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Commentary on Daniel C. Dennett and Marcel Kinsbourne (1992) Time and the observer: The where and when of consciousness in the brain. BBS 15:183–247.

Abstract of the original article: We compare the way two models of consciousness treat subjective timing. According to the standard “Cartesian Theater” model, there is a place in the brain where “it all comes together,” and the discriminations in all modalities are somehow put into registration and “presented” for subjective judgment. The timing of the events in this theater determines subjective order. According to the alternative “Multiple Drafts” model, discriminations are distributed in both space and time in the brain. These events do have temporal properties, but those properties do not determine subjective order because there is no single, definitive “stream of consciousness,” only a parallel stream of conflicting and continuously revised contents. Four puzzling phenomena that resist explanation by the Cartesian model are analyzed: (1) a gradual apparent motion phenomenon involving abrupt color change (Kolers & von Grünau 1976), (2) an illusion of an evenly spaced series of “hops” produced by two or more widely spaced series of taps delivered to the skin (Geldard & Sherrick’s “cutaneous rabbit” [1972]), (3) backwards referral in time, and (4) subjective delay of consciousness of intention (both reported in this journal by Libet 1985a; 1987; 1989a). The unexamined assumptions that have always made the Cartesian Theater so attractive are exposed and dismantled. The Multiple Drafts model provides a better account of the puzzling phenomena, avoiding the scientific and metaphysical extravagances of the Cartesian Theater. The temporal order of subjective events is a product of the brain’s interpretational processes, not a direct reflection of events making up those processes.

**Descartes’ fundamental mistake:
Introspective singularity**

Joseph E. Bogen

Department of Neurological Surgery, University of Southern California, Los Angeles, CA 90033

The thoughtful target article about consciousness by Dennett & Kinsbourne (D&K) (1992) contains many different contentions. This commentary is directed toward one of their specific arguments, that there is no midline structure in the encephalon where one could localize consciousness, hence consciousness must be diffusely distributed.

My use of the term “encephalon” follows that of John Hughlings Jackson (1874) who wrote:

The nervous system, I repeat, is double. . . . I use the word brain to include the cerebral hemisphere and the subjacent motor and sensory tract. [Whereas] I use the word encephalon to include all parts of the nervous system within the skull.

I am in complete agreement with D&K’s assertion that there is no midline structure whose neural composition, connections, and activation could be responsible for various perceptions, ideas, feelings, and so on becoming momentarily conscious. But it does not follow (even if it were to be true) that structures with such composition and connections are nonexistent anywhere, hence that the neural correlates of consciousness must be diffusely distributed, as they assert. Their argument is erroneous because (1) it ignores some well-known facts, and (2) it puts excessive emphasis on introspection. To show how they have gone wrong, some introductory background is necessary. As we will see, although they claim to criticize Descartes, they have implicitly joined him in his most far-reaching error.

One of the most obvious facts about the cerebrum is that, in almost all respects, its parts exist in duplicate. For every structure within each hemisphere, its near twin exists in the other. This fundamental fact was well known to Descartes. Why then did he look for an unpaired midline structure? And why the pineal? To the first question he gave a single, psychological answer. To the second, he gave three reasons, anatomico-physiological.

Descartes looked for a single midline structure because of his

introspectively based conviction that consciousness is single. He wrote, “cogito ergo sum,” both verbs in the singular. In addition, since almost all parts of the brain are double, “inasmuch as we have only one solitary and simple thought of one single thing during the same moment, it must necessarily be that there is some place where [the two come together]” (Clarke & O’Malley 1968, p. 471).

In other words, Descartes gave his psychology greater weight than he gave the anatomical fact of duality. His decision was complemented by three other observations, all concerning the pineal gland. First, the pineal is (as he said) “in the middle” and “the most internal.” Second, its destruction (he believed) resulted in death. And third, it is ideally situated to control (he thought) the flow of ventricular fluids (Clarke & O’Malley 1968; McHenry 1969).

