

THEORETICAL FOCUS

Taking Phenomenology Seriously: The “Fringe” and Its Implications for Cognitive Research

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Evidence and theory ranging from traditional philosophy to contemporary cognitive research support the hypothesis that consciousness has a two-part structure: a focused region of articulated experience surrounded by a field of relatively unarticulated, vague experience. William James developed an especially useful phenomenological analysis of this “fringe” of consciousness, but its relation to, and potential value for, the study of cognition has not been explored. I propose strengthening James’ work on the fringe with a functional analysis: fringe experiences (1) work to radically condense context information in consciousness; (2) are vague because a more explicit representation of context information would overwhelm consciousness’ limited articulation (processing) capacity; (3) help mediate retrieval functions in consciousness; and (4) contain a subset of monitoring and control experiences that cannot be elaborated in focal attention and are “ineffable.” In general, the phenomenology of the fringe is a consequence of its cognitive functions, constrained by consciousness’ limited articulation capacity. Crucial to monitoring and control is the feeling of “rightness.” Rightness functions as a summary index of cognitive integration, representing, in the fringe, the degree of positive fit between a given conscious content and its parallel, unconsciously encoded context. Rightness appears analogous to the connectionist metric of global network integration, known variously as goodness-of-fit, harmony, or minimum energy. © 1993 Academic Press, Inc.

[Duns] Scotus (c. 1266–1308) remarks that in the field of vision there is one point of distinct vision and many indistinct elements; he adds that if this is possible in sensation it is much more possible in the sphere of the intellect. . . . Beneath those thoughts which the will makes clear there may be many indistinct or incompletely actualized thoughts; the will turns to these and exerts itself to raise one of them to clearness. Conversely, with the cessation of the act of will, the idea tends to laps from distinctness.

Brett, *History of psychology*¹

Consciousness has enjoyed a remarkable shift in status during the last 5 years. Dubious not long ago, consciousness is now becoming one of the general topics in cognitive research. Behaviorism, on the other hand, seems dead and unlamented.² Even postmodern behaviorists like Dennett (1993) officially approve behaviorism’s demise in psychology: “The cognitive revolution has triumphed over that barren period. . . .” Nevertheless, behaviorist thinking lingers on. The *frame* that

¹ Brett (p. 295); the two passages separated here by ellipses are in reversed order in Brett.

² But see the “Reflections on Skinner and Psychology” number of the *American Psychologist* (1992).

behaviorism placed around the study of consciousness is surprisingly intact. This frame still limits research on consciousness and, more generally, limits the integration of cognitive science. Consciousness is back from exile, but it is only rehabilitated in part.

1. BACKGROUND

The problem is largely historical. The behaviorist interregnum was so prolonged and, in its prime, so powerful that it produced a kind of mass amnesia. Virtually all links with prebehaviorist consciousness research were cut, destroying as well any clear sense of the relation of traditional consciousness research to its larger cognitive aims.

Behaviorism defined itself in terms of a supposedly irreconcilable dichotomy, an absolute opposition between "introspective or subjective psychology, and behaviorism or objective psychology" (Watson, 1924, p. 1). "Objective" psychology was purely scientific and experimental, while "subjective" psychology concerned itself with consciousness. And consciousness was "neither a definite nor a useable concept" (Watson, 1924). Behaviorism did much to embed this forced-choice presumption into subsequent thinking about consciousness. I suspect that it is still reflected in the current tendency to emphasize consciousness' supposedly unknowable "subjective" nature (Nagel, 1974) or, on the other hand, to demand a completely "objective" approach to consciousness by reducing it solely to known physical processes (Churchland, 1988), even if this means denying the existence of a distinct realm of inner experience (Dennett, 1991).

Even behaviorism's favorite atrocity stories remain with us. So, for example, when experimental psychologists hear the term "introspection," the single most common association is probably still the "imageless thought" controversy between Wundt's laboratory at Leipzig and Külpe's at Würzburg. According to behaviorist orthodoxy, the dispute showed that introspective evidence is inherently intractable and thus beyond scientific adjudication. This canard is still maintained in otherwise excellent introductory textbooks (e.g., Johnson-Laird, 1988). In fact, the balance of experimental evidence favored Külpe (Humphrey, 1951; cited by Zangwill, 1987); nor was the behaviorist phase of experimental psychology without its own lingering disputes. In any case, as a logical matter, the failure of *one* experimental method to study *one* feature of consciousness hardly justifies the general conclusion that our direct conscious experience is beyond experimental investigation. Psychophysics, for example, the oldest and most precise of all branches of experimental psychology, has had remarkable success in quantifying the nonlinear relationships between subjective feelings of stimuli intensity with their objective, physical correlatives.

