, A would presumably no longer be consciously aware.
of the concept $\Omega$ when $S_a$ was stimulated. (This point will be
somewhere in the zone corresponding to $A$’s very early learning of
the concept, before the representation would be conscious. P&V
explicitly concede that there is such a period.) At this point, we
now have $A$ learn $\Omega$ and $B$ learn $\Omega$ for the first time, employing
exactly the same procedure originally used when $A$ first learned $\Omega$.
Surely, P&V would agree that $A$ would relearn the concept $\Omega$
farther than $B$ because, as we have set things up, $A$ will have a rep-
resentational “lead-start” over $B$. We thus have a very simple hy-
pothetical case of how an unconscious representation could sig-
ificantly affect the conscious experience of concept acquisition.
Further, the SOC account, relying as it does only on conscious rep-
resentations, would be at a loss in explaining this learning-time dif-
ference, unless they took the unaffinable position that $A$’s more
rapid learning of $\Omega$ simply demonstrated that the decoded rep-
resentation with $A$ started prior to relearning $\Omega$ must, in fact,
have been conscious all along.

It may well be that there is, indeed, some sort of “connectivity
phase change” when a neural representation has the possibility of
becoming conscious when activated. This could be the point de-
scribed by Hebb as when “reverberation in the structure might be
possible . . . reverberation which might frequently last for periods
of time as great as half a second or a second, [this being the best]
estimate one can make of the duration of a single ‘conscious con-
tent’” (Hebb, 1949, p. 74). But if one is to present a coherent pic-
ture of cognition that takes into account neural, representational,
and cognitive phenomena, one must not neglect the representa-
tional stages leading up to this creation of cell-assemblies or, in
the language of P&V, up to the emergence of fully conscious re-
presentations.

In conclusion, we suggest that the SOC model might do well to
turn to basic neural network principles that would allow it, with-
out difficulty, to encompass unconscious representations, as de-
scribed above. (See, e.g., Clowes and Jimenez 2000; Mathis &
Mroz, 1985.) These “unconscious” representations — some of
which may evolve into representations that, when activated, would
be conscious — can affect consciousness processing, but do so via
the same basic associative, excitatory, and inhibitory mechanisms
that we observe in conscious representations. The inclusion of this
type of representation in no way requires the authors to also post-
superspeditated unconscious computational mechanisms.

Unconscious semantic access: A case against a hyperpowerful unconscious

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Abstract: We analyse some of the recent evidence for unconscious sem-
antic access stemming from tasks that, although based on a priming pro-
cedure, generate semantic congruity effects because of response com-
petition, not semantic priming effects. We argue that such effects cannot
occur without at least some glimpses of awareness about the identity and
the meaning of a significant proportion of the primes.

Like Perruchet & Vinter (P&V), we fully endorse a mentalistic
perspective, which implies that we do not posit the existence of a
"powerful," or more precisely, an intentional cognitive unconscious.
Thus, we basically share the view of Searle (1980; 1982)
and Dallary (1997) that the unconscious is intentional in a dis-
stationary way. In this commentary, we expand on the claim made by
P&V in section 8.2 that the available data on unconscious seman-
tic access do not constitute a challenge to the mentalistic frame-
work.

In assessing the plausibility of the evidence for unconscious sem-
antic access, a distinction must be made between tasks generating
semantic priming effects and tasks generating other effects based
on stimulus meaning, such as Stroop and Stroop-like con-
gruity effects. This distinction has been somewhat blurred in re-
cent work, maybe partly because of the multiple meanings of the
term priming, which can designate an experimental procedure, an
observed effect, and a hypothetical causal process, such as auto-
matic spreading activation in semantic memory (e.g., Neely 1991).
Much of the early evidence for unconscious semantic access un-
der masking, criticized by Holender (1986), was based on a se-
mantic priming paradigm yielding bona fide semantic priming ef-
fects. Much of the recent evidence for unconscious semantic
access discussed by P&V does not qualify as priming because it
rests on tasks that, although based on a priming procedure, are
functionally equivalent to Stroop-like tasks. These tasks are gen-
erally assumed to generate congruity effects because of response
competition (e.g., Eriksen 1965; Holender 1982; MacLeod 1991),
not priming effects.

The studies of Greenwald et al. (1996; Drainé & Greenwald
1998) are based on prime and target words with strong positive
and negative affective connotations. The SOA between the prime
and the target is very brief (under 100 msec), and the prime is in-
terleaved between the same basic category consisting of random
letters strings. Even though the primes could not be discriminated above chance,
the binary classification of the target words in terms of their pleas-
nance is more accurate in congruent trials, in which the polarity
of the prime and the target words are the same, than in incongru-
ent trials, in which the polarities are opposite. Similarly, in the
studies of Delaune et al. (1998; Naccache & Delaune 2001),
which are based on a comparable procedure, the speed of classi-
fication of a single-digit target number in terms of whether it is
larger or smaller than five is affected by the congruency of the
unconscious prime number.

Initially, Greenwald et al. (1996; Drainé & Greenwald 1998)
interpreted their findings as reflecting semantic priming based on
spreading activation. Then, Klinger et al. (2000) demonstrated that
this effect does not depend at all on spreading activation but on
response competition. This was taken as evidence that the un-
conscious primes must be covertly classified according to the same
rule as the one applied to the visible target (see also Delaun et al.
1998). Next, it was shown that the congruity effect only appears
with primes that have been used repeatedly as targets (Abrams &
Greenwald 2000; Damian 2001), which prompted a reinterpretation
of the effects in terms of the formation through learning of a
direct stimulus-response link based on superficial features of the
stimuli. However, Abrams et al. (2002) argued that this link must
rather be established between the stimulus and the semantic cate-
gories, as the learning effect resisted a change in response assign-
ment. Nevertheless, Naccache and Delaune (2001) persisted in
their account in terms of unconscious semantic classification, be-
cause the congruity effect still occurs with unconscious primes,
which have not been seen before as targets.

All these interpretations of unconscious congruity effects rest
on the assumption that the primes are completely unavailable to
awareness. If correct, they imply a hyperpowerful unconscious,
that is, an unconscious even more powerful than the one already
required to explain unconscious semantic priming effects. We
contend that this conception is profoundly mistaken because, as
was pointed out by Priory (1997), a stimulus has no inherent infor-
mation sufficient to specify a response outside the context of a
goal-directed task imposed by the instructions. Besides, the pri-
mary source of response conflicts underlying the congruity effects
described above must lie in conscious mental representations (cf.
Holender 1985), because there is no stored information, and
hence no information that can be spontaneously activated, about
whether a number is smaller or larger than five or about whether
the concept denoted by a word has a pleasant or unpleasant con-
notation. Therefore, the only possible source of conflict lies in the
fact that most participants think about the irrelevant information
in terms similar to those used by the instructions to describe how