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Is Conscious Experience Established Instantaneously? Commentary on J.G. Taylor

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There are various possible ways to approach the problem of explanatory gap between the natural–scientific characteristics of the neural systems and the subjective realm of direct conscious experience that somehow grows out of the activity of these systems. One can depart from the behavioral data obtained in psychophysical experiments, make several assumptions as for the experiential basis of the objectively measured responses of the subjects, and then look at the necessary and/or sufficient neural mechanisms that are capable of providing the clues for the interrelationships found. One can also start with neurophysiology and then look at the constraints the factual knowledge about the regularities of brain processes provides for possible hypotheses for the (in)famous psychophysiological problem. The third strategy would be to start with the list of the basic characteristics of subjective experiences as taken from introspection and philosophy (including qualia) and then find what features of the neural systems could be listed as the best candidates to bridge the explanatory gap. The latter is the strategy chosen by Taylor.

At first I was quite skeptical about the success of this enterprise. (Perhaps we all are frightened by the years-long skepticism taught us by philosophers and behaviorists. On the other hand, even if we use the strategy adopted by Taylor, one would expect the approach where the aspects of subjective experiences which are to be analyzed from the point of view of their neural correlates, could be the relatively ''easy'' ones like latency of sensations or binding of different sensory characteristics into an integrated perceptual objects. Taylor did choose the most difficult way, however.) But the longer I read, the more I was surprised by the unexpected coherence and well-grounded logic of the approach taken. Indeed, even if the explanatory gap will be there forever, nevertheless we can improve the state of our art by more vigorous styles of inquiry if we will create experimentally testable predictions with regard to subjective phenomena that can be directly derived from the features of the neural systems involved and test them. For example, the loss of lower level information and experienced continuity and unity of experience as based on the ''fan-in'' principle of inputs from lower level to higher level (with longer persistence of the activity in higher level bubbles of locally recurrent neural activity) could be tested by experimental perturbation of the higher level bubble activity. This could be done, say, by narrowly localized transcranial magnetic pulses (e.g., Maccabee et al., 1991). Frag-

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mentariness of subjective experience would be the hypothesized result. Or, take Taylor's example about lifetimes of cortical activity traces. The prediction is clear: the longer the lifetime of neural activity in a bubble, the longer the subjective sensory experience should be. (Although the data reported about the studies by Uusitalo and Williamson (1996) contradicted some earlier findings about the inverse duration effect. It has been repeatedly shown (e.g., Haber & Standing, 1970) that subjective visible persistence of brief stimuli decreases as stimulus duration increases. This contradiction between neural and psychophysical processes clearly demonstrates the usefulness of putting forward testable predictions as the main strategy to look for NCC, and therefore to get closer to the understanding of where the explanatory gap strikes the strongest.) Another group of experimental phenomena called change blindness (Simons & Levin, 1997) seems to constitute another instance of empirical testability of definite notions from Taylor's metatheory. The need for suitable persistence of some of the bubbles to outcompete rivals with shorter lifetime explains why the change in some parts of the global image across repetitive cycles of exposure will remain consciously unnoticed at the same time if the global meaning and higher level perceptual specification of the stimulus can be easily caught. For interim summary then: it is not so important if a theory is intuitively close to ultimate truth or not or has wide popular appeal; it is much more important that it should be able to provide empirically testable predictions. Taylor's approach satisfies this criterion.

The Problem of Transition Dynamics between Nonconscious and Conscious States

While I was reading the article several points emerged that I would like to have raised here, but let me concentrate on one main issue: the all-or-none mode of one's having a conscious state of mind or having an experience of a definite perceptual object. Taylor writes that ''. . . there is no sequence of transformations on the content of these states as they appear into consciousness. There is a once-for-all emergence and not a graded process''; and ''. . . latency seen as a delay before the *sudden* (my emphasis) emergence of phenomenal experience.'' Suppose a subject is just about to wake up and enter the conscious mode of functioning. Both from the introspective accounts and neurophysiological data about the workings of the brain systems of arousal it would be quite difficult to precisely specify the point in time where unconscious subject instantaneously transforms into a fully conscious subject. By all means there seems to be a certain degree of transitory state in between. And even if Taylor would insist on rejecting the notion of the degrees of clarity or distinctiveness of, say, visual awareness (or would say that regardless of different degrees of vividness and fullness of its *contents*, conscious experience either exists or not), it still seems that at least the ''seamlessness'' feature of subjective experiences in time and space should be lost and fragmentary experiences in space and time should be a common finding.