Eminently *successful* strands of prebehaviorist cognitive research simply do not fit into the behaviorist presumption of objective = scientific versus subjective = unscientific. Among the best examples of the inadequacy of this behaviorist premise is found in the research of people like Ewald Hering, Ernst Mach, and William James; in various ways, they all employed a tacit method that (to use James' phrase) aimed at "mixing the physical and the mental" as much as possi-

ble (James, 1980, p. 24). The precise mix of elements varied from scientist to scientist and from topic to topic, but in general this “mixed” method studied cognition using a complex interplay of phenomenological analysis, experimental psychology, philosophy, and physiological applications ranging from individual neurons to the brain as a whole. This is not to say that the method used by James and Hering was identical in detail. One virtue of the mixed approach for cognitive research is its ability to change the “weights” on its component elements in response to the problem at hand. So Hering used phenomenology primarily to guide his neurophysiological investigation, while James used his sense of neurophysiology and the larger operations of the brain primarily to guide his phenomenology.

An interdisciplinary cognitive science, then, is nothing new. It is a *return* to a powerful mode of research—with one exception. In the earlier tradition, the most intimate and “subjective” aspect of consciousness, phenomenology (i.e., the directly felt qualities and structural features of experience), was a perfectly acceptable member of the ensemble of elements used for the scientific investigation of cognition.

Again, it is imperative to see that the complex mix of “subjective” and “objective” elements in traditional cognitive science *produced hard scientific pay-offs*. Probably the best single example of the power of phenomenology in the mixed cognitive method comes from Hering’s research on color vision. Drawing, in part, on absolutely subjective facts (e.g., that we experience yellow as a primary color and not as a mixture of red and green), Hering was able *to deduce* the structure of the neural mechanisms implied by the phenomenology. De Valois (1975) later confirmed Hering’s prediction of the opponent process structure of color vision. Hering tried to grasp cognitive phenomena in the most inclusive possible way, which of course also involved philosophy; on this count Hering saw himself as an *intellectual descendent of Kant and Schopenhauer, among others* (see Westheimer, 1987).

To pursue neurophysiology without looking at the related conscious contents would have been, for Hering, like “dissecting a timepiece into its component gears; would not a glance at its face and hands yield an indispensable insight into its function?” (Westheimer’s paraphrase, 1987). Hering was also able to use the mixed method to identify, apparently for the first time, the “center/surround” feature of neural inhibition (Westheimer, 1974). To repeat: taking “subjective” phenomenology seriously has *already* led to significant research findings at the hard “objective” level.

2. JAMES’ APPLICATION OF THE MIXED METHOD TO THE FRINGE³

From the early days of the Cognitive Revolution, seminal figures like George Miller (1956, 1962) and Ulric Neisser (1967) read James carefully and drew openly on his ideas. More recently Barnard Baars (1988) brought out many links between

³ The following sections in general follow Mangan (1992) as read to the annual meeting of the Society of Philosophy and Psychology; this material was in turn drawn from my dissertation, Mangan (1991).

James and current research. On the centenary of the publication of James' *Principles* in 1890, M. G. Johnson (1990) edited a book-length series of articles examining a wide range of James' work in the light of recent research. Today James shows up almost routinely. He is among the great forbearers of contemporary cognitive research and one of its most prescient geniuses.

And yet, to my knowledge, in cognitive science today, there is no systematic treatment—indeed almost no mention at all—of a phenomenon that James insisted was absolutely central to understanding cognition: the “fringe” of consciousness—that vague region of experience that surrounds what we now call focal attention. (James has many roughly synonymous terms for vague experience; I will generally use fringe as the most evocative.) The fringe addresses two absolutely fundamental problems in cognitive science: context and retrieval. For on James' analysis, *the fringe represents context information in consciousness, and the fringe helps mediate the retrieval of new, detailed information into consciousness.*

James' discussion of the fringe occupies the major part of the most well-known section of the *Principles*, the “Stream of Thought” chapter. James could not be more insistent about the cognitive importance of vague experience: “It is, in short, the re-instatement of the vague to its proper place in our mental life that I am so anxious to press on the attention” (James, p. 254); or a page later: “The significance, the value, of the image [in consciousness] is all in this halo or penumbra that surrounds and escorts it. . . .” Yet modern cognitive science, while drawing on James for so many other points, has resolutely overlooked the fringe—just as cognitive science has overlooked its own history before behaviorism and the role phenomenology played in that history.

These oversights are almost certainly linked. James' treatment of the fringe may appear, on the surface, to be an extremely “subjective” phenomenological investigation, dealing with the most diaphanous and elusive of feelings. So it may seem especially foreign to the current “objective” mind set toward consciousness. And without a background sense of James' mixed method, it is easy to miss the interplay of James' phenomenology of the fringe and his deep affinities with what today is called the parallel and distributed aspect of brain activity. For the neural component in James' mixed method worked to direct or “tune” his phenomenology in a way that produced remarkable resonance with current notions of nonconscious processing, especially as captured by connectionism. Thus James' fringe formulation not only deals with conscious experience, but offers a natural way to explore the interface between conscious and nonconscious processing.⁴

The following discussion will fall into three parts. First, and above all, I want to draw attention to James' notion of the fringe. The fringe is resurrected easily

⁴ This is not to say that James' treatment of the fringe fell through the cracks only because of the “subjective” aspect of his method. In hindsight, James placed his treatment of the fringe under an unfortunate heading: “the continuity of consciousness.” Although accurate as far as it went, this implies a far more narrow application of the fringe to current problems in cognitive research than I believe it actually has.

enough *if* the lingering squeamishness about the “subjective” is seen for what it is: an unscientific prejudice, a prejudice that diminishes the scope of research, a prejudice that would have us unnecessarily banish a domain of evidence that has enriched empirical cognitive investigation for more than a century and should still be helpful today.

