

## Lost the Plot? Reconstructing Dennett's Multiple Drafts Theory of Consciousness

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**Abstract:** In *Consciousness Explained*, Daniel Dennett presents the Multiple Drafts Theory of consciousness, a very brief, largely empirical theory of brain function. From these premises, he draws a number of quite radical conclusions—for example, the conclusion that conscious events have no determinate time of occurrence. The problem, as many readers have pointed out, is that there is little discernible route from the empirical premises to the philosophical conclusions. In this article, I try to reconstruct Dennett's argument, providing both the philosophical views behind the empirical premises, and the hidden empirical arguments behind the derivation of the philosophical conclusions.

### 1. Introduction

Since the publication of *Consciousness Explained* (Dennett, 1991) several years ago, there has been an enormous amount of confusion about Dennett's theory of consciousness, the Multiple Drafts Model. For the neophyte, it has been a challenge simply to separate the central tenets of the model from the various conclusions Dennett wishes to draw from them—the starting point from the proverbial finish line, as Dennett would say. For the seasoned philosopher, the problem has been somewhat different. The theory itself seems to be a simple one. It has six central tenets, each one a largely empirical, speculative hypothesis about some aspect of neural function. These six tenets are as follows:

T1. 'All varieties of perception—indeed all varieties of thought or mental

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This paper is the result of three seminars on *Consciousness Explained* given at the University of Illinois, Champaign-Urbana, Corpus Christi College, Oxford and Simon Fraser University; it has also been given as numerous talks. I am indebted to all those people who participated in those seminars and to the lively audiences of those talks. In particular, I would like to thank José Bermúdez, Peter Carruthers, Martin Davies, Daniel Dennett, Naomi Eilan, Martin Hahn, Tony Marcel, and Denis Robinson for all their comments and discussions. And I owe special thanks to Joseph Malpeli for his help with the colour phi model.

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activity—are accomplished by parallel, multi-track processes of interpretation and elaboration of sensory inputs.' (p. 111)

T2. 'The spatially and temporally distributed content-fixations in the brain are precisely locatable in both space and time.' (p. 113)

T3. 'Feature detections or discriminations only have to be made once.' (p. 113)

T4. 'Distributed content-discriminations yield, over the course of time, something rather like a narrative stream or sequence, which can be thought of as subject to continual editing by many processes distributed around in the brain, and continuing indefinitely into the future.' (p. 135)

T5. 'Probing this stream at various intervals produces different effects, precipitating different narratives—and these *are* narratives.' (p. 135)

T6. 'Any narrative . . . that does get precipitated provides a "time line", a subjective sequence of events from the point of view of an observer.' (p. 136)

Most people, I suspect, would find the above tenets somewhat vague; certainly a good deal of elaboration and explication would be needed to make each one clear. Moreover, qua hypotheses in a nascent science, none of these premises seems very likely to be true. Still, whether or not one finds these tenets informative or intuitively plausible, there is nothing 'mysterious' or 'peculiar' or 'bizarre' about them. They are pretty much what one would expect for a speculative, quasi-empirical theory of consciousness. In contrast, the conclusions Dennett draws from these premises—what he takes to be their deductive consequences—are radical. Six such conclusions are as follows:

C1. There is no distinction either in content or in phenomenal experience between the representations of perceptual events and our inferences/judgments about them.<sup>1</sup>

C2. There are no 'fixed facts' about the events and contents of conscious experience other than facts about probes (and bindings).<sup>2</sup>

C3. On a small time scale, there is no distinction, in principle, between a revision of perceptual input and a revision of memory.<sup>3</sup>

C4. On a small time scale, there is no distinction, in principle, between

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<sup>1</sup> 'The results of self-probes are items in the same semantic category—not 'presentations' (in the Cartesian Theatre) but judgments about how it seems to the subject, judgments the subject himself can then go on to interpret, act upon, remember.' (p. 169)

<sup>2</sup> 'There are no fixed facts about the stream of consciousness independent of particular probes.' (p. 138)

<sup>3</sup> 'One could always "draw a line" in the stream of processing in the brain but there are no functional differences that could motivate declaring all prior stages and revisions to be unconscious or preconscious judgments and all subsequent emendations to the content (as revealed by recollection) to be post-experiential memory contamination. The distinction lapses in close quarters.' (p. 126)

'Stalinesque' and 'Orwellian' accounts of certain phenomena—there is no possible evidence, either from the subject's point of view or from the third-person perspective of science, that could decide between two explanations of certain illusions, one in terms of memory revision and the other in terms of perceptual tampering.<sup>4</sup>

C5. There is no determinate time of occurrence for conscious events.<sup>5</sup>

C6. There is no 'seems/is' distinction for conscious experience, between 'how things seem' and 'how things are'.<sup>6</sup>

Most readers have found these conclusions unintuitive; indeed, in the eyes of many, they are simply false or incoherent. But even the most sympathetic philosophers have found it difficult to see how these conclusions follow from the above set of innocuous tenets—or even why Dennett would believe, mistakenly, that the conclusions do follow. As a result, an enormous amount of philosophical time and energy has been spent attempting to discern what the conclusions might mean, what hidden presuppositions Dennett has implicitly relied upon and, failing this latter task, in trying to prove that the conclusions, no matter how they may have been derived, are false.

There is, quite clearly, much exegetical work to be done here and the purpose of this paper is largely that—an exegetical project. The task is to reconstruct, in the most charitable way possible, Dennett's argument for the above conclusions. Part of that task will involve explicating in more detail the six neurophysiological tenets; the greater part will involve drawing out the philosophical views that motivate Dennett's acceptance of these particular empirical premises and, more importantly, that serve as the essential 'glue' in his arguments. What are the implicit presuppositions, one wants to know, that together form the background against which the conclusions have some plausibility?

This paper is not—nor is it intended to be—a 'reconstruction' of the Multiple Drafts model in the detective's sense of the word. It is not a telling of the tale which, if all goes according to plan, describes exactly what happened and when. I make no claim that the arguments given here parallel Dennett's thought processes as he sat writing *Consciousness Explained*. Rather, this paper is a reconstruction in the general contractor's sense: only the most naive client would suppose that all the parts found in the final reconstruction were pieces salvaged from the original structure. Many of the views attributed to Dennett are not presented in his writings on the Multiple Drafts

<sup>4</sup> 'Both models deftly account for *all* the data—not just the data we already have, but the data we can imagine getting in the future . . . both theorists have *exactly* the same theory of what happens in your brain; . . . both account for the subjective data—whatever is obtainable from the first person perspective.' (p. 124–5).

<sup>5</sup> 'If one wants to settle on some moment of processing in the brain as the moment of consciousness, this has to be arbitrary.' (p. 126)

<sup>6</sup> 'The Multiple Drafts Model . . . brusquely denies the possibility in principle of consciousness of a stimulus in the absence of the subject's belief that it is conscious.' (p. 132)

model—they are to be found in later chapters of *Consciousness Explained* or in other works. Indeed some of the arguments appealed to here are not made explicitly in *any* of Dennett's writings on consciousness, and will be noted as such.

Nor is this paper intended as a defence of Dennett's theory, *per se*. In the end, I suspect that the empirical premises are false and that, even if they were true, there are problems with the arguments for Dennett's conclusions. That said, as I understand them, the underlying philosophical views behind the Multiple Drafts Model are complex, insightful and original. Certainly this is an edifice worthy of reconstruction.

To begin the story, however, let us back up and see why it is that Dennett's theory has appeared so implausible to so many people, by assessing Dennett's conclusions from the point of view of the average (somewhat sceptical) reader.

## 2. *Two Models of the Colour Phi Phenomenon*

There are a number of different visual illusions of motion, dubbed phi phenomena. The *colour phi* phenomenon is an illusion that occurs when there are two lights of different colours sitting a short distance apart, say a red light and a green light (Figure 1). If the red light flashes on for a moment (150 msec.) and then goes off, followed (50 msec. later) by the green light, going on and off, one does not see two lights, red and green, flashing in sequence. Instead, the subject sees the red light moving across the screen and changing colour somewhere mid-trajectory. Importantly, this illusion is not the result of learning or expectation—the illusory motion occurs on the first trial and, by switching the order of the lights, the direction of the illusory movement can be reversed at random. It is also a persistent illusion. Even armed with the knowledge that the phenomenon *is* an illusion (that the red light does not actually traverse the space between the two lights), and even given prior warning that the display is about to occur, the subject cannot overcome the illusion—and this no matter how hard he or she tries. Finally, in the human case (as opposed to the rabbit's), we are reasonably certain that the illusion results from cortical, as opposed to retinal, processing, for illusory motion will occur using large stimuli such as triangles and squares, and the processing of these complex stimuli requires cortical processing.

On the face of it, this is an easy illusion to explain. What *must* be happening is that, based upon information about both the red and the green lights, the brain infers (mistakenly) that the red light has moved and changed colour. If the brain does not know, in addition to the position and colour of the first (red) light, the position and colour of the second (green) light, it would not know in which direction to 'move' the red light or the nature of the colour change (why to the right and why green?).

Then again, there is something odd about this seemingly undeniable

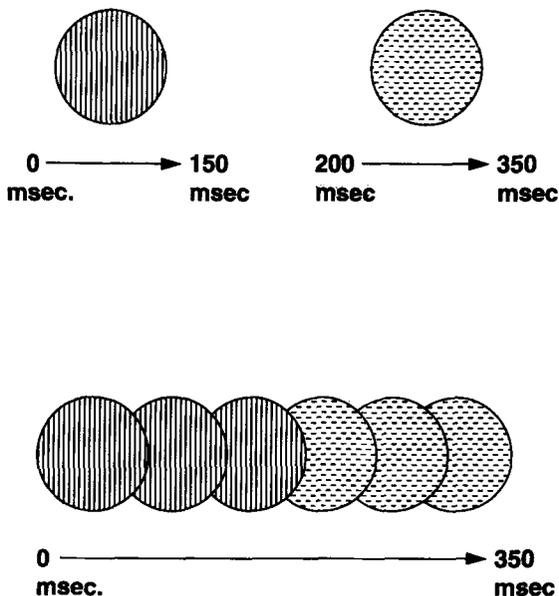


Figure 1 The colour phi illusion. Figure 1(a) shows the stimuli as presented; Figure 1(b) illustrates what we see—how the stimuli appear to us. Vertical stripes indicate the red light; horizontal dashed lines indicate the green light.

explanation. If the brain cannot draw its conclusion before both the red light and the green light have been perceived, why does our phenomenology not reflect this? We do not see the red light first, the green light second, and *then* illusory motion and colour change. We see the illusory motion interposed, as it were, between the red and the green lights. In other words, although the brain cannot infer the colour and direction of motion before information about the green light is gleaned, we *see* the motion and colour change as occurring before we *see* the green light. Exactly how and why does this occur?