Descartes’ proposal has been discredited for a variety of reasons including his metaphysical dualism (see, for example, Ryle 1949), but his dualism is irrelevant. A dualist could say that the soul is manifest *throughout* the encephalon, or one could say, as Fritsch and Hitzig (1870) said of their discovery of the motor cortex, “such facts show that the origin of at least some function of the soul is bound up with circumscribed parts of the brain” (Von Bonin 1960, p. 78).

We should understand that the metaphysical argument (dualism versus materialism) is orthogonal to the localization argument (special locales versus wide distribution). Descartes, taking a solidly dualistic position, was a bit less committed to a special locale than is often thought; he wrote, “although the soul is joined to the whole body, there is, however, a certain part in which it exercises its functions more particularly than in all the others” (Clarke & O’Malley 1968, p. 471). Similarly, one could take a solidly materialistic position and believe that all thalamo-cortical interaction is potentially conscious but that there is a special locale where this potential is particularly realized.

For those who follow Descartes (and D&K) by insisting on the supremacy of the usual introspection (consciousness is single), the pineal is now thought to be a ludicrous candidate. Contrary to the information then available to Descartes, pineal destruction need not result in death. Above all, our current view holds that it is the flow of information between neurons, not ventricu-

lar fluid flow, that subserves the processes we call, in the aggregate, mentation.

It is easy for us to ridicule Descartes now, but we should remember Berry Campbell's criterion: the greatness of a man's contribution can be measured by how long he has held up progress. Half a millennium is surely world class! It is the subsequent accumulation of empirical facts, not better philosophy, that has rendered the pineal a poor choice for those who are still looking for one or more special locales.

D&K recognize the nondependence of Cartesian localization on metaphysical dualism. They mainly criticize what they call "Cartesian materialism" for the assumption that there is a place (in their words) "where it all comes together." And they insist that the assumption of such a single place continues to pervade, as a "bad habit," most people's thinking about consciousness. Indeed it does! And it does so for D&K too! Their error is to suppose a *single* consciousness, and in that, they follow Descartes. And for D&K, there is a single place: "The brain itself is Headquarters" (p. 185). They state, "As a matter of empirical fact, nothing in the functional neuroanatomy of the brain suggests such a [central] general meeting place" (p. 185). They should have said "of the encephalon" rather than "brain" of which (per Jackson) there are two. Their sentence seems relevant only because they refuse to follow Hughlings Jackson, and they do so because they insist that their introspective perception of the oneness of consciousness should have greater weight than not only the fact of anatomical duality but the hemispherectomy and callosotomy evidence for physiologic duality.

The fundamental mistake of Descartes was to assume singularity, based on his own introspection. And a fundamental error made by D&K is to follow him in this respect. *Whatever* the neural substrate of consciousness, localized or distributed, we must infer that it is double from evidence both anatomic and physiologic. First, the anatomy exists almost entirely in duplicate. Second, if either hemisphere is removed, the remaining unpaired hemispheric structures can sustain consciousness. This is a frequently observed fact, as contrasted with Kinsbourne's fantasy that "there is no reason in principle why several or many aware neural systems might not result [from repeated subdivisions of the brain]" (Kinsbourne 1988, p. 252). Any psycho-neuro-philosopher who, in these days, does not wholeheartedly recognize and utilize these two facts (one of them unknown to Descartes) is in the same epistemological ark as theorists on evolution who do not wholeheartedly accept the multibillion-year age of the Earth. In each hemisphere there are a number of candidates (structures with widespread connections) for consideration as a "general meeting place" for those who wish to localize. For those who do not wish to localize, there is no evidence that a piece of a hemisphere can be conscious.