Second, I will try to show that James’ account of the fringe makes sense in terms of current thinking: that is, the current resources of cognitive science can help us explain *why* consciousness has a fringe, and *why* the fringe behaves as James says it does. The key theoretical notion here will be the long-standing recognition that conscious processing is extremely “limited;” the fringe appears to help finesse consciousness’ limitations. There seems to be an intimate relationship between the phenomenology of the fringe and its cognitive functions.

Perusing this argument may also give an example of a mixed method of cognitive research in action. We will see how one of the standard methods of scientific investigation, the principle of converging evidence, is able to augment “mere” subjective descriptions. In other words, we can increase the force of the subjective portion of James’ account of the fringe by tracing out some of the converging lines of objective support for it.

Hopefully one outcome of this approach will be to enlarge our sense of phenomena like subliminal perception and various neuropsychological dissociations. Weiskrantz (1992) recently wondered to what degree the “epidemic” in the discovery of dissociations actually implies the existence of “common mechanisms,” and the fringe looks like a candidate for one such unifying mechanism.

Finally, we will consider some of the implications of this line of thinking for neural research, computer modeling, and the “epiphenomenalist” view of consciousness.

3. JAMES’ PHENOMENOLOGY OF THE FRINGE

As a first-pass account of James’ position, we can say that consciousness has a two-part structure. Consciousness contains clear, relatively vivid experiences. These occupy what today are often called the contents of “focal attention.” But consciousness *also* contains relatively vague, indefinite and ungraspable experiences. James maintains that this second aspect of consciousness, its vague aspect, is almost universally overlooked, and yet it is absolutely crucial for understanding conscious cognition. Roughly speaking, vague experiences represent context information relevant to the clear experiences. Although distinct for purposes of analysis, James understands that vague and clear experiences work in an intimate symbiosis, forming an integrated cognitive system. But James insists (perhaps more than is strictly justified) that it is the vague aspect of consciousness, and *not* its focused portion, that does most of the cognitive work.

James has a variety of terms for the vague portion of consciousness. In general, when James is concerned with giving a more or less static analysis, he calls any single, clear-cut content of consciousness a “nucleus” and calls the surrounding vague aspect of experience its “fringe.” But when James describes a dynamic sequence of contents as they occupy consciousness over time, he tends to call

the clear portions of consciousness “substantive” experiences and the vague aspects of consciousness “transitive” experiences.

James did not intend the “stream of conscious” metaphor to refer to meandering reveries such as Molly Bloom’s soliloquy in *Ulysses*. James’ aim was to illustrate how pervasive and enveloping vague experiences are in consciousness:

The definite images of traditional psychology form but *the very smallest part* of our minds as they actually live. The traditional psychology talks like one who should say that a river consists of nothing but pailsful, spoonsful, quartpotsful, and other molded forms of water. Even were the pails and the pots all actually standing in the stream, still between them the free water would continue to flow. *It is just this free water of consciousness that psychologists resolutely overlook.* Every definite image in the mind is steeped and dyed in the free water that flows around it. With it goes *the sense of its relations*, near and remote, the dying echo of whence it came to us, the drawing sense of whither it will lead. *The significance, the value, the image is all in this halo or penumbra that surrounds and escorts it.* (p. 255, 1890; my emphasis)

Context, then, is represented by the “free water” of *vague* experience, the domain of feelings of relation, of significance, of value. The clear images in consciousness are, in themselves, quite barren of these qualities. The cognitive tang or import of conscious experience—or what James calls its “inward coloring”—is manifest by the fringe.

Now what, more specifically, are these “feelings of relation?” James insists, for example, that there is “a feeling of *and*, a feeling of *if*, a feeling of *but*, a feeling of *by* . . .” (p. 245–246; James’ emphasis). We have names for some feelings of relation, but most of them are without names because, James says, they are “numberless” and constantly shifting.