Two intuitive explanations spring to mind. First, there might be a revision of perceptual input or what Dennett calls 'Stalinesque Revisionism' (named after Stalin's show trials, in which false evidence and testimony were presented against 'enemies of the state' in order to 'justify' the predetermined conclusion of guilt). Alternatively, there might be a revision in memory, what Dennett calls 'Orwellian Revisionism' (named after Orwell's novel 1984, that portrays a society in which all historical documents are destroyed or rewritten). On the Stalinesque story (Figure 2), there is a time lag between the events of visual processing and the subject's consciousness of the illusory movement: the red and green lights are 'perceived' (unconsciously); various inferences about those events are made; the conclusion that the red light has

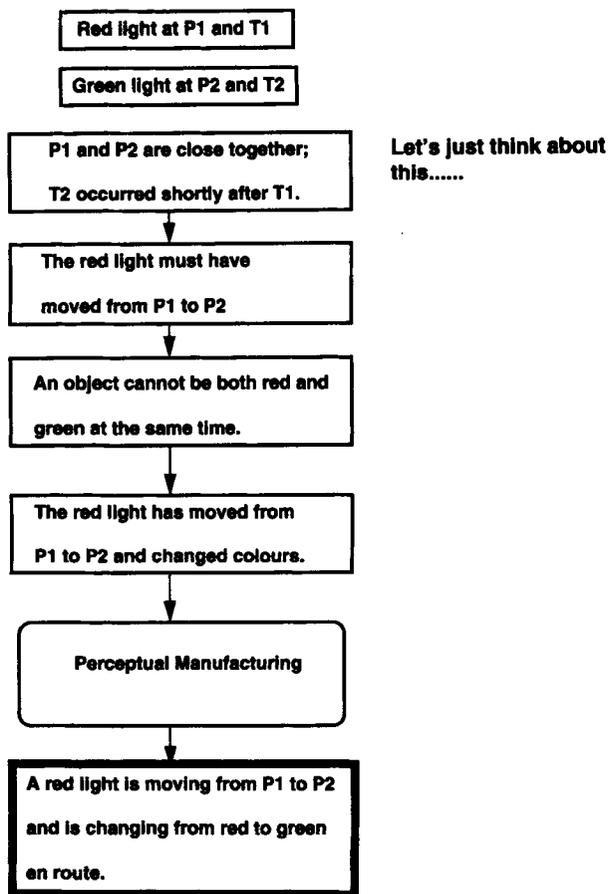


Figure 2 *The Stalinesque Model (perceptual tampering)*. The cognitive sequence goes as follows: first, the subject perceives (unconsciously) a stationary red light and then a stationary green light; then there is a series of propositional inferences that result in the conclusion that the red light has moved and changed colours; a visual state is manufactured, and finally; the subject has the conscious experience of the red light moving and changing from red to green. A double-outline around a box indicates conscious awareness.

moved and changed colour is reached, and finally a visual (as opposed to a sentential) representation of the entire event, complete with intervening movement, is created. It is this doctored representation that the subject experiences, long after the actual events in the world have come and gone. On the Orwellian story (Figure 3), however, the train of processing events begins with two conscious experiences—an experience of the red light flash-

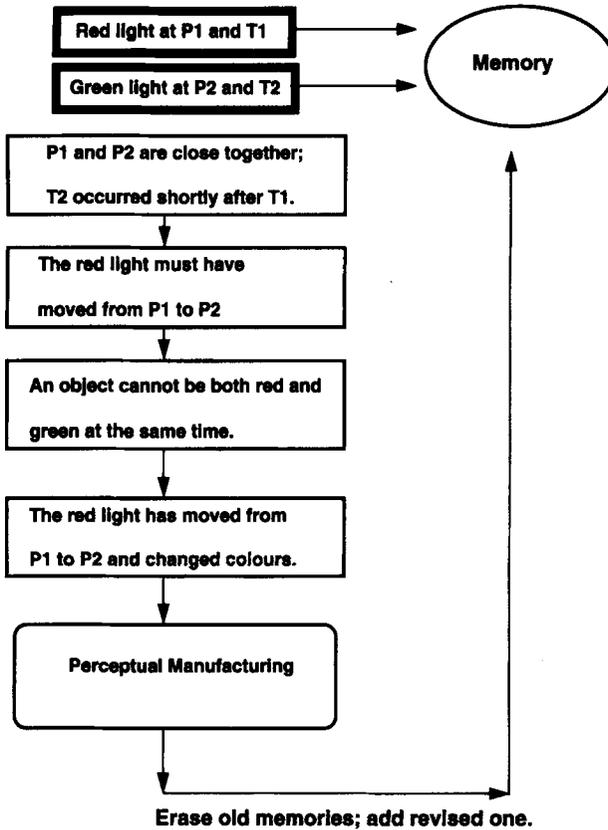


Figure 3 *The Orwellian Model (memory revision)*. The cognitive sequence goes as follows: first the subject consciously experiences a stationary red light and then a stationary green light; simultaneously, memories of these experiences are produced and stored; then there is a series of propositional inferences that result in the conclusion that the red light has moved and changed colour; a visual state is manufactured, and finally; the memories of the original perceptions are erased and replaced with the new manufactured visual 'memory'. A double-outline around a box indicates conscious awareness.

ing on at a certain place and time and an experience of the green light shortly thereafter, at a small remove. Following these experiences, the very same steps as postulated on the Stalinesque model occur: the same inferences about motion and colour are made, a final conclusion is drawn, and a perception is manufactured. Then, however, a divergence occurs: the memories of the initial conscious perception are erased and the new perceptual conclusions are placed in memory. All of this, we suppose, happens nearly

instantaneously. So when the subject wants to know, a mere moment after the event, what he or she experienced, the answer is found in memory. The subject 'remembers' seeing the red light move from left to right and change colour mid-trajectory. Or more precisely, on the Orwellian model, he experiences himself as having experienced the motion and colour change.

Note that the central difference between these two stories is only the stage at which consciousness is postulated to have occurred. Both models posit the same sequence of events, a sequence that begins with two *perceptual events*, followed by a series of *inferences* and that ends with the *rendering* of the conclusion into visual form. On both models, each event has a propositional content (indeed the same propositional content), each event occupies a determinate position within the sequence, and each event has a dateable time of occurrence. Most importantly, the obvious functional difference between the two models is of no theoretical consequence: it does not matter that the Orwellian story posits a process of memory storage and revision while the Stalinesque story does not. If one were to add the storage and deletion processes postulated by the Orwellian model to its Stalinesque counterpart, the intuitive difference between the two models would remain. Suppose, say, that on the Stalinesque story, there is a record-keeping procedure that stores the *unconscious* percepts 'Red spot at T1 at P1' and 'Green spot at T2 and P2' until the final perceptual result is rendered (Figure 4). After the inferential process is finished and just as the final conclusion is experienced, the stored unconscious percepts are erased and replaced by a memory of what has just been experienced. This would eliminate the obvious functional difference between the two models, while retaining the core of the distinction. The Orwellian model still postulates two distinct conscious perceptions of the red and green lights prior to inferential processing; the Stalinesque model still attributes a single conscious perception of motion at the end of processing. So the *prima facie* functional differences are not at the heart of the distinction.

Looking at both these serial models, side by side, it is easy to see why Dennett's readers have found his conclusions so implausible. Consider conclusions C1 through C4. C1 states that there is no difference between perceptual and inferential events, yet there is a clear demarcation on both models between the initial perceptions of the red and green lights (even though, on the Stalinesque model, these are unconscious 'sightings') and the inferential processes that follow. Contrary to C2, there certainly seem to be 'fixed facts' about our conscious experiences prior to the perception of illusory motion. Because each model posits a sequence of distinct propositional events, we can ask of each such event whether or not the subject was conscious of it: we can run through the sequence asking 'was the subject conscious of this one?' At least in principle, there ought to be an answer, 'yes' or 'no', each time this question is asked. Indeed, it is precisely because these questions can be asked, that there is a clear and coherent distinction between the Orwellian and Stalinesque models and between the processes of perceptual tampering and memory revision. Thus neither C3 nor C4—the views that

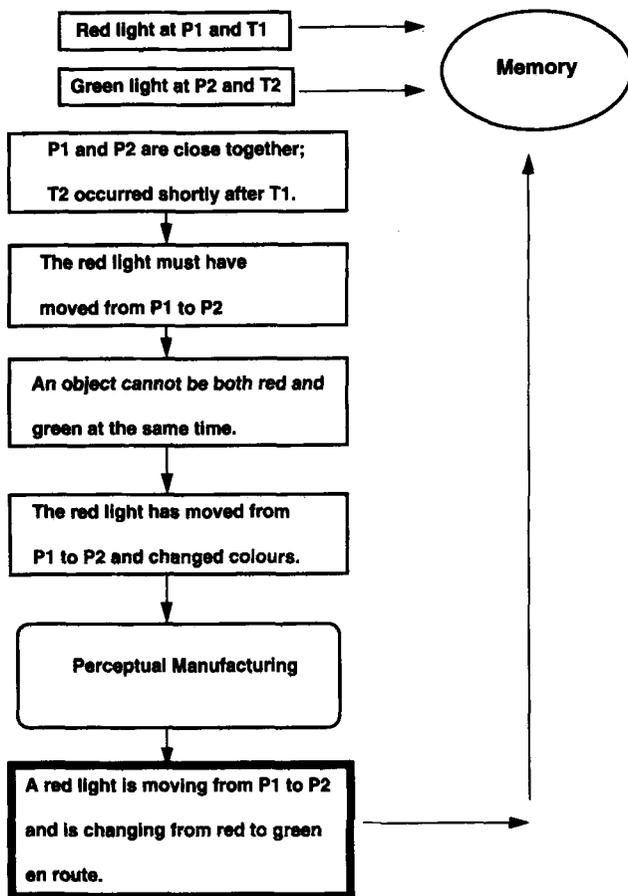


Figure 4 *The Stalinesque Model with the addition of memory*

there is no distinction between perceptual tampering and memory revision nor between the two kinds of models—seem plausible.<sup>7</sup>

For similar reasons, C5 is also mysterious. If each representational event occurs at a determinate time in the sequence, then there is no reason why we cannot accurately date each and every conscious experience. We can imagine a time line running from the top of the processing sequence to the bottom; we need only determine which events have entered the subject's

<sup>7</sup> Ned Block makes this point in his response to Dennett and Kinsbourne, 1992 (Block, 1992, 205). As he points out, '(t)he difference between *some* such phenomenal experience and *no* such phenomenal experience is an 'inside' difference if ever there was one.'

conscious awareness and locate those events on the time line. In principle at least (if only we had a time piece accurate enough to clock neural events), each event has a determinate and determinable time of occurrence.

Finally, consider C6, the claim that conscious experience is necessarily subjective, that it does not admit of an appearance/reality distinction. At least on the Orwellian model, there *is* a clear distinction between how things *seem* to the subject and what the subject actually experiences—how your experiences seem to you versus how they are. A moment after the perceptual conclusion is deposited in memory, it *seems* to the subject, on suitable reflection, that he has seen the red light move and change colour—but he has not. Then again, although the subject *has* seen the sequential independent flashes of the red and green lights, it does not *seem* to him that he has. It seems to him that he has not. Indeed, if all perceptual processing turned out to be Orwellian, our experiences would have the following paradoxical nature. On the one hand, there would be numerous conscious states—all those that occur midstream, in the course of processing, the memories of which are erased—to which we would not admit ownership. ('I certainly didn't see *that!*' you might say about each of the individual lights). On the other hand, we would lay claim to numerous 'conscious' states which we had never in fact had. ('I most certainly did see the light move!' you might say.) Paradoxically, we would be 'aware' of only those perceptual conclusions of which we were not, in fact, conscious! So the Orwellian model amounts to a radical denial of the appearance/reality distinction for conscious events—certainly not one that anyone to date, with the possible exception of Ryle, has made. None of Dennett's six conclusions, then, seem plausible when presented against the backdrop of these two models.

It is important to realize that Dennett, himself, would not find these conclusions dispiriting. On the contrary, I suspect he would wholeheartedly endorse the above summary of the problem. If we attempt to explain the colour phi phenomenon with either of these two intuitive models, Dennett would reply, the six conclusions do *not* look plausible. But this is to agree that our intuitions—and therefore the models—have led us astray. It is *because* the models explain the colour phi phenomenon by appeal to a serial inferential process that the conclusions, C1 through C6, seem so unlikely. If these intuitions of serial processing are excised and a genuinely parallel model given, the conclusions will no longer appear implausible. On the contrary—or so Dennett wants to claim.

### 3. *Explaining the Premises*

Let us turn then to the six central tenets of Dennett's argument, examining each in turn, to see more precisely what each one says and why Dennett believes each to be true.

3.1 (T1) 'All varieties of perception—indeed all varieties of thought or mental activity—are accomplished by parallel, multi-track processes of interpretation and elaboration of sensory inputs.'

Although Dennett's Multiple Draft Theory is intended as a general theory of consciousness—that is, to explain all manner of conscious phenomena—at the heart of the view is a research finding about *perception*: that complex mammalian sensory systems consist of numerous distinct processing sites, some cortical and some sub-cortical, that are often spatially remote, one from the other. More specifically, I suspect that Dennett had in mind, given the predominance of visual examples in the text, the mammalian visual system, as illustrated by Van Essen's composite 'wiring diagram' of the macaque visual system (Figure 5) (well, perhaps not *exactly* what he had in mind).