The behaviors of callosotomized cats, monkeys, and humans are most reasonably interpretable on the view that consciousness can proceed simultaneously and differently in each hemisphere. As for the intact human, we can reasonably expect that there will be occasions when the anatomic potential for duality becomes a physiologic actuality, for shorter or longer times (Bogen 1990). To believe otherwise is to make what I call the "Assumption of Perpetually Obligate Synchrony." Suppose we agree to this assumption. Suppose we accept, for purposes of argument (in the nonsplit case), that a combination of callosal and various subcallosal mechanisms keeps in essentially complete synchrony the neural activities of the two hemispheric systems for consciousness. Doing so does *not* allow one to ridicule localizationist materialism on the basis that there is no *midline* meeting place. Once the duality of consciousness is recognized, a neo-Cartesian view has no need for such a single encephalic meeting place, indeed it explicitly denies it. That D&K use this argument shows how embedded within their own approach is the idea of what Kinsbourne has acclaimed as "the intact individual's unified awareness" (Kinsbourne 1988). This grand delusion (common to us all) permeates their own position

no less than that of those they criticize, or of Descartes himself. Until D&K (and others) give up their belief in conscious singularity they will only be arguing about the structure of their own preconceptions, rather than about the physico-chemical activities subserving consciousness.

A model devoid of consciousness

Bredo C. Johnsen

Department of Philosophy, University of Houston, Houston, TX 77204-3785

Dennett & Kinsbourne (D&K) (1992) deny the charge that they banish consciousness from the mind, but there is a stunning feature of their work that makes the charge correct, and may well explain their failure to grasp it: D&K's entire "conception" of consciousness is that it is not phenomenal; that is, they have no conception of it. So on their own terms, the so-called Multiple Drafts model of consciousness (MD) can be no such thing, since there is nothing for it to model.

This is easily missed, because D&K often talk in terms of the very stream of consciousness whose existence they officially reject in favor of "a parallel stream of conflicting and continuously revised contents" (p. 185). They say, for example, that experimental probes may disrupt the normal progression of the stream of consciousness (p. 185). Even their summary remarks are framed in terms of it: "The representation of sequence in *the stream of consciousness* [my emphasis] is a product of the brain's interpretive processes, not a direct reflection of the sequence of events making up those processes" (p. 200). Indeed, one of their basic strategies presupposes its existence: they accept the challenge of making sense both of "a primary phenomenological aspect of our human existence" (Libet 1985, quoted in D&K, p. 187) and of anomalies that appear when one attempts to put the subjective sequences into registration with objective ones. This strategy presupposes not only the existence of a subjective sequence, but reliable, independent access of its contents: "It is only when we try to put the sequence of events . . . in the objective . . . stream into registration with the . . . subjective sequence *as indicated by what the subject subsequently says* that we have any sign of anomaly at all" (p. 190).

Let me now show that D&K have no conception of consciousness. Various things they say bear directly on the question, Which events are conscious? (1) "The stream of consciousness . . . is a parallel stream of conflicting and continuously revised contents, no one . . . thread of which . . . [is] the true version" (p. 185); that is, the question has no answer. (Note that the notion of "a" parallel stream may be incoherent. Parallel to what? Do they mean parallel streams of consciousness? With or without conflict, this notion would be baffling, at best.) (2) This is later escalated: "[On the MD model] these questions [whether particular events were conscious] cannot meaningfully arise" (pp. 194–95). Indeed, (3) the Cartesian Theater model (CT) is faulted for the fact that according to CT it is a determinate question whether a given event is conscious. And finally, (4), "the fundamental implication of the Multiple Drafts model [is that] if one wants to settle on some moment of processing in the brain as the moment of consciousness, this has to be arbitrary" (p. 194). This, like (3), is a matter of principle, not a trivial point about fuzzy boundaries and, given the implicit assumption that the conscious/unconscious distinction is to be drawn in terms of brain processes, it amounts to denying that the concept has any theoretical significance whatever.

In sum, our question has no significance, has no answer, is not even determinate, and cannot meaningfully arise. But then the question Which events does MD model? cannot meaningfully arise either; MD cannot be a model of consciousness. In addition, there can be no anomalous relations between the stream of consciousness and any "other" sequence of events. (Incidentally, D&K beg the question against Goodman's [1978] account of the

color phi phenomenon when they reject it on the grounds that there seems to be no point in the brain's "filling in the gap"; they readily accept arguments by Shepard [1992] and Roskies & Wood [1992] that the brain does fill in some gaps, without providing any idea of what the point might be of its doing so.)