But a few feelings of relation occupy huge stretches of experience and manifest the most general, inclusive, and recurrent of context relations. James does not put these pervasive relation-feelings into a special category—but I will, and will call them “control” experiences: these include such feelings as “rightness,” “wrongness,” and “familiarity.” Functionally speaking, they work as both passive (monitoring) and active control signals in consciousness, helping direct the overall operations of conscious cognition. Perhaps the most important of all feelings of relation are the evaluative signals I will call “rightness” and “wrongness,” although we will focus on the positive half of this evaluation polarity, rightness. James has many ways of referring to these evaluative feelings, at one point calling them “felt suitability or unfitnes to the context and conclusion” (p. 265). But before returning to this central point, we must first understand other features of James’ phenomenology.

James maintains that there is a kind of oscillation between vague and clear experiences in consciousness. Here he uses his dynamic, transitive/substantive terminology.

If we take a general view of the wonderful stream of our consciousness, what strikes us first is the different pace of its parts. Like a bird’s life, it seems to be made of an alternation of flights and perching. The rhythm of language expresses this, where every thought is expressed in a sentence and every sentence closed by a period. The resting places are usually occupied by sensorial imaginations of some sort whose peculiarity is that they can be held by the mind for an indefinite time, and contemplated without changing; the places of flight

are filled with thoughts of relation, the matters contemplated in the periods of relative rest. Let us call the resting places the "substantive parts" and the places of flight the "transitive parts" of the stream of thought." (p. 243).

Consciousness, then, has a kind of pulse. During the transition from one clear experience to the next, the vague aspects of consciousness momentarily come, relatively speaking, to the fore. But even during this transitive phase, vague experience remains vague. Here we encounter another feature of the fringe: it is oddly slippery, elusive, ungraspable.

It is very difficult, introspectively, to see the transitive parts for what they really are. . . . Let anyone try to cut a thought across in the middle and get a look at its section, he will see how difficult the introspection of the transitive tract is. The rush of thought is so headlong that it almost always brings us up to the conclusion before we can arrest it. Or if our purpose is nimble enough and we do arrest it, it ceases forthwith to be itself. . . . The attempt at introspective analysis in these cases is in fact like seizing a spinning top to catch its motion, or trying to turn up the gas to see how the darkness looks." (p. 243–244)

This elusive aspect of the fringe certainly helps explain why the fringe is ignored; and James could hardly claim to have found a vast realm overlooked by traditional introspective psychology if he did not also explain how such an oversight occurred. We will see later that this pulsation can be interpreted as the result of initiating an act of retrieval, and that the ungraspable aspect of the fringe is in part a consequence of its "call" or retrieval-mediation function. James himself, however, does not seem to see retrieval as the cause of the transitive/substantive oscillation, even though he insists that transitive experience normally leads rapidly to substantive experience.

James' link-up of context with the vague qualities of consciousness is rooted in his sense of the operation of the brain as a whole. James took the brain to be in a state of constant, interconnected and simultaneous activity that frequently, but only momentarily, reached states of equilibrium. Here we see a prime example of James' mixed method: his phenomenology is informed by his sense of brain structure. James' natural affinity with "connectionist" thinking also stands out. All this is set out by one of James' brilliant metaphors: in this case a kaleidoscope.

We believe the brain is an organ whose equilibrium is always in a state of change,—the change effecting every part. The pulses of change are doubtless more violent in one place than another, their rhythm more rapid at this time than that. As in a kaleidoscope revolving at a uniform rate, although the figures are always rearranging themselves, there are instants during which the transformation seems minute and interstitial and almost absent, followed by others when it shoots with magical rapidity, relatively stable forms thus alternating with forms we should not distinguish if seen again; so in the brain the perceptual rearrangement must result in some forms of tension lingering relatively long, whilst others come and pass. But if consciousness corresponds to the fact of the rearrangement itself, why, if the rearrangement stop not, should the consciousness ever cease? . . . As the brain-changes are continuous, so do all these consciousnesses melt into each other like dissolving views. Probably they are but one protracted consciousness, one unbroken stream. (pp. 247–248)

James uses great ingenuity to investigate vague experience, in general isolating moments when for one reason or another it is not masked by a substantive nu-

cleus. So, for example, he asks us to consider the way our *intention* to say something feels when it first enters consciousness, but before it is elaborated:

How much of [the intention] consists of definite sensorial images, either of words or of things? Hardly anything! Linger, and the words and the things come into the mind; the anticipatory intention, the deviation is no more. But as the words that replace it arrive, it welcomes them successively *and calls them right if they agree with it, and calls them wrong if they do not.* (p. 253; my emphasis)

Many things could be said here, but for our purposes the most important is to note the feelings of right and wrong relation. Surprisingly enough, James says relatively little explicitly about the feeling of rightness, although rightness is often an implicit part of James' analysis, as in the above passage. At one point, however, James does insist that in most cases "*the most important feeling in these fringes . . . is the mere feeling of harmony or discord, of a right or a wrong direction in the thought*" (p. 261; my emphasis). Again, James has a variety of evocative terms for the same experiential fact, at times calling rightness "the feeling of rational sequence," and at others "dynamic meaning." "Dynamic meaning," he says, "is usually reduced to the bare fringe we have described of felt stability or unfitness to the *context and conclusion*" (p. 265; my emphasis).