David Van Essen's illustration draws together the research findings of about three decades of neuroanatomical and neurophysiological research. The net result, you will agree, looks a bit like a map of the London tube system run amuck, say the state of the London tube in 2050—or better, given that there are interconnections between each 'stop', what the present London tube system would look like if there were a reasonably direct route from every subway station to every other one. The macaque visual system, as we now understand it, is a system with 26 identified cortical visual areas, with 187 connections between them. A close look at the details of this diagram reveals that the visual system is only loosely hierarchical. For one, most of the connections are reciprocal or two-way connections: in general, information travels in both directions along a single route, both 'up' and 'down' between levels, and back and forth between sites on the same level. Thus, right at the outset of processing, there are as many projections back to the retina from the lateral geniculate nucleus (LGN) in the mid-brain as there are lines that travel up from the eye towards the brain (this is not shown on the diagram, because it begins at the LGN); while there are routes from V1, primary visual cortex, to V2, secondary visual cortex, there are also paths back from V2 to V1 and so on all the way up through the system. Second, there are direct routes from lower levels to higher ones, routes which bypass the intermediate structures. For example, there are routes from primary visual cortex, V1, to areas MT, PO, V4t, and V4, all of which bypass V2 (that is, skip a level); there are direct routes from V2 to V3A (one level above), to MT (two levels above), MSTI (three levels) and FEF (four levels). So the nature of the connections gives us good reason to believe that, functionally, vision is as much interactive as hierarchical. To put this somewhat more graphically, imagine how the processing of a single stimulus occurs in this system. Here, one should not visualize the information about a certain stimulus seeping upwards through the system, from the bottom to the top, from the LGN to the highest areas of visual cortex. When processing, say, information about the red light in the colour phi phenomenon, 'redness' (information about the red light) does not start at the bottom and creep towards the top. It is more realistic to imagine that the information about a

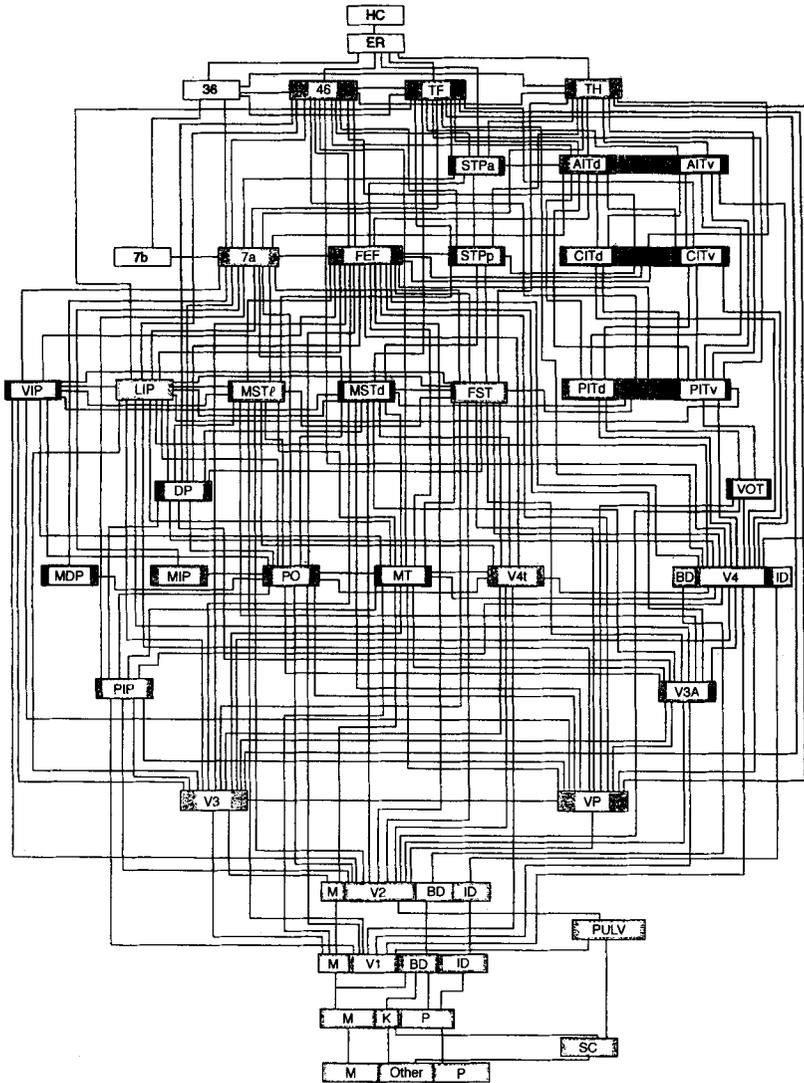


Figure 5 Diagram of the macaque visual system, showing 32 visual cortical areas, two sub-cortical visual areas (the retina and the lateral geniculate nucleus) and several non-visual areas. From Van Essen and Deyoe, 1995, p. 388. In M. Gazzaniga (ed.), *The Cognitive Neurosciences*. © 1995 Massachusetts Institute of Technology. Reprinted with permission.

stimulus initially flows serially through the lowest levels of the system (the LGN, V1 and V2) and then, thereafter, quickly reaches sites on multiple levels, sites which simultaneously process information about one and the same stimulus. Hence, Dennett's reference to 'parallel, multi-track' processes.

What, then, according to Dennett, occurs at each stop? In his own terms, individual perceptual modules carry out 'content discriminations', 'content-fixations' or 'feature detections' while non-perceptual or cognitive sites arrive at 'decisions' or 'judgments', or perform 'processes of interpretation and elaboration'. Thus, in vision, the various sites in Van Essen's diagram serve to extract, from the retinal signals, information about specific properties or features of the visual scene. If I see before me, say, a red spherical object, bouncing up and down, then on this view there are modules that infer the presence of these properties—of redness, roundness, up-and-down motion and so on. In essence, each stop serves to detect or describe a certain set of features of the visible external world, its objects and properties.

It is this particular way of portraying the visual system, however, that gives rise to a puzzle about our conscious visual experience, a puzzle commonly called the 'Binding Problem', or, in this particular guise what I will call the 'Spatial Binding Problem'. Suppose, once again, that you are looking at a shiny red ball, bouncing up and down, six feet in front of you and to the right. On this 'property detection' view, all the properties of the single object in the visual scene are discerned in spatially distinct locations throughout the brain. Yet despite the spatial disunity in the representations themselves, our perceptions of the world are spatially unified and coherent: we see a world of objects, properties and events—in this case, a single red ball, at a particular location, bouncing up and down. How, then, do the disunified representations throughout the brain manage to support a perceptual experience of a unified world of objects and events? If there are only individual representations of properties, scattered willy-nilly throughout my brain, why do I see *one object*, this ball in front of me, as spherical, red, and bouncing? This is a problem that Dennett's theory of consciousness must resolve given his assumption of parallel processing—or as we shall see shortly, a problem that he attempts to dissolve.

3.2 (T2) *'The spatially and temporally distributed content-fixations in the brain are precisely locatable in both space and time.'*

Given that, on Dennett's view, each module is engaged in determining certain features of the world (or certain properties of the stimulus) by ordinary computational means, there is nothing 'mysterious' about these computational processes themselves or their results. It is possible (at least in principle) to 'clock' each such computational conclusion. If asked 'when did V4 determine that the light was red?', there is a precise answer to this question—or as precise an answer as the clock permits.

3.3 (T3) '*Feature detections or discriminations only have to be made once.*'

This third tenet is probably the most puzzling of the six, for it is, as Dennett knows, false. If T3 is understood as the blanket empirical claim that the computational brain never covers the same ground twice—never addresses the same informational problem more than once, does not use the very same sensory input, reduplicated, for a number of different tasks, that single modules never send 'copies' of their results to other modules for use in further computations and so on—then it is surely false. There are a host of reasons (anatomical, computational, and evolutionary) why the reduplication of information does occur and, moreover, why we can expect, in our further investigations, to find 'more of the same'. Why, then, barring ignorance of these facts—and Dennett is not ignorant of these facts—would Dennett be wedded to this thesis?

The most charitable interpretation of this claim is that Dennett has simply overstated his case. The point of this third premise is not that 're-representation' *never* occurs. Rather, Dennett wishes to warn us that the reasons which often lead us to posit re-representation are bogus—and bogus even though such reasons may seem natural to us given our pre-theoretical views about our perceptual experiences and hence the kinds of representational states that are likely to underlie them.

First, and least controversially, Dennett is arguing against the existence of a Cartesian Theatre or against the view that consciousness requires a 'central stage' where all perceptual conclusions are brought together for inspection by an Inner Observer. In particular, we ought not to think that the Spatial Binding Problem, for visual perception, will be solved in this way—by positing a single place where all the spatially disunified representations of the properties of a visual stimulus can be brought together into a spatially cohesive whole, such that an inspection of that whole will precipitate a spatially unified experience. Dennett is warning us against positing reduplication in the service of 'collection' or 'inspection'. As there are no such processes of inner inspection, 'they' do not require re-representation.

Second, and more interestingly, Dennett wants to deny two interconnected theses about perception. The first is a general view about perception; the second view, a corollary of the first, is about the nature of perceptions within a single perceptual modality.

The first view, call it the Naive Theory of Perception, is the thesis that properties of the world must be represented by 'like' properties in the brain, and that these representations, in turn, give rise to phenomenological experiences with similar characteristics. Thus, a very naive person might imagine that viewing a red rose gives rise to a red-coloured representation in the brain (a representation coloured with neural 'pigment'), which results in a visual image of a red rose, an image which is itself 'red' in some metaphorical sense (as Dennett would say, an image that is 'coloured' with some mental property, 'figment'). Less naively, one might imagine that looking at an armchair results in a two dimensional picture of the armchair on the

retina and at various places in visual cortex, pictures that result in a visual experience of the armchair which is, itself, somehow 'chair-shaped' or, more vaguely, 'spatially extended'.

As Dennett points out (Dennett, 1991, pp. 85 ff.), there is no a priori reason why representational vehicles *must* themselves exhibit the properties represented—why colour needs to be represented by coloured symbols, why the spatial relations of the world must be mimicked by the spatial relations between various symbols in the brain. A red rose need not be represented by a red representation or a chair by a chair-shaped representation. This is a thesis, I take it, with which most philosophers and neurophysiologists would agree. More controversially, however, Dennett also holds that there is no a priori reason why the physical properties of representations must be like the properties of the experiences which they support—why an experience of an object *as* coloured requires a coloured representation, why an experience of a cube *as* a cube must involve a cube-shaped representation or even a square one, why the experience of an event as occurring at time T1 requires a representation that itself occurs at T1 and so on. *By Dennett's lights, the only a priori restriction on the relation between types of experience and types of representation that we need acknowledge concerns their contents: the contents of any conscious mental event must be underwritten by a neural representation of 'like' content.*<sup>8</sup> So, for example, a subject's experience of a red rose might result from a neural representation of the rose's shape given in the co-ordinates of a viewer-centered co-ordinate system and from a representation of the rose's colour given by a set of ordered triplets, numbers representing the firing rates of each of the three colour receptors. One sees a rose just insofar as there is a representation(s) with the appropriate content, with the content 'there's a red rose in front of me now'.

If the above conjecture is true however—if only the content of the representation must 'match' the phenomenology—then there is no need to posit a second stage of sensory processing whereby the perceptual conclusions already derived are then rewritten into the proper phenomenology-inducing representational form. If I have a conscious experience of a red rose, there need not have been any process which has 'translated' the viewer-centered spatial co-ordinates (the abstract shape representation) and the ordered triplets of colour representation into a red, rose-shaped structure in my visual cortex. To posit such a translation only exposes one's implicit commitment to the Naive Theory.

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<sup>8</sup> I have argued in Akins and Winger (in press) that Dennett holds an even stronger thesis, namely that it is the content of neural 'judgments', not their form or structure, that is 'transparent' in conscious experience. The very 'feel' of our phenomenology, in all its apparent complexity and variety, in some sense 'is' the representational content of a 'narrative stream', a stream that has been precipitated by particular probes or questions. In conversation, at least, Dennett has agreed that this is the implicit view that motivates the Multiple Drafts Model. This fact will become crucial later on, in the reconstruction of Dennett's argument for C5.

As a corollary, Dennett also denies that the sensory experiences of a particular modality (visual, auditory, olfactory, tactile or gustatory experiences) require a unitary underlying form of representation. Visual phenomenology, for example, does not require a certain 'imagistic' form of neural representation. Thus if I visually examine a red rose, noting its richness of colour, perfect shape and velvety texture, I have this experience in virtue of the perceptual conclusions reached by a variety of visual modules (the colour module, shape module, texture module and so on), each of which might use a different representational system and different syntactic conventions. Taken together, these conclusions result in the paradigmatically visual experience that I now have—of the red, velvety, perfectly shaped rose—even though each conclusion is represented in a distinctive representational form. In other words, according to Dennett, *heterogeneous representational forms can give rise to a seemingly homogeneous experience*. But if so, then a visual experience (or any other kind of sensory experience) does not require any 'rewriting' of the modular conclusions into a single representational form. Looking back at the Orwellian and Stalinesque models, then, it is clear that one common step of both those models can be removed, namely the process of 'perceptual manufacturing'. There is no reason to posit a step that renders the conclusions of an inferential process into the requisite phenomenological form.