This alternative assumption about the gradual nature of acquiring conscious experience applies not only to relatively slow transitions like in sleep–wakefulness cycles, but also to the normal perception of stimulus images in fully awake, healthy, subjects. Consider an example from mutual masking studies (e.g., Bachmann, 1994). Two brief stimuli are successively exposed. The first stimulus (S1) has longer duration than the succeeding one (S2). Perhaps the lifetime of the bubble of neural activity that stands for the S1 should outcompete the bubble that represents S2. Actually, what happens, is that with *shortest* SOAs, indeed, S1 wins the race. But, if we increase the SOA up to intermediate values around 50–70 ms (which should even more lead to the S1 advantage), then S2 obtains conscious quality and S1 will not be experienced. How can it be explained that the shorter stimulus that now comes even later after the longer, first stimulus, wins the competition. Even more, it has been shown that it is possible to *increase* the vividness of the impression of S2 if it is exposed after S1 in comparison with the condition where S2 is exposed alone (Bachmann, 1988a). It seems as if the stimulus-related activity bubble alone cannot be made responsible for conscious quality. A time-consuming, gradual process that is the necessary ingredient in conscious perception can be ‘‘traded’’ between different stimulus objects. The above-mentioned interactive effects refer to the possibility that there are some mechanisms independent of the functions of direct encoding of a specific stimulus information (and, alas, of the qualia related to it), but still necessary to disclose the initially implicit nature of the encoded stimulus information. These stimulus-invariant mechanisms provide just modulations of the activity of the localized recurrent active nets. The thalamus, illustrated in Fig. 5 of Taylor, could be a good candidate for such a role.

The Microgenetic Approach

There is a tradition shared by perceptual psychology, developmental psychology, and neuropsychology that is perhaps much less known in comparison with the mainstream information processing or psychophysical approaches—the tradition of microgenetic theory (Sander, 1928/1962; Werner, 1948, 1957; Flavell & Draguns, 1957; Arieti, 1962; Brown, 1977, 1988; Froehlich et al., 1984; Draguns, 1986; Hanlon, 1991; Glicksohn, 1995; Nakatani, 1995; Bachmann, 1980, 1988b, 1990). The ideas of this theory have been grounded on experimental research with various techniques that expose stimuli in well-controlled, however impoverished conditions like in changing the value of brief exposure durations or in changing the stimulus onset asynchronies (SOAs) in masking. According to the microgenetic approach, each cognitively transparent perceptual representation is a dynamic, evolving entity that unfolds over real time (e.g., within 100 ms poststimulus). It is assumed that not only the end result of largely preconscious information processing operations suddenly acquires conscious status in its final form, but that the conscious percept itself undergoes formation. (The analogy with developing a photographic print after the exposed photographic paper has been bathed into the developer would be helpful here.) Percepts with invariant, stable quality reach that state (unfold) through the orderly sequence of qualitatively different, preliminary, subjective perceptual stages. An invariant physical stimulus–object will undergo gradual (perhaps smooth) change in observer’s consciousness through a sequence of variable experiential states. Already Nikolai Lange (1893) described the succession of stages: at first, a ‘‘push into consciousness’’ is experienced where qualia are absent except the pure understanding that something happened. Then a phase that carries awareness of modality of stimulation is revealed. Further on qualia of, e.g., color or timbre of a tone will be sensed, followed by awareness of the concrete form of the object. Unfortunately, Lange used experimental methods without strong control over dependent variables. Several features of microgenesis have been described in later studies, including more rigorous tests of the veridicality of subject's reports (e.g., Vekker, 1974; Kirkham, 1977; Hughes, Nozawa, & Kitterle, 1996). Some characteristics like motion, localization, achromatic tone, rough size preceded other characteristics like color, angularity, or metrically invariant form in microgenetic development. Coarse spatial scales will be perceptually represented sooner than the fine grain, detailed spatial scale information. The phases of form development have been also described as a succession of different forms of pre-Gestalt quality that gradually approach the stable, final Gestalt (see, e.g., Glicksohn, 1995, who nicely reminded us about this).