Rightness is also a crucial although only partial aspect of James' discussion of the tip-of-the-tongue (TOT) experience. In his view, a TOT occurs when, for whatever reason, a substantive nucleus fails to arrive in its normal way. The transitive, vague quality of experience is thus prolonged and more available for introspective analysis. James would have us extrapolate *back* from this relatively infrequent occurrence to get a better sense of transitive experience as it usually operates.

Suppose [James says] we try to recall a forgotten name. The state of our consciousness is peculiar. There is a gap therein; but no mere gap. It is a gap that is intensely active. A sort of a wrath of a name is in it, *beckoning us in a given direction*, making us at moments tingle with the sense of closeness. . . . If the wrong name is proposed to us this singular gap acts immediately to negate them (p. 251)

And, of course, when the right word comes, it instantly feels right. Current tip-of-the-tongue and feeling-of-knowing (FOK) research grew directly for James' discussion of TOT (see Hart, 1965), although this link is now largely forgotten.

We will try to explain James' phenomenology of the fringe in a moment. But first I cannot resist briefly noting the apparent link between the ungraspable or elusive quality of fringe experiences, especially its component feeling of rightness, and aesthetic experience. (James, to my knowledge, did not discuss this point.)

Aesthetic experience, J. L. Borges (1964) once wrote, evokes of "the imminence of a revelation that does not occur." It would be difficult to get to the heart of aesthetic phenomenology in fewer words. Tennyson catches the character of this abiding, tantalizing "something"—a vast but inarticulate meaning on the periphery of experience—in the lines:

Yet all experience is an arch wherethrough
 Gleams that untravelled world, whose margin fades
 For ever and for ever when I move.

Attempts to account for aesthetic ineffability go back almost to the beginning of Western philosophy. They became especially prominent in modern aesthetics with Leibniz and Kant, who, perhaps not incidentally, worked out their groundbreaking theories of unconscious processing in conjunction with their aesthetic theories. Kant called the aesthetic "cognition in general," and said it exemplified "a universal rule we cannot state" (Kant, 1790/1950). Aesthetic phenomenology appears to have at its core an especially intense experience of rightness. It is this feeling that gives aesthetic experience its phenomenological profile: the sense of immediate correctness, of an especially well-integrated or "right" relation of parts, of a primary and metaphysical YES! of cognitive disclosure. This quality is notoriously hard to specify and results, I believe, from the more general "ungraspable" character of all fringe experience. One virtue of the functional analysis to be sketched out below is that *aesthetic experience can be derived from it*; that is, to a degree, it is possible to derive features of "subjective" experience from an "objective" cognitive model. But for reasons of space, we cannot pursue the aesthetic applications of the fringe here. They are discussed extensively in Mangan (1991).

To return now to James' phenomenology of the fringe and summarize those features of it that I will try to explain below: (1) Vague experiences are a constant presence in consciousness. (2) They usually occupy the background or periphery surrounding the clear-cut contents in consciousness. (3) They function to represent context information, notably feelings of relation. (4) Vague feelings are peculiarly elusive; even when strongly felt, they are still phenomenologically indefinite and will not stabilize in the nucleus or focus of attention. (5) There is a sort of pulsation or alternation in consciousness in which vague experiences periodically and briefly take on a stronger character; (6) Some fringe experiences perform evaluative functions, notably the feelings of rightness and wrongness that work to signal "stability to the context and conclusion."

4. EXPLAINING THE FRINGE

James' account of the fringe is in essence descriptive. But we can go further and try to explain why consciousness has a fringe, and why it has the features James describes. In other words, we can attempt to *explain* the phenomenology of the fringe as a consequence of its cognitive function. This will mean examining the relation of the fringe (1) to focal attention, (2) to nonconscious processing, and (3) to a basic constraint on the overall operations of consciousness, a constraint on what is often called "processing capacity" that has been noted in one way or another since the early years of the cognitive revolution. Let me put my main points briefly and intuitively before turning to the empirically based evidence that helps support them.

The cognitive function of the fringe is to radically *condense* information in

consciousness, and so finesse consciousness' limited processing capacity. My analysis turns on specifying what the limit on "processing capacity" actually amounts to. I propose that consciousness is a very finite cognitive resource: *consciousness can only articulate so much experience at any given moment*, and consciousness is husbanded accordingly. The fringe/focus structure is a trade-off strategy to maximize consciousness' limited articulation capacity, or what, alternatively, could be called consciousness' limited power of resolution.

An analogy with a similar case of articulation trade-off should make this point clearer. Think of consciousness as the video screen (CRT) of a PC computer. Of course, over time, a virtual infinity of different images can occupy the screen. But at any moment the resolution of any given image is necessarily limited by the size and number of pixels. Now consider the menu-bar device as found on many computer video screens and the way the bar works to finesse the pixel limitation. For in part the bar functions to indicate the existence of potential information, information not, itself, on the screen. *Some* pixels that might otherwise be allocated for the better articulation of the immediate business at hand are allocated to the menu-bar instead. This trade-off allows some information to be displayed in radically summarized form, indicating information that can be *potentially* called to the screen in detail—just as the fringe radically summarizes information that can be called into focal attention.