3.4 (T4). *'Distributed content-discriminations yield, over the course of time, something rather like a narrative stream or sequence, which can be thought of as subject to continual editing by many processes distributed around in the brain, and continuing indefinitely into the future.'*

Suppose one were to construct a 'time line' on which the computational events of vision, for a particular visual task, were recorded—in this case, the time line of visual events that occur during the processing of the colour phi stimuli. What exactly would this time line look like?

Even when we consciously set aside the Stalinesque and Orwellian serial models, it is tempting to imagine, given our orderly coherent experience of the world, that the conclusions on the time line largely mirror the order of the events perceived—that the conclusions are orderly and consistent. One might imagine that the time line begins with a segment devoted to all and only the computational results about the red light (that it occurred at a certain place and time and that it was round, bright and red), for this is the external event that happened first; that next segment of the time line will record the conclusions about the green light, for it occurred second, and that only then will various computations occur that interpolate the intervening events. One might also expect that the properties discerned form a coherent set—that is, that the time line contains a set of properties that the world could possibly have, that it 'describes' a way the world might possibly be. Intuitively, we expect the time line of a parallel process to respect the canons of good narrative—to be an orderly consistent account of some possible series of events.

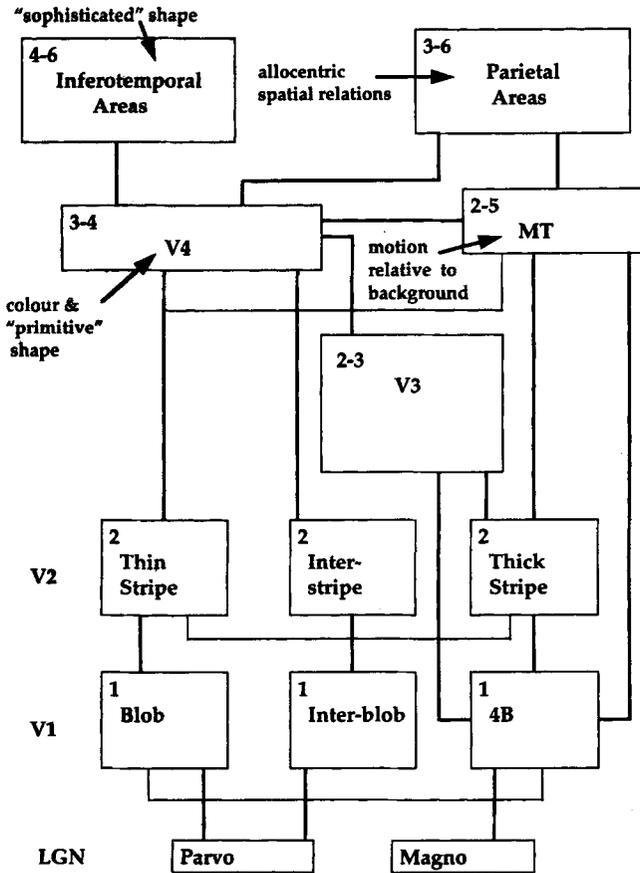


Figure 6 Simplified diagram of the primate visual system, showing two main pathways for visual signals, the parvocellular and magnocellular pathways, and the visual functions that have been associated with the selected cortical areas. Numbers in the corner of each box indicate the number of connections between that site and the LGN.

Turn now to a parallel model of colour phi processing (in reality only a 'schema') of what might go on when we see illusory motion of this kind. If a realistic model were to be made, it would no doubt have each and every site illustrated in Van Essen's diagram. For our purposes, however, we will use a much simplified diagram that includes only a few of the cortical areas that would actually be involved in creating the colour phi phenomenon (Figure 6). This diagram illustrates two major pathways of visual processing, the Magnocellular and Parvocellular pathways, which start at the Lateral Geniculate Nucleus (LGN) of the thalamus (the mid-brain structure that

receives input from the retina). The LGN serves to 'relay' the information, in the two (more or less distinct) paths, to primary and secondary visual cortices (or V1 and V2). From there, information travels to a number of functionally distinct cortical sites, each of which has been associated with specific informational tasks: area V4 represents 'primitive' shape and colour information; MT assesses motion relative to background; the parietal areas are concerned with spatial processing, in particular with the representation of allocentric position (as opposed to retinal position or egocentric position), and the Inferotemporal areas provide what one might call 'sophisticated' shape information, information about three dimensional shape. For simplicity, the schema leaves out the weak lateral connections shown in the Van Essen diagram; it is also assumed that the connections between areas at different levels are not reciprocal—that is, that contrary to fact, information goes up but doesn't come down.

Note that each box or cortical site is labeled with a numeral or set of numerals, '1' or '2-4' and so on. These numerals represent the number of neural connections between the indicated cortical area and the Lateral Geniculate Nucleus in the thalamus. Using the subway metaphor, you can think of these as the number of stops between the LGN and the final destination. So, for example, the Blob region of V1 (yes, this is a technical term) is one connection away from the LGN by the Parvo path, while the Thin Stripe region of V2 is two stops away by that same route. Other cortical sites, however, can be reached from the LGN by multiple paths. For example, there are three different routes to MT, which have between two and five stops each. The most direct route (two connections) goes from LGN, on the Magno pathway, through 4B in V1, then directly to MT; the most circuitous route goes from LGN to V1-4B, to V2 Thick Stripe, to V3, then to V4, and finally to MT (five connections).

The significance of multiple pathways for visual function will be discussed later, but here there are two points that are relevant to our purposes. First, multiple pathways serve to extend the period of time over which information about a single stimulus is received and processed. Imagine, for example, five people, a rowdy group of football fans, who set out on the London tube, starting at Earl's Court and agreeing to meet at King's Cross. Each fan, however, decides to take a different route. Some time later, they will begin to show up at King's Cross. Even with all the luck in the world (always helpful in dealing with London Transport), no doubt the first person will have to wait a few minutes before the very last person from the group appears. Theoretically, at least, the time of each person's trip is a function of the total distance travelled, plus the number and length of the stops along the way (here a constant velocity is assumed). Depending upon the routes chosen, the trips will be of varying lengths. Hence, there will be a period of time over which the multiple travellers with the very same departure time will arrive. Similarly, for neural 'travellers' or signals about a single retinal stimulus.

Second, if the routes to a single site are suitably different, both in distance

traversed and in the number of stops along the way, there may be an overlap in the processing of stimuli which originate in successive retinal images—the *simultaneous* processing of *serial* stimuli. Imagine, again, another group of five people, fans of a different team, call them the Greens, who set out from Earl's Court about five minutes behind the first group, call them the Reds. The Greens, too, will arrive individually at King's Cross, across some period of time. Those Greens who take the most direct and shortest routes, however, might well arrive *before* the slowest travellers in the Red group, the Reds who took the longest routes. The speediest travellers in the second group will arrive before the tardiest travellers of the first. Hence the arrival at King's Cross of the Reds and Greens will overlap. Similarly, in the visual system, those cortical visual sites to which there are multiple routes may receive information about later stimuli, before all the information about earlier ones has been received. Thus there will be *simultaneous* information processing of signals carrying information about *sequential* stimuli, such as the red and green lights.

Figures 7 (a) through 7 (h) show the flow of processing activity through the various visual areas during the colour phi phenomenon. The time factors are as follows: a stimulus time of 150 msec. for both the red and green lights; an inter-stimulus time of 50 msec.; a retinal processing time of 50 msec; a travel time between sites of 10 msec. per level and; a decay time (during which activity tapers off) for processing of 50 msec. (For those readers who have noticed the odd fact that the model does not include any computation time, this oddity will be taken up momentarily.)

How does the activity proceed? At about 75 msec. after the red light flashes on, the first signals reach the visual cortex at V1. From there, information about the red light flows upward through various sites and by about 100 msec., all of the cortical sites are processing information about the red stimulus. This processing continues through 250 msec., fully 100 msec. after the red light turns off. Next at the 260 msec. mark, the LGN receives its first information about the green light (which came on at the 200 msec. mark), information that briefly overlaps with information about the red light. Again, at 270 msec. and 280 msec., there is a brief overlap of the red signals with the green signals in V1 and V2 respectively. Things become interesting, however, at around 290 msec. At this point, the higher cortical areas involved in providing information about shape, colour, motion and location, are simultaneously processing information about both the red and the green lights. Because there are a number of different routes to each cortical site, information about both lights will be received numerous times, presumably by the shortest paths first and then by the longer paths. Finally, between 330 and 460 msec. the visual system continues to 'think about' the green stimulus. And by 500 msec. the processing is finished, fully 150 msec. after the end of all events in the external world.

(I take it that the 'shape' of colour phi processing is reasonably similar to the above model, although note that the simplifying assumptions make this a very conservative model, one that underestimates informational overlap.

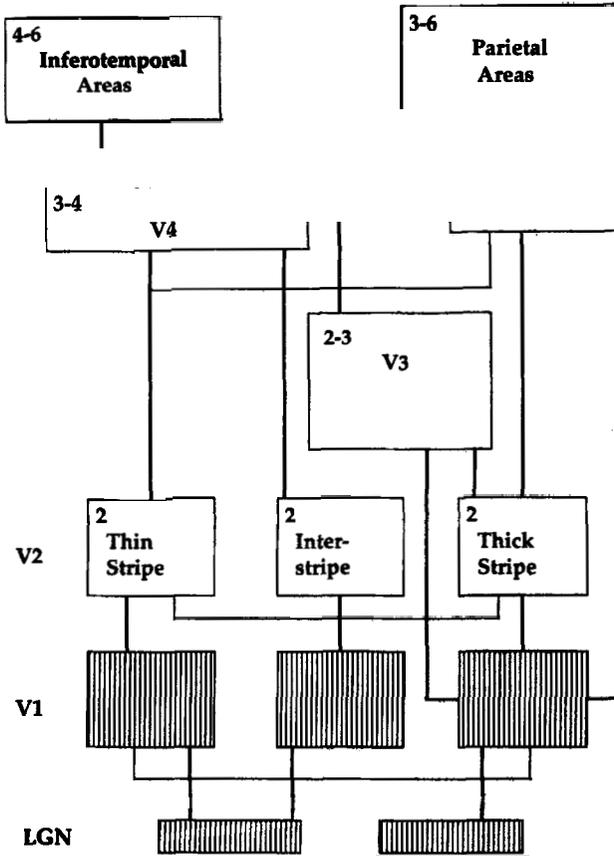


Figure 7 (a)  $T = 75$  msec. Figures 7 (a)–(h) show the progression of retinal information through the visual system during colour phi processing. Vertical stripes = information about the red light; Horizontal dashes = information about the green light; Cross-hatched areas = information about both lights.

If the parameters left out were added in, this would increase the length of activity at most sites. For example, there are no provisions made for the various distances between sites which, as we noted in the London Underground example, is a factor that affects travel time. Instead, a 10 msec. period (the shortest possible travel time between sites) was used for every exchange. So more realistic distances would add travel time. More critically, actual computational time, as I said above, was not included *at all*, there being no generally reliable data on which to base estimates of these times. Instead, there is only a decay time for activity, as if once neural activity has begun, it immediately starts to dissipate barring any further input. Moreover,

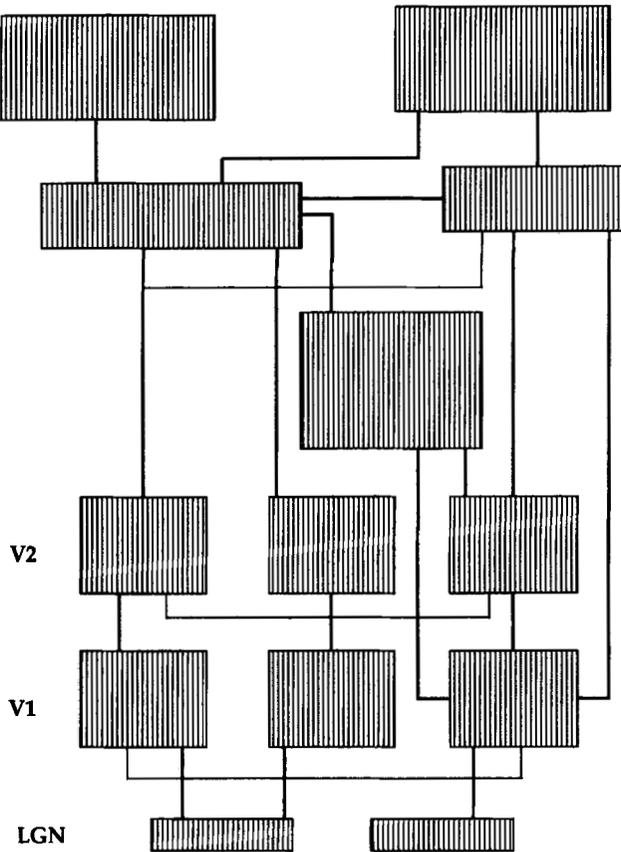


Figure 7 (b)  $T = 100\text{--}250$  msec. Note that the red light goes off at 150 msec. while the green light comes on at 200 msec. No information about either of these external events has reached visual cortex during this time period.

because there is no computational time at all, and given that there are no reciprocal connections between higher and lower modules, the model does not represent any additional computational time for resolving answers in the face of inconsistency. Had various complications such as these been added in, one would see longer periods of activity at most sites and presumably, longer periods of overlapping activity between the higher sites as well.)