Actually, D&K provide one hint at how they may conceive of conscious events: "Some . . . effects [of contentful states in the brain] – for instance, influences on subsequent verbal reports – are at least symptomatic of consciousness" (p. 184). But (1) this obscure remark points, if anywhere, toward the classic stream of consciousness and (2), to the extent that it suggests taking either judgmental status or influence on subsequent judgments as the mark of consciousness, it is a hindrance, not a help, since D&K regard neither of these as sufficient for consciousness. They attribute judgmenthood to many unconscious brain states (p. 184), and thus are inconsistent in saying of the color phi case that the brain's judging that motion had occurred "would suffice [my emphasis] for it to seem to the subject that . . . motion had been experienced" (p. 194); and they are willing to say even of verbally reported judgments only that they are normally sufficient for consciousness (p. 194). (Admitting that they were sufficient would of course bring D&K close to recognizing a single stream of consciousness.)

Finally, notice how D&K's vacillation bears on a second, more provocative, version of their summary remarks: "At [the time-scale used in the experiments] the standard presumption [that our experiences of events occur in the very same order as we experience them to occur] breaks down" (p. 200). Clearly, this sentence makes sense only if read as saying both that there is an "order in which we *experience events to occur*," that is, a single subjective sequence, and that it differs from the order in which we experience the events; even more strikingly, to establish its truth would require access to the content of both sequences.

D&K's provocative formulation of the "standard presumption" is radically misleading. The presumption D&K have actually discredited is that the order in which we experience events to occur is the same as the order in which our brains discriminate them. But in doing so (1) they have relied on the classical conception of consciousness, (2) they have left phenomenal consciousness unscathed, and (3) they have constructed a model of the brain's processing of perceptual information, not a model of consciousness.

Had I space, I would trace the pernicious effects of D&K's unstated assumption that there is a unified stream of consciousness if and only if there is a place in the brain "where it all comes together perceptually" and I would show the strength of the view that would result from integrating MD as a model of brain activity with the recognition of phenomenal consciousness.

The "Multiple Drafts" model and the ontology of consciousness

Antti Revonsuo

Department of Philosophy, University of Turku, Turku SF-20500, Finland
Electronic mail: revonsuo@sara.utu.fi

We do not yet have any basic, universally accepted account of what consciousness actually is. The current theories or models have no common core because they stem from diverse philosophical foundations. However, only a consensus concerning the fundamental character of consciousness can guide future empirical research, and the nature of consciousness should be made as clear for cognitive science and psychology as the nature of life has been made for biology. Thus, we need a clear answer to the most profound question: What, basically, are conscious phenomena? This is the question, as philosophers say, about the "ontological status" of consciousness.

The target article by Dennett & Kinsbourne (D&K) (1992), did not quite succeed in being clear about the ontology; in the

commentaries D&K were accused of, for example, totally rejecting the reality of consciousness. In their response, D&K attempted to clarify their position, which they consider unproblematically "realist" and materialist: "Conscious experiences are real events occurring in the real time and space of the brain." But, D&K hurry to remind us, "Certain sorts of questions . . . have no answers because these questions presuppose inappropriate – unmotivable – temporal and spatial boundaries that are more fine-grained than the phenomena admit." They say that the creation of conscious experience is a continuous process, in which "microtakings" interact. A microtaking "cannot just be inscribed in the brain in isolation; it has to have its consequences," for example, for "guiding action." Conscious experience is "a succession of states *constituted by* various processes occurring in the brain and not something over and above these processes that is *caused by* them," and "becoming a conscious experience does not clearly endow an event with potencies it previously lacked." They say that "a contentful event becomes conscious if and when it *becomes part of a temporarily dominant activity in cerebral cortex*." However, there are no principled answers to any detailed questions about this process. They write: "There is no crisp way of telling exactly which parts of the multiple parallel streams are conscious. Any one of the streams sometimes contributes to awareness and sometimes not. No one stream is necessarily conscious by its very nature. . . . And that is our theory of consciousness."

These clarifications, I fear, are not very clarifying: we would still like to ask, But *what*, exactly, *is* consciousness, according to the theory? I propose that if we look at Dennett's philosophy of mind, we can arrive at an illuminating way to interpret the ontology of consciousness in the Multiple Drafts model. If this is the correct interpretation, however, I am afraid that the worries about the ontological status of consciousness were well warranted.