According to Werner (1957) the early phases of percept development are characterized by physiognomic qualities and by undifferentiated, structureless aspect of representation. At this stage it is difficult to discriminate between feeling and perception. Now, if Taylor would argue that in case of microgenetic progression we may have just many different, all-or-none type percepts experienced in rapid succession (or multiple drafts densely packed within a fraction of a second, to use the Dennett and Kinsbourne's (1992) multiple-drafts approach) then an epistemological problem emerges: how and why an invariant physical object, briefly presented, gives rise to a multitude of subjective representations in awareness that do not contradict each other due to their genetic consistency?

By the way, the ''perspectivalness'' feature (Taylor) resonates surprisingly well with what microgenetists (e.g., Wapner & Werner, 1957; Brown, 1977, 1988; Draguns, 1986) regarded as one of the central tenets in their approach—the originally intrinsic and integral quality of organismic, affective, and sensory aspects of mental experiences. Microgenetic process of cognition is not exclusively exogeneously determined stimulus–response type of successive operation with the symbol-processing system as an interim variable, with consciousness being situated somewhere at the top of the whole gadget. Instead, subjects *explore* their environments and conscious understanding of even simple perceptual objects and events unfold from the core (as the center of personality) to surface where sensory representations are to be found. The process of experiencing any stimulus begins with lack of intentionality with regard to external world objects (sensory awareness of organismic, internal qualities prevails) and grows over to awareness of environmental objects differentiated from the self. In the sensory-tonic field theory of perception of Werner and Wapner it is assumed that an ''internal field'' captures the perceptual aspects of experience even before the commencement of external stimulus influences proper. Proprioceptive and viscerotonic qualities precede the environmentally intentional qualities of cognition in the course of the same microgenetic formation of perceptual experience. For Brown (1977) consciousness is not an endproduct of stagewise processing, but each stage possesses a form of awareness characteristic to that evolutionary level. In terms of Taylor's conceptualization, this means that an invariant stimulus should create various locally recurrent activities (e.g., SOFM or local-CNFT bubbles) that are related to conscious experience and that these bubbles gradually transform into more integral activities of nets. The later ones being intrinsically founded on former. In terms of this conceptualization, pathology in consciousness-related cognitive processes can be understood as the *normal* process of unfolding that is abbreviated or terminated before the final, latest stages of microgenesis.

Within the microgenetic tradition, there are indeed some quite radical hypotheses that may be very difficult to accept. One of the radical stances of microgenesis was suggested by Lange (1893). In what he called ''the law of perception,'' and most probably under the indirect influence of Charles Darwin's and Herbert Spencer's conceptualizations (Lange did not cite them for whatever reason there may have been), Lange conjured the idea that all percepts go through developmental stages exactly according to the qualitative succession of the perceptual capabilities the species had throughout the course of biological evolution. In other words, the perceptual qualities that were given to different organisms at different stages of phylogenetic progression are repeated in the same succession, however extremely compressed in actual time, within a single perceptual act of a human being. The recapitulation hypothesis was accepted in several influential microgenetic schools (e.g., by Werner, 1948; 1957). This assumption requires one to (1) accept the view that in each full-blooded, normal perceptual process (that started after the exposure to the physical object) main responsibility for the outcomes of cognitively transparent, immediate perceptual experience will be successively handed over from more ancient, deeper brain structures (e.g., brainstem) to phylogenetically more recent ones (e.g., limbic complex), up to the newest structures (e.g., cortex, especially prefrontal areas); (2) that animals possess consciousness, although in its more primitive forms; (3) that preliminary *conscious* states of the perceptual image are gradually, quickly, and continuously replaced by or transformed into, succeeding conscious states of different quality so that the former are lost for short-term memory and focal attention. (I beg a pardon for coming close to saying that while reading these letters here and now each of you, dear readers, for a fraction of second, possesses the consciousness of a frog. But the brighter side of this is that you forget it extremely quickly.)