One rather large problem with this model is that we do not know exactly what happens in each module. Hence we cannot say exactly how the colour phi phenomenon comes about. We can imagine, though, a few plausible tales, consistent with Dennett's views given in T1. For example, between 90 and 270 msec, area MT receives information about the red light alone.

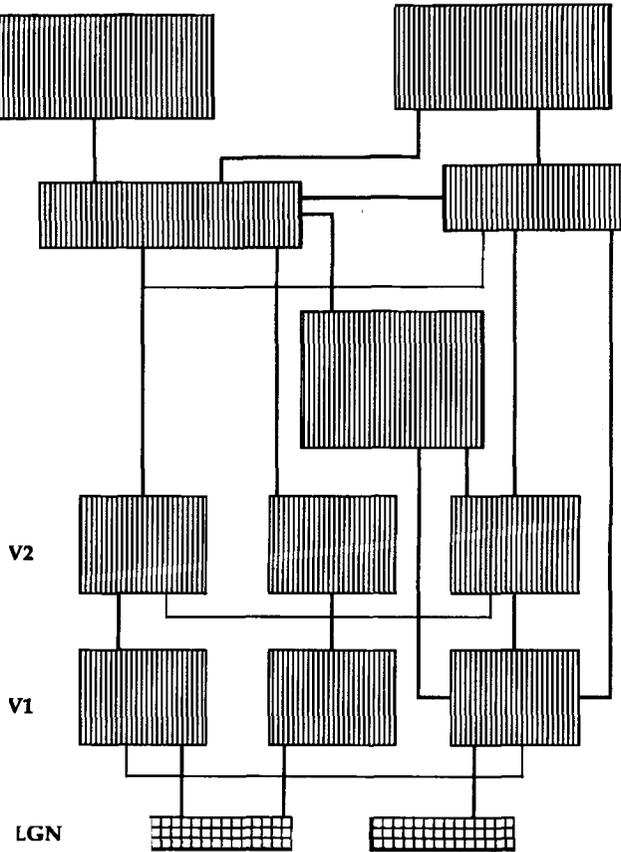


Figure 7 (c)  $T = 260$  msec.

Suppose it deduces that there is no motion. At 280 msec., MT, in advance of area V4 and the Parietal areas which are at least 3 connections away from the LGN, receives information about the green light; given the spatial proximity of the two stimuli, MT ought to draw the preliminary conclusion that the first stimulus has moved. In the meantime though, area V4 has received independent information about the colour of both lights. Presumably V4 has reached the conclusion that the first light is red and round, and is working towards discerning the colour and primitive shape properties of the second light; slightly later, the Parietal areas, now with the provisional conclusions from MT in hand, begin to calculate the allocentric location of the green light. Of course, if there were a moving red light in the world, then the answers from V4 (about colour and 'shape') and the Parietal areas (about location) ought to be consistent with MT's conclusion about movement—namely, if the light moved, then it ought to have changed allocentric

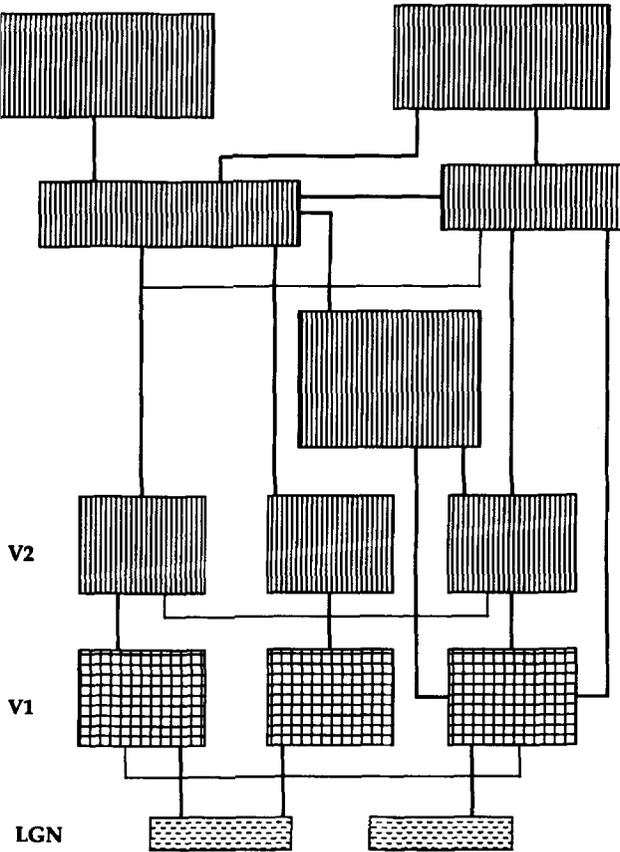


Figure 7 (d)  $T = 270$  msec.

locations while remaining the same colour and 'shape'. The problem arises when V4 concludes that the second light is green. How can this be resolved? If the first and second lights are the same object, then surely they will have the same three-dimensional shape, not merely the same two-dimensional extension in the retinal image or 'primitive' shape. This is information that the Inferotemporal areas can provide given enough computational time. So while V4, MT and the Parietal areas all re-examine their answers in light of the other areas' conclusions, the IT areas draw the common inference that the shape has remained constant. The largest consistent set of conclusions, then, 'portrays' the spot as having moved, changed position and changed colour from red to green—no doubt the set of conclusions upon which the system comes to settle. This is one way of imagining how the informational story, prior to a probe, might go.

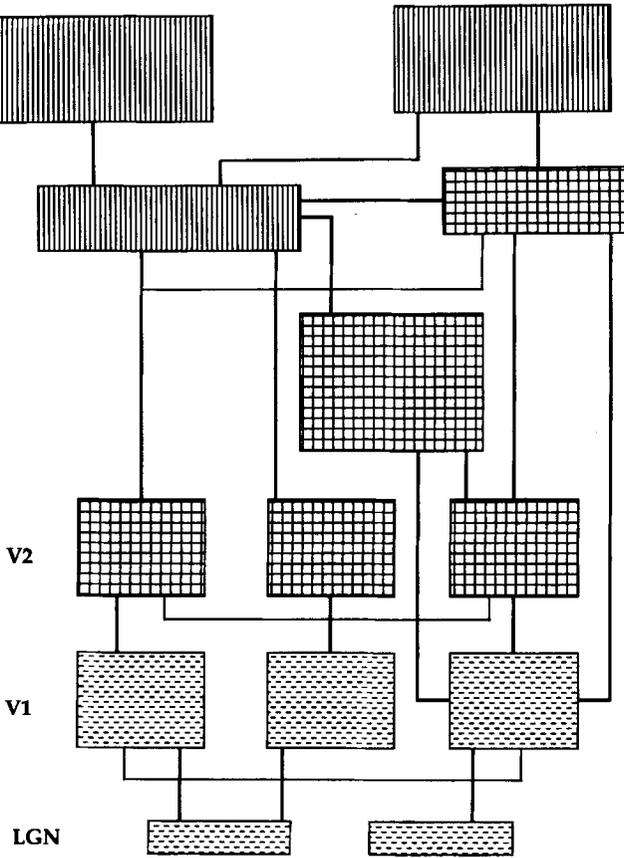


Figure 7 (e)  $T = 280$  msec.

Return now to the question with which this section started, namely ‘why do content discriminations yield something that is only *rather like* a narrative stream?’ The canons of good narrative, as I said above, prescribe a story that gives an orderly, consistent account of some possible series of events, of some way the world might be. But any set of conclusions, produced during the course of parallel processing, is unlikely to meet these demands. The order in which modular conclusions are reached need not reflect the order in which the events in the world actually occurred. Moreover, any set of conclusions, reached at any arbitrary moment, will often be inconsistent. What one module ‘says’ need not cohere with or be consistent with what another module ‘says’. Hence, an arbitrary segment of the time line need not ‘describe’ any possible world. It does not describe some way the actual world might possibly be.

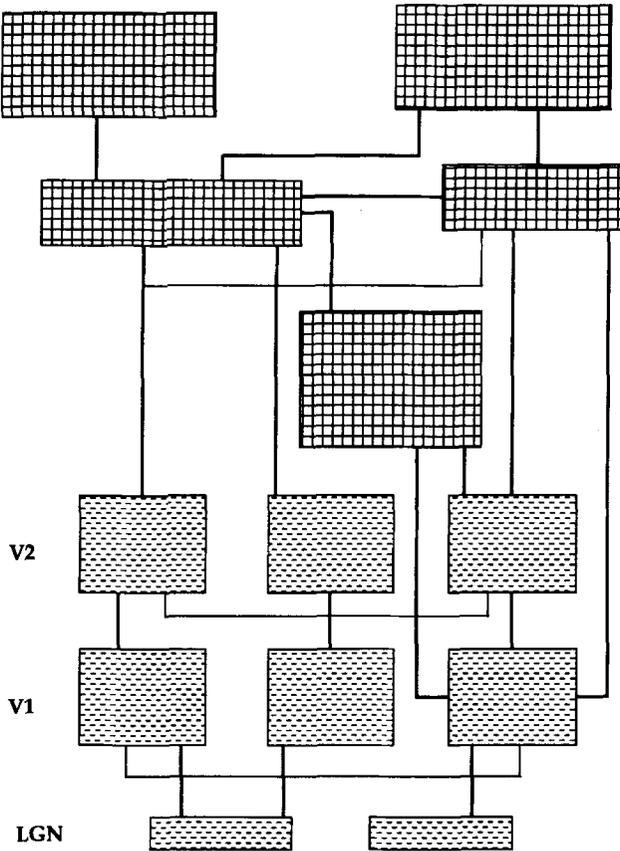


Figure 7 (f)  $T = 290$  msec.

It is important to realize that there are very general reasons, not connected with the particulars of this example, why good narrative is unlikely to be produced in the course of visual processing. First, there are general considerations about visual processing that make it unlikely that the conclusions will occur in neat ordered sets that reflect the order in which stimuli occur in the world or the order in which signals about those events leave from the retina. For one, sites which are closer to the LGN or which can be reached by relatively direct routes with fewer stops, will receive information before their compatriots, those modules that are, as it were, later stops on the milk run. In a vaguely hierarchical system of this sort, some modules will always receive their input after all the others. Hence some modules will start processing information about a particular stimulus sooner and presumably, will finish processing sooner as well. For another, given the differences in task complexity, some computations will take longer than others to complete.

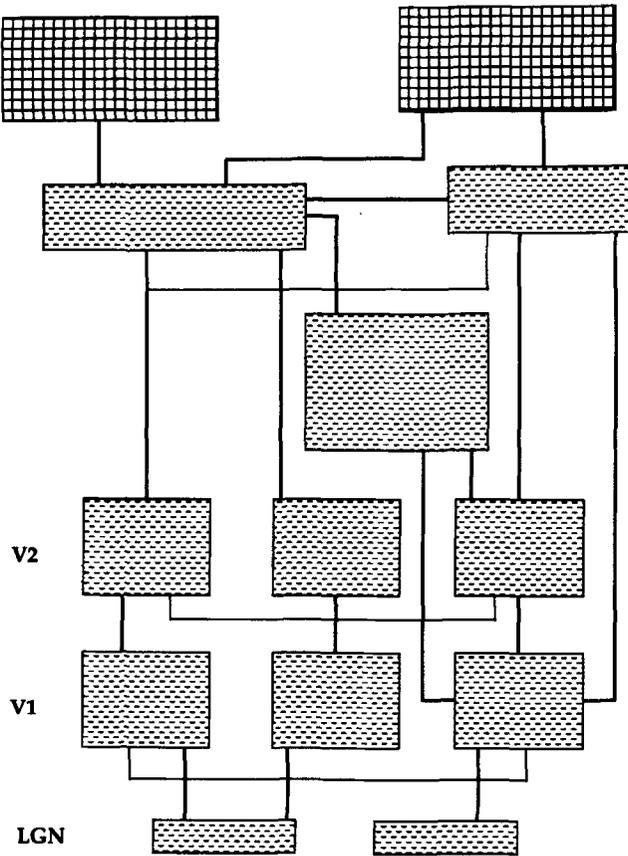


Figure 7 (g)  $T = 320$  msec.