Furthermore, in many cases, the actual operation that triggers the conversion of the potential information into explicit information on the computer screen is moving the cursor to the relevant part of the menu-bar and clicking the mouse: this move and click command is a necessary link in the sequence which then calls the potential information indicated by the bar into actual manifestation on the screen.

The fringe would seem to execute the same functions, and in the same general way: (1) the fringe makes only small demands on limited articulation capacity by implying, with minimal resources, that information of various sorts is available to be called into focal attention. (2) The fringe also *provides a peripheral target for "calling" the information it implies*; that is, the command that calls the information implied by the fringe into attention is the *attempt* to focus attention on the relevant aspect of the fringe. *In this way the fringe mediates the voluntary retrieval of information into focal attention.*

Point (1) explains why the fringe is so vague or diaphanous, since in this "low resolution" form it impinges less on the limited ability of consciousness to articulate experience. Point (2) explains why fringe experience is so elusive or slippery, and at the same time explains why consciousness goes through its transitive/substantive pulsations: for the cognitive aim of attempting to attend to the fringe is *not* to inspect fringe experience as such, but rather to use the fringe as an inherently transitive device; attempts to attend to the fringe begin the process of bringing new, detailed information into consciousness. The fringe would not work as a retrieval mechanism if we *could* focus on fringe experience as such. Each voluntary act of retrieval, then, produces a pulsation. We are constantly retrieving new information into consciousness and thus constantly initiating new transitive pulses.

There is all but universal agreement that the operations of consciousness are highly context dependent and that at least the great bulk of context information is processed nonconsciously. If consciousness is presumed to have cognitive efficacy, however, it must somehow take account of, and above all *have evaluative information about*, vast amounts of context information. But, paradoxically, consciousness cannot possibly represent in detail (given real-time demands) anything distantly approaching the totality of information that bears on its cognitive activity.

The fringe experience of rightness (and wrongness) condenses context information in a particularly radical and extremely useful way: it is the most basic evaluative structure in consciousness. In functional terms, rightness delivers a very simple, absolutely crucial, cognitive message: it tells consciousness the degree to which a content in the focus of attention is compatible with or fits with its nonconscious context. In this sense, then, rightness works to help control virtually all voluntary conscious activity.

If we consider the operations of consciousness over time, rightness works as a feedback device, guiding the local and specific operations of focal attention toward greater and greater conformity with antecedent and consciously encoded context demands. And of course, over time, this process allows for reciprocal interaction between conscious and unconscious processing, since the process of detailed conscious analysis may itself change the context, which in turn changes the evaluative signal rightness manifests, and so on.

On this account, then, fringe experience is far more than just a preliminary stage in the production of conscious experience. The idea of the fringe goes considerably beyond current notions of preattentive processing, although there are certainly similarities between the two concepts. As we will now see, the fringe and its main control components do emerge, at least tacitly, in contemporary research.

5. CONTEMPORARY RESEARCH AND THE FRINGE

General anticipations of the fringe. The extreme “narrowness” or limited capacity of consciousness is of course one of the earliest findings of the cognitive revolution. It remains a fundamental orchestrating fact for the empirical study of consciousness, as Baars (1988) has shown in some detail. The cognitive revolution virtually began with the dichotic listening experiments of Cherry (1953) and Broadbent (1954), who showed that consciousness can usually handle only one complex stream of novel information at a time—the so-called Cocktail Party Effect. And within a single stream, consciousness labors under the further restriction of its chunking limits, first set out in the contemporary literature in Miller’s (1956) now classic paper “The Magic Number Seven, Plus or Minus Two.”

To handle these findings, researchers often appealed to the same explanatory principle used above in section 3—the presumption of efficient allocation of a scarce cognitive resource. Broadbent (1958), for example, argued that the single source limitation could be explained as an efficient way to husband limited processing capacity. Miller (1956/1962) explained the operations of packing and un-

packing as a cognitive strategy that worked, over time, to circumvent the chunking limit. Early in his career, Neisser (1967) argued that the distinction between preattentive processes and focal attention was the result of a trade-off of limited cognitive resources, with the narrowness and selectivity of focal attention "simply an allotment of analyzing mechanisms to a limited region of the field" (p. 89).