Dennett (1987; see also 1988) divides psychology into two radically different explanatory realms: subpersonal cognitive psychology and intentional system theory. The latter is "a sort of holistic logical behaviorism" and it "deals with the prediction and explanation from belief-desire profiles of the actions of whole systems" and "the *subject* of all the intentional attributions is the whole system rather than any of its parts" (Dennett 1987, p. 58). The concepts of subpersonal cognitive psychology differ strictly from those of intentional system theory. Whereas the latter name observer-relative "calculation bound entities or logical constructs," the former concepts refer to "posited theoretical entities." That is, the subpersonal theory describes the real happenings of the brain in a functionalistic language. The ultimate goal for the subpersonal theory is to decompose the cognitive functions of the organism into more and more simple subsystems, the operations of which can finally be constructed at the implementational level (neurophysiology). This box-model of cognition, or positing of many "stupid" homunculi to explain the behavior of the whole, must be conducted so that the homunculi do not duplicate the system-level properties they are supposed to explain (Dennett 1978).

The natural question to ask now is, Where, in this scheme, does consciousness belong? Although Dennett does not explicitly answer this question, the solution seems to be rather obvious. Dennett (1978, pp. 150–54) says that the subject of the access of personal consciousness is "the person and not any of the person's parts" and that a subpersonal model "evades" the question of personal consciousness. Thus, it seems clear that, for Dennett, consciousness belongs to intentional system theory and, consequently, shares the ontology of the other entities of that theory. What, precisely, is that ontology? Let us compare the best known concept of that theory, belief, with the Multiple Drafts concept of consciousness. Dennett says that "all there is to being a true believer is being a system whose behavior is reliably predictable via the intentional strategy" (Dennett 1987, p. 29). "There is no magic moment in the transition from a simple

thermostat to a system that really has an internal representation of the world around it" (Dennett 1987, p. 32). And because there is no unique "right" intentional interpretation of a system, it follows that "no further fact could settle what the intentional system in question *really* believed" (Dennett 1987, p. 40; emphasis in original). "There could be two different systems of belief attribution to an individual which differed *substantially* in what they attributed . . . and yet where no deeper fact of the matter could establish that one was a description of the individual's *real* beliefs and the other not . . . The choice of a pattern would indeed be up to the observer, a matter to be decided on idiosyncratic pragmatic grounds" (Dennett 1991a, p. 49; emphasis in original). Consequently, Dennett thinks that it is a "mistaken conviction that our own beliefs and other mental states must have determinate content" (Dennett 1987, p. 42).

The Multiple Drafts model, in turn, includes at least the following claims: (1) It is impossible to classify brain events into conscious and nonconscious. At the level of internal brain processes, this distinction is arbitrary or meaningless. (2) Our contents of consciousness are never determinate; there is no single stream of consciousness. (3) Although there seems to be phenomenology, there *really* is not (Dennett 1991b, p. 366).

The resemblance begins to come clear: like beliefs, consciousness cannot be defined at the level of neurophysiology. Like contents of beliefs, contents of consciousness are not determinate. Just as there is no "right" or "true" interpretation of what an intentional system really believes, there is "no single narrative that is canonical" or no "actual stream of consciousness of the subject." As there really are no beliefs, independent of observers and interpretations, there really is no phenomenology "presented for the subject." So, is consciousness, like belief, an observer-relative, "calculation-bound entity" or "logical construct"? This certainly would make sense of D&K's tortuous clarifications of the nature of consciousness. Why do "microtakings" have to have their effects on "guiding action" before they can reach the status of consciousness? Why is there "no crisp way of telling exactly which parts of the multiple parallel streams are conscious"? Is it because the "fact" is observer-relative, and, as for beliefs, there is "no fact of the matter" because it is a matter of interpreting "objective patterns" of behavior, not of discovering some natural phenomenon?