Note that the problem here is not just that some tasks (say, shape recognition) are inherently more complex than others (say, colour naming), a difference in complexity and processing time that, all things being equal, evolution would probably have levelled by this time. Rather, differences in computational complexity are often a function of exigency, of what is out there in the world. If I have before me a red beach ball on an otherwise empty green lawn, for example, the tasks of object segmentation and shape recognition are as simple as they will ever be under natural conditions. If I am picking out weeds from an overgrown vegetable garden, however, these very same tasks of object segmentation and shape recognition will be significantly more complex. So given the vast differences across visual scenes, there is certain to be a large variability in the time of computation for a given property. For these reasons, then—variability in travel time and the

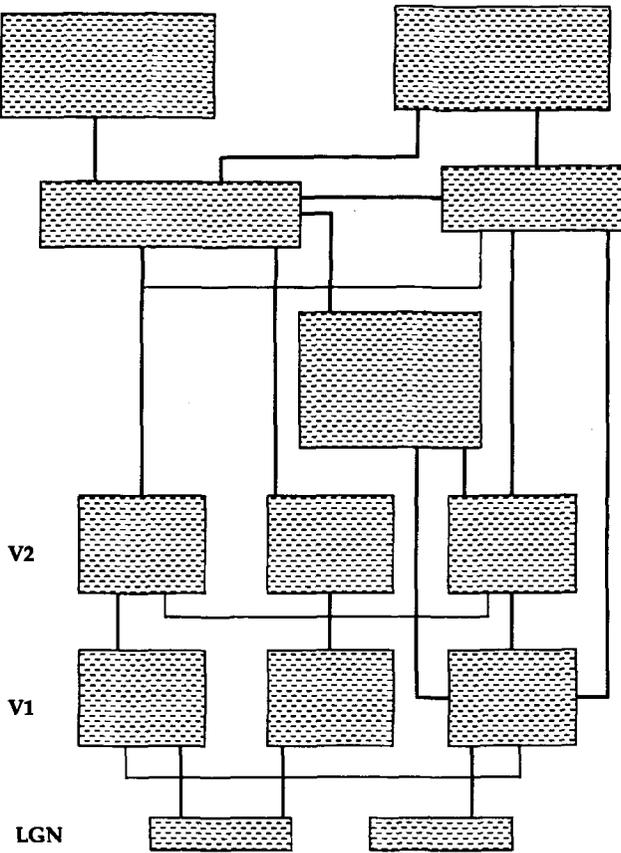


Figure 7 (h)  $T = 330\text{--}460$  msec. Note that the green light turns off at 350 msec.

sequencing imposed by hierarchical elements of the processing, plus differences in task complexity—we can expect to see some ‘jumbling’ in the order of the conclusions relative to the order of the retinal images.

Second, the highly interconnected, parallel nature of the visual system strongly suggests that it uses a particular sort of computational strategy, a strategy according to which inconsistency is actually a positive and ‘foreseen’ feature of visual function. On this theory, the problem of vision is essentially one of mutual constraint satisfaction. Given a retinal image, the brain must extract many different kinds of information about the visual scene—hence the multiple cortical and sub-cortical sites, each concerned with a different computational task. Now for each such task, the information contained in the retinal image underdetermines the desired answer, fails to provide a unique solution to the computational problem. The information

received from the retina will often be consistent with several different modular conclusions (e.g. consistent with the conclusions that a surface is convex and concave). Fortunately, however, there is only one way that the world could be and this places a strong constraint on the set of answers provided by the visual system as a whole: the set of all modular conclusions must be mutually consistent. Any single conclusion is constrained by all of the others and vice versa. Hence the form of the informational problem—a problem of mutual constraint satisfaction.

The question is then: what kind of system would most efficiently solve a very complex problem of mutual constraint satisfaction (for time is of the essence in real-time direction of movement)? And the answer is: a sloppy one. Let the individual modules employ whatever computational strategies will produce swift but only moderately reliable answers. Then impose consistency checks between modules and across time in single modules in order to reveal errors and pinpoint where lengthy, resource-consuming calculations must be made. On the assumption that consistency checks, on average, are less costly than complex but reliable computations, the system will save both time and computational resources. Errors will occur but they will eventually succumb to the world's demand for consistency, a demand imposed internally by the consistency checks. On this view of mammalian vision, then, inconsistency is an 'intended' consequence of normal visual functioning, the result of an informational strategy that seeks to maximize speed in a highly complex but interdependent system. The end result is that the answers produced in the short run will not form an orderly or consistent bunch—nor were they 'intended' to.

3.5 (T5) *'Probing this stream at various intervals produces different effects, precipitating different narratives—and these are narratives ...'*

For the reasons given above, the mere occurrence of modular conclusions need not yield a consistent or empirically possible story about external events. Yet our normal experience of the world *is* coherent; our perceptual experiences represent events and objects that are logically and empirically possible (e.g. an apple does not look both red and blue at the same time). Hence, concludes Dennett, there must be *some* process whereby a single consistent thread of narrative is selected from among the many states of affairs described, a process of unification or binding brought about by a 'probe'.

Notoriously, Dennett's notion of a 'probe' is sketchy and vague. We are told only that, in effect, a probe asks the question 'what is happening now?' or 'what just happened a moment ago?' or 'what happened at that particular time?' and that a probe precipitates the selection of a consistent set of representations for some particular time interval. We are also told that, because a probe must work with whatever conclusions are presently available, two probes about one and the same event, made at different times, will often produce quite different versions of what occurred. Indeed, as Dennett points out, if a probe is made at a very early stage of perceptual processing, some

modules may have no answers at all to offer, not even of a provisional or rough kind. Hence, probes need not yield the 'complete' story of an event; the narratives they yield need not characterize an object or event as having a determinate property as opposed to a merely determinable one. (E.g. an object that flashes by, may seem to have some colour or other, but no colour that one can describe.) We are also told that probes are initiated in a variety of ways. Sometimes in virtue of a 'call to action' by the world—when a consistent description of the world is needed in order for us to respond in appropriate ways to external events—at other times in virtue of some internally posed or self-imposed question of a non-action-guiding sort. This has the important result (a view that has become prominent in Dennett's revisions of his theory) that the bindings or unifications that occur in virtue of probes are not global or all encompassing. *Any question has an appropriate—that is, a delimited—answer.* Hence, the unifications thus engendered involve only that information required to solve the problem or perform the task at hand. Finally, we are told that probes are not a 'scheduled' process of sensory or non-sensory systems. For example, the visual system does not have a default setting such that, say, every 100 msec., it asks the general question 'what's happening in the world now?' In sum, probes are *problem-driven questions that arise irregularly in response to internal or external puzzles and that initiate the integration of select subsets of information.*

From the philosophical tenets described so far, we can also make some inferences about what probes do *not* do. They do not gather conclusions by transporting them to some special place in the brain, for that would be to postulate a Cartesian Theatre; nor do probes rewrite the various conclusions into any 'special' representational format, say a format specific to conscious visual experience. Finally, probes do not serve to re-order the selected conclusions, say by selecting all of the discriminations made within a prescribed time interval, physically constructing a 'time line' of representations (by first making sets of cotemporaneous properties and then constructing an ordered set of such sets), and then replaying this revised time line through the Cartesian Theatre. Somehow, there is 'selection' but without the processes of rewriting, re-ordering, or redirecting the representations to a single location.

3.6 (T6) *'any narrative . . . that does get precipitated provides a "time line", a subjective sequence of events from the point of view of an observer.'*

It is answers to these probes, answers to individual questions about how things stand in the world and with one's own self, that taken together form each individual's phenomenal experience—his or her 'stream of consciousness', 'subjective point of view' or phenomenology. It is important to realize here that what probes produce, on Dennett's view, is not merely a coherent set of representations; they do not merely select a set of discriminatory states with compatible contents. Rather, answers to probes are intended to bridge the gap between sub-personal, sub-doxastic property representations and the conscious psychological experiences of persons, the explicit beliefs and

judgements of the subject as opposed to the content-discriminations or 'judgements' or individual modules. Without probes, there are merely numerous content discriminations, perhaps mutually consistent, perhaps not. With probes, there is a subjective point of view, a subject's perceptual experience of a coherent objective world.

The notion of a probe, then, is both a pivotal and a mysterious one, for Dennett does not tell us how probes function—what kinds of processes could affect the unification or binding of contents and, moreover, how they might do so without revisiting the Cartesian Theatre. More pointedly, it is mysterious why Dennett thinks that this very sketchy explanation, given his anti-Cartesian constraints, constitutes a satisfactory explanation of conscious experience. This is not a point that Dennett's readers have overlooked.<sup>9</sup>

A large part of the answer, I suspect, concerns what Dennett wants to *deny*. While probes are designed to bridge the gap between modular content discriminations and first person perceptual beliefs, he wants to deny that this gap is as large as it seems. That is, he wants to hold that the Binding Problem, as standardly presented, does not constitute a genuine hurdle for any theory of perception, and hence is not a problem that the postulation of probes must solve.

Recall from above, one half of that hurdle, the Spatial Binding Problem. Given that the visual system processes different properties of the stimulus at spatially distinct sites, how is it possible that we perceive the world in the spatially coherent manner that we do? If there is not some particular place where all the various representations are brought together into a spatially coherent whole, why do we experience the world as spatially unified? A similar puzzle can be raised about our experience of external events as ordered in time, call this the Temporal Binding Problem. We saw above in the parallel model of the colour phi phenomenon that modular conclusions about a single event in the world (say the red light) will be produced, one by one, across a period of time, and moreover, that these conclusions will be inter-mixed with conclusions about previous and subsequent events (in this case, with conclusions about the subsequent occurrence of the green light). If we were to plot the neural events (modular conclusions) on a time line, we could see that the conclusions occurred in a kind of temporal jumble—the order in which the conclusions are produced does not mirror the order in which the events occurred. The Temporal Binding Problem, then, is just this: if there is no place where a re-ordering of these conclusions occurs (where conclusions about one and the same event are displayed simultaneously and conclusions about sequential events are displayed sequentially), how do we come to see an orderly and coherent world? How are we able to perceive each object as having, simultaneously, a set of

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<sup>9</sup> See, for example, the commentaries of Lloyd, Damasio, Glymour et al., Roskies and Wood, and Velmans in response to Dennett and Kinsbourne, 1992.

properties? And how do we witness coherent events that follow one upon the other?

For Dennett, both of these problems (at least as standardly presented) are pseudo-problems: both tacitly presuppose the Naive Theory of Perception. What the Spatial Binding Problem assumes is that the spatial unity of a perceptual experience must be mimicked by the spatial unity of the representational vehicles themselves: if I am to see the world as something other than a jumble of spatially disjoint properties, the representations cannot themselves be spread higgledy-piggledy around the brain. Similarly, if we perceive a world of temporally unified objects and orderly events, then the representations that underlie our experience must themselves occur in the correct temporal sequence: the temporal relations of the perceived world must be underwritten by 'like' temporal relations between our neural representations. Both puzzles assume, in other words, that the phenomenological properties of our experiences must 'match' the physical properties of the neural vehicles, that time must be represented by time, that space must be represented by space.

If we deny the Naive Theory as Dennett does, then the Binding Problem, in either guise, ceases to look intractable. Recall Dennett's view that the only a priori restriction on the relation between perceptual experience and the underlying neural representation is that the *content* of any conscious mental event must be underwritten by a neural representation of 'like' content (and vice versa). Thus, given any conscious perception of a spatially unified object located at a determinate position in external space, it must be the case that the visual system represents a set of properties *as* belonging to one and the same object and *as* instantiated in one particular place. The representational vehicles that carry this content need not, themselves, instantiate the properties they represent: representations of single, spatially unified objects need not themselves be spatially unified or singular. Indeed, it is possible—and Dennett would claim, *likely*—that a conscious visual experience of a single object is sustained by multiple, spatially disjoint representations (cf. Rosenthal, 1995). Similarly, the problem of disentangling the temporal jumble of modular conclusions can be overcome by the brain by representing the order and duration of events in some symbolic way. Through symbolic representation, the brain differentiates the order in which conclusions are produced from the order in which the 'parent' stimuli arrive at the retina. And we perceive an ordered world of objects and events just insofar as those very temporal relations are symbolically represented by the brain.