Spatiotemporal Transformations in the Microgenesis of Subjective Experience

Even if the immediacy and once-for-all characteristics of conscious experience prove to be correct in the long run (and therefore microgenesis of a percept would be understood as fast succession of different percepts of different stimuli that are extracted from the same object), it would still be important to study the psychophysical spatiotemporal regularities of transforming the objective stimulus characteristics into subjective (or, to please also the more marxist-oriented specialists—how objective characteristics of the events in space and time become *reflected* by a special property of living matter, by the consciousness). Consider the experiment with laterally moving lines, for example (Bachmann & Kalev, 1997). Two laterally moving vertical lines were exposed on a computer screen in repetitive sweeps. In each trial, lines move in the same direction along the parallel motion paths. The lower line (reference stimulus) moves across the screen within the wide spatial window. The upper line appears only in the aperture above the center of the motion path of the reference line. The speed of motion and the diameter of the aperture can be varied. Subjects had to effect the leftward and/or rightward shifts of the aperture line until it appeared to be aligned with the reference line. If the speed of motion was low and aperture not too small, subjects provided perfect results—subjective collinearity equalled that of objective, 1D physical collinearity. However, if the speed of motion was gradually increased and/or the diameter of the aperture gradually decreased in different sessions of the experiment, subjects made more and more errors of adjustment. In order to achieve subjective collinearity, the aperture line had to be shifted ahead of the position where it would have satisfied physical collinearity, along the motion path in the direction of motion. Indeed, if a line appears from behind the edge of the aperture, it takes some time to represent it as conscious perceptual image and the higher the speed, the bigger the subjective spatial error with regard to the objective position of the stimulus. If it were simply for the latency of establishing subjective, conscious representation of moving visual stimuli, however, then there should not be errors of adjustment because the speeds and intensities of the lines are equal. For some reason the subjective image of the aperture line lags behind the subjective image of the reference line in perceptual space–time and in order to overcome this spatiotemporal handicap, subjects shift aperture lines ahead in physical space. The main characteristic that differentiates the reference line and the aperture line is how long the stimuli have been influencing the perceptual system. The stimulus *availability* for the reference line has been higher than for the aperture line. In other words, the microgenesis of subjective representation for the reference did start earlier and this somehow leads to *relative* slowness of the microgenesis of the representation for the aperture line, given small apertures. Whereas with large enough aperture the effect disappears, then we should conclude that there is a process of acceleration within the microgenetic episode of creating the subjective image of dynamic stimulus events. But the concept of acceleration contradicts with some of the characteristics Taylor attributed to conscious experience (''Consciousness is all-at-once at its cruising height and speed'').

A compromise between the microgenetic approach and Taylor's theory is possible. It appears that if we specify consciousness as the content of mental representation that becomes subjective experience which is reported or actually evaluated at the metacognitive level (i.e., either communicated between the representatives of the same species, including the possibility to verify if the categories that are used to describe the experiences that result from same physical influences are matching, or reflected within the intrapsychic ''referencing'' system that features the capacity of metacognitive intentionality). Now interim conscious experiences, vis-à-vis the invariant object, that are nonreportable (''masked'' by following experiences and/or quickly forgotten) become *quasi-conscious entities.* They cannot be termed preconscious because they already have possessed the important quality of consciousness—subjective experience (or P-consciousness of Ned Block). But they cannot be termed conscious either because the potential of reportability or metacognitive intentionality (or A-consciousness of Ned Block) was not actually carried out. Therefore, to study quasi-conscious experiences one should get the help from special experimental procedures that make it possible to have conscious experience of something that normally is quasi-conscious. (And not only get help from brain deficits as Taylor seems to assume.) Similarly, in order to reach someday the science of consciousness we must be satisfied with quasi-science of consciousness today. I am happy with it insofar as correlates of consciousness will be still studied scientifically. So seems to be Taylor.

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