If fringe experience is in some sense distinct from focal attention, and the fringe itself is able to manifest distinguishable component experiences like rightness and familiarity, it should be possible to find cases where these cognitive elements do *not* operate in their normal, integrated fashion, but are disrupted by neurological malfunctions or can be teased apart experimentally. *We should then expect to find at least some cases, where fringe components operate in the absence of focal consciousness and, conversely, where focal consciousness can occur in the absence of the context information normally encoded in the fringe.*

For our purposes, Neisser's research is the natural place to begin, since to my knowledge his early work on "preattentive" processes came the closest to rediscovering the fringe experimentally. According to Neisser (who tried to avoid the term consciousness; see Mandler, 1975) the preattentive realm contains "shadowy and impalpable experiences" (p. 303) that represent "crude and global properties" (p. 301) of the articulated contents in the focus of attention. To a degree, preattentive processes work as a context in which attentive acts take place: "Attentive acts are carried out in the context of the more global properties already carried out at the preattentive level" (p. 90).

But there are significant differences between the fringe and Neisser's notion of preattention. So, for instance, preattention confounds conscious and unconscious elements. Neisser uses the term to refer indiscriminately to vague, inarticulate, and peripheral *experiences* on one hand, and to extremely complex, parallel, and *nonconscious* processes on the other. And his main interest in preattention is on preliminary figural segmentation and not on the representation of context information in consciousness; nor does he consider the role of "preattentive" experience in voluntary acts of retrieval.

Nor does Neisser take the elusive aspect of preattentive experience to be a positive structural characteristic, serving a functional aim; rather he explains as the result of its supposedly fleeting and preliminary character. In some respects, however, it is easy to see how the fringe and Neisser's idea of a preattentive mechanism could seem identical: When the fringe is used to "call" more detailed information into consciousness, information does in a sense move from a vague and perhaps fleeting experience in the fringe to a subsequent, articulated experience in the focus of attention.

Perhaps Rock and Gunman (1981) have produced the most significant, experimentally based understanding of the dual functions of fringe experience in general (i.e., signal availability of more detailed information; provide access to it). They see very clearly that what they call "inattentive" experience (this term avoids the conscious/nonconscious confound in "preattentive") provides certain kinds of information in consciousness, but information that is not specified as an identifiable form or object. So subjects viewing stimuli of two superimposed figures

(say a tree and a house), by virtue of the task situation, will only attend to the tree. But when this happens some information about the nonattended figure can still be reported (e.g., it had curvy lines and was red). At the conclusion of their paper they note the crucial distinction that "in daily life . . . [when] we are not attending to a pattern at which we are looking, there is the distinct impression nevertheless that something is there and has certain phenomenal characteristics. . . . By virtue of the iconic representation, we as observers recognize that the *potential* to transmute this impression is there" (their emphasis). In other words, information experienced "inattentively" is conscious, although it lacks the overall specifiable organization of an object in attention. And inattentive experience has the further feature of implying the *availability* of detailed information if attention is, in fact, directed toward it.

Another experimental approach to the fringe (taken in James' sense of directly felt significance or meaning) is to recognize it by contrast when fringe-experience is relatively absent. After "semantic satiation" a rapidly repeated word will lose its cognitive savor; we naturally say a word in this case has "lost its meaning." The effect is familiar to most children, is quite amenable to experiment, and has been called since Severance and Washburn (1907) a "laps of meaning." This sort of meaning laps is a completely introspective phenomenon, but its experimental manipulation yields consistent results. So, for example, Wertheimer (1960) reported that image-related words retain their feeling of meaning longer than abstract words.

Coming from a very different theoretical direction, Crick and Koch (1990) developed a notion of "working awareness" that they feel corresponds roughly to a "spotlight of attention" model. But they suspect that, by itself, a clearly defined content may not be sufficient to capture the reality of conscious experience: "Can a spotlight of attention, moving over the visual field from one 'salient' location to the next, explain the perceptual richness of our [conscious] environment? Would such a mechanism not lead to a sort of tunnel vision? . . . We suggest very tentatively that this richness may be mediated by another form of awareness that is very transient . . . (p. 272)."

The idea of vague experience as a sort of rapidly changing blur (and without attribution of monitoring and control functions) also emerged recently in the connectionist literature. Rumelhart et al. (1986) interpret a stable content in consciousness as a fully settled or "relaxed" parallel network. They note, however, that if "the relaxation process is especially slow, consciousness will be the time average over a dynamically changing set of patterns and thus would be expected to lead to 'fuzzy' or unclear impressions" (p. 39). This implies that there is, at least occasionally, a parallel aspect of cognition *in* consciousness. Of course this resonates with James' notion of the fringe, which was also based on the presumption of a multiple overlay of simultaneous and interacting neural events. But again, for this connectionist formulation, vague feelings are that way simply because they are fleeting and merged with one another. There is no sense of a separate aspect of consciousness performing its own characteristic cognitive function.

Rightness. Under various guises, references to the feeling of rightness can be found in the cognitive literature, but for the most part they are tacit or remain at the level of asides. This is partly because of the peculiar phenomenology of rightness: it shares the elusive character of all fringe experience, and in addition, as a control experience, rightness has no corresponding focal form.