Dennett's conclusion, then, is that the disunified nature of individual content discriminations does not make, in and of itself, for a conundrum about perceptual experience. *Instead, the only genuine problem of disunity or incoherence that probes must solve is the problem of the unification of representational contents.* Binding must create representations which, together, portray unified objects—call these 'content-unified', as opposed to 'vehicle-unified' (physically unified) representations. This is a problem that necessarily arises in virtue of the architecture of the visual system, from the multiplicity of

informational problems that the visual system undertakes and the semi-independent computational processes that solve them. It is the disunity of *content*, not the spatial separation of the processing sites or the temporal disarray of the content-discriminations, that must be resolved if we are to understand why our perceptual experience of the world has the particular form it does. This is the job that probes are designed to solve, the problem that motivates Dennett to advance such a mysterious and unspecified process. Probes are postulated, in other words, in the wake of the dissolution of the Binding Problem (as it is ordinarily given), not in order to solve it.

While the above considerations do not entirely absolve Dennett of the need to explain how probes unify content, they do somewhat mitigate the absence of an explanation. Still, there is much that needs to be said about the relation between probes (or more accurately, their answers) and one's conscious experience—and nothing more is to be found in *Consciousness Explained*. For the purposes of exegesis, then, I am going to attribute to Dennett the very strong view that *probes are both necessary and sufficient for conscious experience*. I will assume, for the purpose of argument, that the stable view is as follows: (a) in the absence of a probe and an answer, a subject will not have any phenomenal experience at all; and (b) every answer to a probe forms a part of a subject's experience.

This brings us to the end of the exegesis of Dennett's six central tenets.

#### 4. *Deriving Dennett's Six Conclusions*

In order to derive Dennett's six conclusions, let us go back to the parallel processing model of the colour phi phenomenon. Whatever the actual details of visual processing might be, the model shows us three ways in which parallel processing differs from serial inferential processes, from the Orwellian and Stalinesque models. First, in the serial models, there is a strict separation between three stages of processing: the initial perceptual processes, the inferences of the system based upon that information, and the final perceptual experience. We intuitively assume, in imagining the two models, that if there are two sequential events in the world, a flashing red light and a flashing green light, then the system must begin by producing two representations of those two events. First the system produces a representation of the red light and then it produces a representation of the green one. We assume, in other words, that the order of representation mimics the order of the external events. It is these perceptual representations (whether conscious or not), we suppose, that then are evaluated for coherence and plausibility, presumably by some kind of 'inference engine' further down the line. Finally, a perceptual experience occurs.

On the schematic of parallel processing presented, however, there are no initial perceptions from which inferences are made, no final conclusion from which a perceptual experience or memory is manufactured. Instead, the visual system's 'story' about two events in the world emerges, piece by piece

through a process of approximation and revision, over a period of time. All the processes, in each module, are *inferential*, all are equally *visual* or *perceptual*, and all are *potential candidates for inclusion in conscious perception*. Thus we have Dennett's first conclusion, C1: there is no distinction either in content or in phenomenal experience between the representations of perceptual events and our inferences/judgements about them.<sup>10</sup>

Second, there is no sequence of events—each event with the particular propositional content envisioned by both models—that constitutes a serial argument for the conclusion 'a red light moved across the screen and changed colour mid-trajectory'. There are no moments on the time line that can be selected as the moments at which such inferences have occurred or at which intermediate conclusions have been reached. Thus, when the serial models were presented it seemed reasonable to suppose that, at least in principle, we could ask of each and every inferential step 'was the subject conscious of *that?*' E.g. was the subject conscious of the single red light at P1? According to the parallel model, however, such questions simply cannot be asked for there are no representations with the correct propositional contents. There are none of the envisioned representations of which we might ask these questions.

Third, and most radically, it is not clear that any propositional content at all can reasonably be ascribed to the visual system *as a whole* at arbitrary points throughout the processing of the colour phi stimuli. When presented with the colour phi schematic, that is, it is tempting to interpret the model

<sup>10</sup> An obvious response to this claim is that it flies in the face of our own phenomenology. After all, my vivid visual experience, say of looking out at the mountains and skyline before me, seems very different phenomenologically than my *considered* visual judgments, say that the small white blur in the sky is indeed a seaplane about to land. Our perceptions do not *seem* to be judgments.

Recall, however, that on Dennett's view, the only a priori restriction on the relation between a phenomenological event and its neural/representational realization is that they must have identical intentional contents. Hence there is no reason why we *must* have access to the judgment qua a particular kind of representational form. Given that perceptual experiences are judgments about the state of the world, the content of those experiences is *about the perceived world*, not about the judgment itself. It is *through* such judgment that we become perceptually aware *of the world*, while the judgments themselves, qua vehicles, may remain invisible. Thus, as strange as it may seem, our rich and vivid 'imagistic' visual experiences may well be 'judgments' even if they do not seem to be.

This is not to deny that there are differences in phenomenology between our standard perceptions and our considered ones. Most of the time, when someone talks to me, I look at his or her face; at other times I search the speaker's features intently, looking for clues about his or her emotional state. These two kinds of events *feel* different to me. On Dennett's view, too, any difference in feeling must have an explanation but it will be an explanation in terms of *representational content*. When I conceive of particular experiences as judgments, this must be explained by some additional information which I have about those experiences, perhaps based upon a second-order thought about the experience—for example, the information about how the experience was initiated, say through conscious direction, or about the informational richness of that visual experience relative to other perceptions.

along familiar lines, to assume that, while it is surely true that the particular representations and inference patterns proposed by the Stalinesque and Orwellian stories do not occur, nonetheless the system must still have, at each moment, some propositional content or other. Hence over time, one can view the system as moving from one propositional state to another, in something like the imagined inferential sequence. After all (one might think), if each cortical site is charged with the task of determining some specific property of an external object, perhaps the propositional content of the system can be discerned by 'conjoining' concurrent conclusions in each site. For example, suppose a subject sits, watching a red, spherical ball bounce up and down, and the modules, as a set, contain the conclusions 'red', 'ball' 'spherical', and 'up and down motion'. Why not conclude that the visual system as a whole has the propositional content 'there is a red, round ball, bouncing up and down'? But this will not do.

Recall from above the characterization of the visual system as involved in mutual constraint satisfaction. On this view of mammalian vision, inconsistency is an intended consequence of normal visual functioning, not a problem to be eliminated by better computational strategies or the further evolution of the brain. The multiple sites of visual cortex are all engaged in a process of mutual constraint satisfaction, of deciding one possible way the world might be. The method employed is one of successive approximation, using swift but not entirely reliable computational strategies, the iterations of which are guided by consistency checks between answers. It is not a system, however, that lends itself to the interpretation of being a serial inferential processor. Of course, in one sense, there is nothing that positively prevents such an interpretation. Insofar as the visual system consists of a set of modules that make individual property discriminations, one can always simply declare, by fiat, that the propositional content of the entire system is to consist of a conjunction of those contents. The question, however, is whether doing so makes any sense, whether such an interpretation has any explanatory value.

Any interpretation of the visual system as yielding serial stages of an inferential process requires more than the *mere possibility* of an ascription of propositional contents across time. Rather, the contentful states must be such that we can understand them as playing an inferential role in solving the problem at hand, i.e. in describing the state of the external world. We must be able to imagine that first, these suggested states *qua* inferential steps are probable and helpful conjectures about the events of the external world and that, second, they must be related to one another (follow from one another) in some kind of rule-governed way. A 'chain of inferences' is not a series of representations, with irrelevant contents, which follow one upon the other in arbitrary ways.

It is just such an arbitrary series of strange representations that 'conjoining' the contents of individual modules would yield. Given the nature of the system, it will often be the case that two modules temporarily hold conflicting conclusions, say that an object has moved against a stable background

but that it has not changed allocentric position. Here, the conjunction of the contents produces a *contradiction*—the conclusion that the object has both moved and not moved. But a contradiction is not a serious candidate for the role on offer, namely one step in a series of inferences about the present state of the external world. A contradiction does not describe any way the world might be, hence it cannot be considered as a 'hypothesis' about a possible state of the world at all. Moreover, as we all know, a contradiction licenses any conclusion; in this context, a contradiction would provide 'evidence' for each and every way the world could be. Again, this is not a very helpful step in an inferential process about the nature of the world. (For anyone who is tempted to sidestep this problem by *disjoining* all contradictory conclusions, the result is no better. This yields a tautology, the conclusion that the object is either moving or that it is not. In other words, it yields a 'hypothesis' which fails to select any possible world over any other.) So our natural urge to recast a parallel system in the role of a serial inferential processor does yield what is needed.

More generally, however, there seems little reason to ascribe a single propositional content, of any form, to the system as a whole. If the modules of the visual system merely deduce individual properties of the visual scene as suggested, the mere fact of concomitant representation does not assure us that the system *as a whole* has a propositional content—that the system ascribes a set of properties to an object in the external world. To put this another way, a traditional puzzle about propositional attitudes is what they are, over and above the mere conjunction of concepts. To think of a red shiny ball, bouncing up and down is not to have, merely, a motley group of concepts—the concept of red, the concept of a sphere, the concept of movement, etc. Something more is needed. But there is nothing in the story of parallel processing that provides us with an answer to this question. Prior to a probe, there are no processes or acts postulated that might serve as that essential 'glue', the means by which individual content fixations are brought together into coherent propositional attitudes. So on the basis of this story alone (the story of vision as mutual constraint satisfaction) there is no reason to suppose that the disparate events of visual processing, selected in mid-stream, necessarily form a unified propositional attitude.

This brings us to Dennett's second conclusion, C2, that there are no fixed facts about the events and contents of conscious experience other than facts about probes and the unifications probe engender. If prior to a probe there are no propositional states at all—no representations with the content suggested in the serial models or indeed with any propositional content at all—there are no states which are suitable candidates for conscious awareness. There simply are no representational states about which the skeptic can ask 'but was the subject conscious of *that*?' This conclusion holds, of course, only if it is agreed that the typical episodes of conscious awareness are ones with propositional content.

The third conclusion, C3—that on a small time scale there is no distinction, in principle, between a revision of perceptual input and a revision of mem-

ory—also follows from the particular view of visual function endorsed. Because successive approximation is the processing strategy used, revision and memory storage are part and parcel of the perceptual process itself. The system does not produce single coherent answers which are then stored or used in subsequent inferential processes. Were this so, there would be a firm line to be drawn between the 'raw materials' from which perceptual conclusions are wrought and the inferred conclusions themselves—and in virtue of this division, a further distinction between the revision of perceptual inputs and the revision of perceptual conclusions. Instead, each small subsystem produces a swift but tentative answer. These modular answers are sent on to other modules for inclusion in those computational processes, checked against the conditional conclusions of other modules, returned, recomputed and revised in the light of additional incoming information. There is no principled basis on which to label some of these conclusions 'genuine inputs' and others 'perceptual memories'. All are merely part and parcel of the ongoing perceptual sifting prior to a probe.

Dennett's fourth conclusion, C4, recall, is that, on a small time scale, there is no distinction in principle between the Orwellian and Stalinesque accounts of certain phenomena. And given C3 above, this may seem, at first glance, to follow directly. After all, the Orwellian story is an explanation of the colour phi illusion in terms of memory revision while the Stalinesque account explains that phenomenon in terms of perceptual tampering. So if there is no distinction between the revision of perceptual input and of memory, it seems, there should be no difference between the two models either. This is, in fact, how Dennett himself argues for C4 (see, for example, page 124 of *Consciousness Explained*) but it involves, I suspect, a mis-step in reasoning, a confusion about what conclusions are licensed by a certain plausible form of verificationism about scientific theories and what conclusions are not.

One plausible verificationist view about the meaning of scientific theories—a view which Dennett explicitly endorses—holds that two theories are equivalent if each theory gives rise to exactly the same set of empirical consequences. If theory A postulates the existence of some class of entities, a's, while theory B postulates the existence of b's, yet each theory predicts exactly the same outcome for each conceivable experimental set-up, then despite the apparent difference in their ontological commitments, the theories do not differ. We can count them as one and the same theory. Thus if the Orwellian and Stalinesque theories always predict the same experimental outcomes, they too can be counted as one and the same theory.