In conclusion, D&K's realism about consciousness seems to be of the same variety as is Dennett's (1991a) "mild realism" (i.e., instrumentalism?) about beliefs; in fact, D&K refer to exactly that article "for an extended version of this version of realism." Perhaps the content of this version of realism explains why D&K use quotation marks when talking about "realism." As there are no real beliefs inside our minds independent of what stance anybody adopts, so there are no conscious, contentful traces independent of fixing the content from the outside. As there is no "intrinsic intentionality" (Dennett 1990), so there are no intrinsically conscious states. If my interpretation of the ontological status of consciousness in the Multiple Drafts model is appropriate, we ought indeed to be worried about the theory. If the ontological foundation of consciousness research is an observer-relative and calculation-bound entity, it renders a natural science of the basis of consciousness a futile effort, a disastrous category error. The "logical constructs" of intentional system theory are not out there in nature to be discovered by us in the same sense as, for example, DNA molecules – the basis of life – were there even when we did not know the ontology of life. I believe, however, that cognitive neuroscientists pursue a *natural* science of consciousness and, therefore, the Multiple Drafts ontology will not be able to serve them.

ACKNOWLEDGMENT

The author is also affiliated with the Academy of Finland.

Authors' Response

Counting consciousnesses: None, one, two, or none of the above?

Daniel C. Dennett and Marcel Kinsbourne

Center for Cognitive Studies, Tufts University, Medford, MA 02155

Electronic mail: ddennett@pearl.tufts.edu

In a minute there is time
For decisions and revisions which a minute will reverse.

T. S. Eliot, "The Love Song of J. Alfred Prufrock"

In a second there is also time enough, we might add. In his dichotomizing fervor, Bogen fails to realize that our argument is neutral with respect to the number of consciousnesses that inhabit the normal or the split-brain skull. Should there be two, for instance, we would point out that within the neural network that subserves each, no privileged locus should be postulated. (Midline location is not the issue – it was only a minor issue for Descartes, in fact.)

As one of us (Kinsbourne 1982) has pointed out, it follows from the nonexistence of a privileged locus that the limit on the number of consciousnesses that could theoretically be housed in the brain (given suitable disconnections) is the minimal complexity of the neuronal substrate that suffices for this kind of functioning. There could be many, and certainly more than two. Not all these consciousnesses may be to Bogen's liking. Given a lateral (coronal) transection, the posterior sector may be precluded from controlling behavior, while the anterior one be sorely lacking in information to guide spared action. The separated left or right hemisphere, in contrast, is more fully equipped with input and output possibilities, depleted though they are.

Bogen claims that our argument "puts excessive emphasis on introspection." On the contrary, it goes further to discredit introspection than Bogen himself can countenance. What is the Multiple Drafts model if not a *denial* of the singularity of consciousness? In our view, Bogen's duality of consciousness is just as simplistic as Descartes' singularity. Our references to (apparently) unified normal awareness, to which Bogen takes such exception, are in the service of the very position that pleases him: the apparent unity is not a necessary reflection of any unity in the neuronal substrate. So Bogen's arrow misses its mark; or perhaps he was just using this occasion to ride his own, unrelated hobbyhorse.

Johnsen's point concerns a confusion about the stream (or streams) of consciousness. We speak of a "parallel stream of conflicting and revised contents" and he asks: parallel to what? Here is what we meant: the *apparently* single and unified "stream" is in fact composed of many different, largely independent, contemporaneously evolving content elements. These occasionally conflict with each other, occasionally mutually support each other. Coalitions of such elements take turns dominating their alternatives until they all fade away. That temporary

ascendancy is our substitute for the more traditional idea of an entrance into a privileged sphere or theater as the "mark" of consciousness or awareness.

Some commentators have wanted to read our substitute as a variation on, or version of, the traditional idea, and because the crucial difference is hard to keep in focus, we turn to an analogy that may help anchor the discussion – but only if the points of comparison are carefully marked.

You go to the racetrack and watch three horses, Able, Baker, and Charlie, gallop around the track. At pole 97 Able leads by a neck; at pole 98 Baker, at pole 99 Charlie, but then Able takes the lead again, and then Baker and Charlie run ahead neck and neck for awhile, and then, eventually all the horses slow down to a walk and are led off to the stable. You recount all this to a friend, who asks "Who won the race?" and you say, "Well, since there was no finish line, there's no telling. It wasn't a real race, you see, with a finish line. First one horse led and then another, and eventually they all stopped running." The event you witnessed was not a real race, but it was a real event – not some mere illusion or figment of your imagination. Just what kind of an event to call it is perhaps not clear, but whatever it was, it was as real as real can be.

Notice, first, that verificationism has nothing to do with this case. You have simply pointed out to your friend that since there was no finish line, there is no fact of the matter about who "won the race" because there was no race. Your friend has simply attempted to apply an inappropriate concept to the phenomenon in question. That is just a straightforward logical point. You certainly do not have to be a verificationist to agree with it.

Notice that each horse's career can be precisely tracked, including the spatio-temporal intervals during which it led (if it ever did). The same must be true, surely, for events occurring in the brain. At different times and places different contentful processes may dominate ("be in the lead"), but no such time or place is privileged (the "finish line"). What counts in the analogy as being conscious? Simply *running well* – contributing to the "dominant focus of neuronal activity" (Kinsbourne 1988) for some (unspecified) period of time. No doubt the property of *being in the lead* is a property which has precise temporal boundaries in the case of the horses, and its analogues in the brain may be presumed to be just as determinable (e.g., some property of *relative neuronal dominance*), but such domination does not confer some *extra* property of awareness (so that moving into the lead is becoming conscious, and ceding the lead is lapsing into memory or unconsciousness). The succession of dominance is what gives the stream of consciousness its seriality (such as it is), but it is a feature *within* the stream of consciousness, a sufficient but not necessary condition of being a conscious content.

Johnsen claims that a sentence of ours makes sense "only if read as saying both that there is an 'order in which we experience events to occur,' that is, a single subjective sequence, and that it differs from the order in which we experience the events." This was not our intended reading (if it even makes sense). We said what we meant: the standard presumption *breaks down* – for quite mundane reasons. Of course we can specify times before consciousness of an item has begun and after which consciousness of that item has ceased, but it is in the nature of the

phenomena that this timing principle does not apply at all scales. Similarly, the standard presumption that political events can be put into a unique time sequence breaks down when we choose our events carefully. Which came first: Clinton's victory or the closing of the polls? It is only those who have a "finish line" model of consciousness who cannot tolerate leaving such questions unasked and unanswered.

Revonsuo summarizes our replies to earlier commentators and says they are not very clarifying. He correctly analyzes Dennett's position in earlier work, and sees that our joint view is consonant with it. As he says, subpersonal cognitive psychology "evades" consciousness, but this only means: don't look for a consciousness module, any more than you should look for an honesty module or a shame module.

Revonsuo then asks some questions, to which we here supply the answers:

"Is consciousness, like belief, an observer-relative 'calculation-bound entity' or 'logical construct'?" No, but heterophenomenological objects are (see Dennett 1991b). (Feenomanism [Dennett 1978; 1991b] is a perfectly real phenomenon – a religion – but Feenoman is not real.)

"Why do 'microtakings' have to have their effects on 'guiding action' before they can reach the status of consciousness?" It is not that microtakings must first have their effects on guiding actions and then acquire some additional property of consciousness; their having these effects is constitutive of their being conscious takings.

"Why is there 'no crisp way of telling exactly which parts of the multiple parallel streams are conscious'?" Not, as Revonsuo surmises, because of observer-relativity, except in the minimal sense that it is the observers' concept(s) of consciousness that break down (as noted above) at this point.

Revonsuo perpetuates one large (but common, and forgivable) misreading of Dennett's position on observer-relativity and reality. Beliefs, according to Dennett, are quite real even if no one ever attributes them to their subject, and they are as discoverable-in-principle as genes, to use Revonsuo's example. Notice, by the way, that this comparison is particularly apt. According to current thinking, there do not turn out to be any *Mendelian* genes – Mendel did not quite carve nature at the joints. So we face a terminological choicepoint: do we say there never were any genes or that genes turn out to be rather different from what their "discoverer" claimed they were? In fact there has been some heated disagreement among biologists, but the general trend certainly seems to be to keep the term "gene" and abandon Mendel's definition. But in a free country (and science is a free country) this lexical decision could go either way.