The problem here is that, contrary to what Dennett suggests, the Stalinesque and Orwellian models do not fit this picture. It is true that both theories propose the same series of representational events, as was shown in Figures 2 and 4. However, the two theories do not have the same deductive consequences; they do not predict the very same empirical results in all experimental circumstances. Indeed, against the background assumption of a chain of inferential events, we know exactly what kind of test would decide

between them, what would count as a 'crucial' test. At least in principle, we could simply stop the clock (halt the processing) after the representation of the red and green lights by the visual cortex and then, before any further inferences can be drawn, ask the subject 'what did you see?' If the subject were to report nothing, then the Stalinesque story would be confirmed; if the subject were to report seeing both lights, then the Orwellian account would be vindicated. These are two contradictory predictions that follow from the axioms of the different theories.

If the parallel model of processing is correct, however, this crucial test is one that could never be carried out. The problem with both theories is that they are false: both make shared background assumptions that do not obtain. Specifically, both postulate the existence of an ordered set of representations that does not exist. Thus one could never 'stop the clock' at the required juncture in processing, for that juncture does not exist either. In other words, the very conditions that are required in order to conduct the crucial test simply do not hold. So it is only in a very strained sense, that the two models are 'indistinguishable'. They are 'indistinguishable' in the actual world because, we are assuming, human vision is a parallel system involved in mutual constraint satisfaction—and thus no experiment of the envisioned kind could be carried out in the actual world. (If Dennett wishes to hold that the two theories are indistinguishable in some stronger sense, he must adopt and defend a more radical verificationist view—for example, the view that all false theories have the same meaning.)

This leads us to C5, by far the most controversial of all of Dennett's conclusions, the view that there is no determinate time of occurrence for conscious events. Recall from T6 that (on this interpretation at least) a necessary and sufficient condition for any consciousness state is that a probe must be made. It is a probe which draws together or unifies the conclusions of the individual modules, which, given T3, must be a unification of the *contents* of those representations, not a physical drawing together of the vehicles themselves. Any conscious visual experience of a single spatially unified object, Dennett claims, is probably the result of multiple, spatially disparate, yet 'content-unified' representations. Unfortunately, as I said above, Dennett does not himself tell us what kind of binding processes might unify the contents of multiple representations, but here the details of the binding process do not really matter. Whatever kind(s) of process are used, binding is surely not an instantaneous event. Unifying the contents of numerous modules will take time. Prior to a probe, there is no consciousness; after the probe the subject will report having had a phenomenal event. The puzzle that arises, then, is this: does consciousness occur after the probe is fully completed or bit by bit in the course of unification or . . .? Given that processes of unification take time, consciousness could occur at any moment from the start to the finish of the binding process. *It is this question—when, during the binding process, does consciousness occur?—that according to Dennett has no answer in principle.* There is no possible evidence that could decide this question, either from the first-person point of view, the subjective experi-

ence of the subject, or from third-person perspective, from the objective findings of science.

First, consider the evidence available to the subject. Again, recall from T3 the relation between conscious states and the representations that underlie them: *the contents of any conscious mental event must be underwritten by a neural representation of 'like' content*. In other words, when one has, say, a visual experience, it is the content of 'content-unified' visual representations, not the properties of the vehicles themselves, that inform our experiences.<sup>11</sup> When the subject sits, eyes open, looking out at the world, what the subject experiences are perceptions of *the world*—the order and duration of external events. The subject first sees, for example, a red car go by, followed by a green one and so on. But what the subject does not have access to are the time relations among the representational vehicles themselves, the times at which individual conclusions are reached or, what is relevant to this question, the order in which independent representational contents are unified. The binding process itself is not available or 'visible' to the subject, hence neither is the temporal order of the binding process. No matter how or in what order the contents actually come to be unified, the subject's experience is still one of an orderly external world, the red car going by and then the green one. So first-person phenomenology and reports of that experience are of no use in answering the crucial question.

Second, consider what science might tell us. Suppose that, after careful investigation, a certain theory about binding and conscious awareness is confirmed. Armed with a theory of neural content, imagine, we have been able to confirm that each and every conscious event coincides with a certain kind of unification: whenever a conscious thought is reported, there is some process that produces content-unified representations, representations with the very content that the subject experiences in conscious awareness; nor do any conscious experiences occur in the absence of the postulated binding process. So now we have the key to consciousness: a scientific explanation of the neural events in virtue of which consciousness occurs. What this scientific result could not tell us, however, is what we wanted to know, namely exactly *when* in the process of unification consciousness occurs. It confirms the nature of the binding process or processes, a process or processes that we can

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<sup>11</sup> No doubt that you, the alert reader, will have noticed that two distinct points have just been elided, using the innocuous phrase 'in other words'. This is for pedagogic reasons. Dennett's argument against the Naive Theory of perception, if successful, entitles him to the conclusion that neural representations that 'support' phenomenal events need not have physical properties that are similar to the phenomenal properties of our conscious experiences, e.g. a visual experience of a chair does not require a chair-shaped neural representation. The premise that Dennett's argument for C5 requires, however, is much stronger, namely that all phenomenal properties are a function of representational content alone, and hence that, in consciousness, we have access to *only* the contents of neural representations (see note 8). Insofar as I can see, Dennett does not argue for this stronger premise but his argument for C5 cannot be reconstructed without it.

now time from beginning to end. But being able to time the process from beginning to end, does not tell us when, exactly, conscious awareness occurs.

It is important to realize that Dennett intends C5 to be an entirely general consequence. No matter what theory of consciousness is adopted, it will not be possible to pinpoint the exact time of conscious experience. By Dennett's lights, any theory that postulates a functional explanation of consciousness, such that the relevant functional event(s) is not instantaneous, will be able to pinpoint the onset of consciousness experience only *approximately*, as confined within the temporal bounds of the postulated function. Add to this Dennett's considered view that any genuinely explanatory theory of consciousness must be a functional explanation (Dennett and Kinsbourne 1992, p. 237; Dennett, 1991, pp. 401–4) and Dennett reaches the strong conclusion that no (legitimate) theory of consciousness will be able to determine the exact moment of conscious experience. This, then, is the argument for C5.

Finally, we come to the last conclusion, C6, the conclusion that there is no appearance/reality distinction for conscious experience, no difference between how our conscious states seem to us and how they really are. Says Dennett (p. 132),

The Cartesian theater may be a comforting image because it preserves the reality/appearance distinction at the heart of human subjectivity, but as well as being scientifically unmotivated, this is metaphysically dubious, because it creates the bizarre category of the objectively subjective—the way things actually, objectively seem to you even if they don't seem to seem that way to you!

*Prima facie*, this is a very odd view for Dennett to espouse. Famously, Dennett wishes to deny that there are any phenomenal events, qualia, which are directly apprehended and to which the subject has incorrigible or privileged access. Indeed, Dennett's suggested method of investigating consciousness, 'Heterophenomenology', is a third-person approach designed to test what we sincerely say about our inner lives against scientific results that will tell us how things really are—a methodology designed to separate our true beliefs about our own experiences from our fictions. As Dennett says in 'A Method for Phenomenology' (p. 96):

If you want us to *believe* everything you say about your phenomenology, you are asking not just to be taken seriously but to be granted papal infallibility, and that is asking too much. You are *not* authoritative about what is happening within you, only about what seems to be happening in you, and we are giving you total dictatorial authority over the account of how it seems to you, about *what it is like to be you*.

Does Dennett espouse an appearance/reality distinction for phenomenal events in his methodology chapter, then, and deny it two chapters later in

his presentation of the Multiple Drafts theory? I take it, not. On a charitable interpretation, one must resolve this seemingly blatant contradiction.

Return once again to Dennett's particular view of visual processing given in T1, that individual modules perform 'content discriminations' or serve to detect certain properties of the world, and his view, presented under the explication of T4, that the contents of conscious experience must 'match' the contents of whatever representations give rise to them. If each of the modular conclusions represents some property of the external world, the binding process produces content-unified representations (although not necessarily a unified, singular representation) of objects and events of the world. Moreover, if the content of phenomenal experience 'matches' the unified contents that result from a probe, then our experience is an experience *of the world*. In normal, unreflective perception at least, my phenomenal experience—how things seem to be—just is how I experience *the world* to be.

To put this another way, suppose our conscious experiences resulted from a second-order representation, a representation of our (in this case, perceptual) representations of external events (for example, in the manner suggested by Rosenthal, 1993). Were this so, the appearance/reality distinction might hold for 'subjective' experience. There would be room for disparity between the contents of the two kinds of representations—a difference between the content of my representations of the world itself and my second-order understanding of those representations (how I depict those representations). But, on Dennett's view, perceptual consciousness does not involve a depiction of one's own representations of the world: it simply *is* the representation of certain external events. Thus, according to Dennett, there is no room for 'slippage'. In normal perception, the contents of the perceptual representations fully comprise and exhaust the contents of my phenomenology. That is all there is to the matter, of how it seems to me.

We now see how Dennett might both deny the appearance/reality distinction for phenomenal events (as a consequence of the Multiple Drafts model) and maintain his allegiance to the methodology of heterophenomenology. Insofar as perceptual consciousness is non-reflective (the normal case) there is no difference between one's experience of the world and how it seems. The content of the subject's experience simply is the unified content of the brain's representations of the world. When I attempt to describe how things seem to me, however—when I turn my inner eye upon my own phenomenology in order to describe it to myself or others—I now represent my own representations. And it is at this juncture where one's theoretical biases, where folk wisdom and simple mistakes enter into the description. When phenomenology becomes the subject of reflective enquiry, the appearance/reality distinction opens up. It is in this way that Dennett dismisses the 'objectively subjective' yet maintains a role for the third-person revisionary investigation of conscious phenomena.

## 5. Conclusion

The above reconstruction of Dennett's Multiple drafts argument has been lengthy and complex. For the sake of clarity, then, a brief synopsis seems in order. (Not surprisingly, what follows sounds quintessentially Dennettish.)

Dennett's six conclusions stem largely from his views about the very nature of visual (or perceptual) processing and his views about the relation of phenomenology to representational content. According to Dennett, vision involves numerous parallel computational processes, each of which is charged with discerning properties of the external world. Because all of the modular answers must, taken together, form a coherent description of the world, the process, understood as a whole, is one of mutual constraint satisfaction. This interactive process, however, is both disorderly and noisy—through a process of rough calculation, successive approximation and revision, modular conclusions emerge in a piecemeal fashion. The order in which conclusions are drawn need not mimic the order of actual events in the world; nor need the conclusions be, at a given time, consistent or complete. Thus the process of mutual constraint satisfaction does not yield, serially, anything like states with propositional content or descriptions of possible worlds. Phenomenologically, however, our normal experience of the world *is* coherent, consistent and orderly. So there must be some process or other that unifies or 'binds' these disjoint contents, a unification that results in conscious experience. What we do not need to postulate, however, is a special process of 'perceptual manufacturing', a re-representation of modular conclusions into the correct 'visual' format. To assume that visual phenomenology requires, say, special 'imagistic' representations is to succumb to the Naive Theory of Perception. We need only assume that the contents of our conscious experiences are mirrored by the contents of their underlying neural representations. Hence, all computational conclusions, we ought to suppose, are equally good candidates for unification or binding—and hence equally good candidates for inclusion in conscious perception.

It follows from this view of vision, first, that vision is inferential 'all the way down'. There is no distinction to be drawn between 'genuinely' visual processes and inferential ones—all visual processes are equally inferential. Hence, C1, there is no difference in either content or phenomenal experience between representations of perceptual events and inferences about them. Second, C2, there are no fixed facts about the contents of conscious experience, prior to acts of binding because there are no states, prior to binding, with propositional content. Third, C3, there is no distinction, prior to a unifying probe or binding process between memory revision and perceptual tampering because, prior to a probe, there are no 'perceptions', as such, to tamper or revise. Fourth, Stalinesque and Orwellian models of perceptual processes do not constitute genuine alternative accounts of perceptual phenomena (such as the colour phi illusion) given that both presuppose perceptual and inferential states that do not obtain. Both are false, and in this sense, there is nothing to distinguish between them (C4). Fifth, C5, neither

subjective reports of conscious experience nor experimental insight into the nature of the binding process will ever allow us to pinpoint an exact time of occurrence for conscious events. We, as subjects, are aware of only the results of that process: we have perceptions of events in the external world, not perceptions of the binding processes themselves. What science will tell us, on the other hand, is what kind of processes are involved in content binding and how long, for any particular conscious event, the process of binding takes. We will be able to time the first act of binding and the last act of unification, but there is no further evidence that could select any more precise time as 'the' moment of consciousness. Finally, ordinary perceptual consciousness comes about through content binding, the binding of representations which are about properties of the external world. In perception, we are directly aware of the world's events. There are no inner states, qualitative or propositional, which we introspect and about which we might be mistaken. Hence, C6, in normal perception there is no distinction to be drawn between how conscious events seem and how they are.

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