To those critics who claim that we have not so much provided a model of consciousness as a denial of its very existence, we can reply, in a similar spirit, that we take consciousness to be rather different from what they think it is, but those who hate to see consciousness robbed of some of its "defining" properties can keep their "essences" if they insist – we will simply have to declare then that consciousness, so defined, does not exist. Something that is rather like *that* consciousness – enough like it to be called consciousness by the lexically lax! – does exist. That is a realistic variety of realism.

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Commentary on Steven Pinker and Paul Bloom (1990) Natural language and natural selection. BBS 13:707–784.

Abstract of the original article: Many people have argued that the evolution of the human language faculty cannot be explained by Darwinian natural selection. Chomsky and Gould have suggested that language may have evolved as the by-product of selection for other abilities or as a consequence of as yet unknown laws of growth and form. Others have argued that a biological specialization for grammar is incompatible with every tenet of Darwinian theory – that it shows no genetic variation, could not exist in any intermediate forms, confers no selective advantage, and would require more evolutionary time and genomic space than is available. We examine these arguments and show that they depend on inaccurate assumptions about biology or language or both. Evolutionary theory offers clear criteria for when a trait should be attributed to natural selection: complex design for some function, and the absence of alternative processes capable of explaining such complexity. Human language meets these criteria: grammar is a complex mechanism tailored to the transmission of propositional structures through a serial interface. Autonomous and arbitrary grammatical phenomena have been offered as counterexamples to the position that language is an adaptation, but this reasoning is unsound: communication protocols depend on arbitrary conventions that are adaptive as long as they are shared. Consequently, language acquisition in the child should systematically differ from language evolution in the species, and attempts to analogize them are misleading. Reviewing other arguments and data, we conclude that there is every reason to believe that a specialization for grammar evolved by a conventional neo-Darwinian process.

The functionality of the study of language origin

Antoni Gomila

Philosophy Department, University of the Balearic Islands, 07071 Palma de Mallorca, Spain

Electronic mail: dflcpt@ps.uib.es

Although I am sympathetic to the position of Pinker & Bloom (1990) (P&B), I would like to point out two ways in which their case could be strengthened. After clarifying what I take to be the key question in the discussion, I try to show, against P&B's claims, the importance of an evolutionary reconstruction of language evolution. I further argue that taking this reconstruction seriously can turn out to be relevant to the question of the nature of the language faculty. In other words, my contention is that the relationship between language acquisition and language evolution is not just unidirectional, with knowledge about language acquisition helping determine how language evolution took place, but it is bidirectional: evolutionary considerations can also set constraints on the nature of the language acquisition device (LAD).

1. The way out of the antinomy. P&B insist that the evolution of the language faculty must be understood the way the evolution of the eye is, and we must conceive of language as we conceive of

stereopsis; however, there are reasons to think that an important asymmetry separates the two. Whereas the optical stimulation required for the visual system to begin to work properly is nonspecific (Hubel & Wiesel 1962), this is not the case with respect to the acoustic stimuli necessary to develop a language – not just any kind of sound will do. Another more radical difference between the two capacities is that whereas the existence of optical energy is independent of the existence of a visual organ, in the case of language the linguistic stimulation necessary for the development of linguistic behavior presupposes the existence of the same faculty for language (in someone else, of course).

What these differences suggest, in my view, is that it is misleading to think of language as merely a biological competence; it must be seen as a cognitive one. The particular difficulties of accounting for the origin of language can then be better understood. The requirement that linguistic stimuli be available for language ontogeny raises the problem of how such linguistic data became available in the first place (in phylogeny). The problem can be formulated in the following antinomy (which generalizes over Sperber's [1990] "paradox"):

An evolutionary account of the origin of language must take as its starting point a situation in which language is absent and, accordingly, one in which no specialized mechanism for language acquisition has yet appeared. If such a mechanism is