Perhaps because Neisser *did* recognize a kind of protofringe, he was also able to move closer than most to recognizing control experiences, and—under another name—the feeling of rightness. Neisser thought he had isolated the feeling of “familiarity,” and for the moment we will use that term to explain his findings.

Familiarity is treated as a preattentive experience (p. 97), and Neisser asserts that the feeling of familiarity *by itself* can be a datum in target search experiments. No experience of a specific content is necessary. Neisser reports that, on occasion, subjects will be able to recognize that one of a possible set of prespecified targets is present in an array of other letters (e.g., either the letter “D” or “W”) without being able to say *which* target was present (p. 99). This finding can be interpreted as a sort of dissociation of the feeling of “familiarity” from a specific content. The feeling is taken to be a sufficient datum for subjects to perform the target search task, even when the specific “familiar” *content* is not experienced.

If we look closely at Neisser’s experiment, it seems that it was rightness, and not familiarity, that allowed subjects to know that a target letter was present, without knowing what specific target it was. Certainly the feeling of rightness is quite distinct from familiarity. We can feel strongly that something is right, even if it is very unfamiliar, for example, *when we recognize the solution to a problem for the first time*. When Archimedes discovered the principle of specific gravity, his “eureka” hailed the recognition of the right, but absolutely *unfamiliar*, discovery. Neisser’s own target search experiments did not manipulate familiarity levels. Subjects were to respond as quickly as possible when the designated target was present, i.e., to the “right” target. As Walter Kintch (1970) notes, “Obviously, ‘appropriateness within a given context’ [rightness] as well as ‘perceived oldness’ [familiarity] may serve as the basic datum for a subjects decision” (p. 276) in some recognition tasks.

Even when explicitly called “feeling-of-knowing,” there is very little attempt to work out the precise phenomenological character of the feeling. A growing TOT/FOK literature exists, but apparently lingering behaviorist prejudices are still at work. This is especially ironic, since if we trace the FOK research back to its source in the experimental investigation of the TOT, the original paper by Hart (1965) makes explicit reference to James’ discussion of TOT. But current research does not approach the TOT with James’ larger picture in mind. So far as I can tell, the explicit link between TOT and the fringe has not been made.

Typically a feeling of knowing experiment elicits TOT’s by asking questions like “What is the capitol of Vermont?” or “Name the Union general who was in command at the battle of Gettysburg.” When a TOT occurs, subjects estimate the likelihood that they know the right answer, which produces a FOK measure. Typically subjects respond well above chance, and among the most interesting TOT/FOK findings is that the strength of the feeling of knowing judgement is positively correlated with the amount of time a subject spends searching for an

inaccessible memory (Nelson, Gerler & Narens, 1984). The finding that the feeling of knowing influences search time is of some importance, since it is evidence that the design and operation of consciousness itself presupposes its functional efficacy, as does the fringe structure generally. Nelson et al. further note that for Korsakoff's syndrome amnesiacs, search times are very short, implying that the disruption in the FOK system may also contribute to retrieval failure in this type of amnesia. Janowsky et al. (1989) also found low feeling of knowing for Korsakoff's amnesiacs, but not for non-Korsakoff amnesiacs, suggesting that FOK deficit is associated with pathology of the frontal lobe.

Again, one might think the FOK and TOT literature would be concerned with the *feeling* of knowing, and not just the changing content which accompanies the feeling in this or that case. Instead, at the inception of TOT/FOK research, we encounter another version of the "fleetingness" hypothesis: in each case, a *specific word* is presumed to occupy consciousness in a very brief "flash." Overlooked is the possibility of a generalized control experience of rightness—a signal of (potential or actual) context-fit, that is, a *recurring* experiential component in TOT and FOK phenomena. So Brown and McNeill (1966), in one of the classic studies of TOT, offer this interpretation:

We know from the Sperling phenomenon . . . that people can have fleeting access to many details in visual memory that they cannot retrieve a fraction of a second later. . . . There are other sources of support for the idea of fleeting conscious events. In the tip-of-the-tongue phenomenon people often report a fleeting conscious image of the missing word "going by too quickly to grasp." Often we are sure that the momentary image *was* the missing word, and indeed if people in such a state are presented with the correct word, *they can recognize it very quickly and distinguish it from incorrect words*, suggesting that the fleeting conscious "flash" was indeed accurate." (my emphasis)

There are many difficulties with this analysis, and the chief one Brown and McNeill indirectly note themselves, but without seeing its import: the crucial datum is the *evaluative recognition* that the right configuration is potentially available, or now manifest, in focal attention and that this evaluation can take place very quickly. Certainly the general evaluation of right-fit must be made at some cognitive level, and this evaluation is something over and above the specific word taken by itself, be it represented inside or outside consciousness. The heart of a TOT is the *recognition of rightness*, and that recognition is antecedently specified by the particular context, which is of course largely unconscious at any given moment.

We all know that occasionally a TOT can last for quite a few, sometimes agonizing seconds, plenty of time to introspectively recognize the specific content—if that were really the heart of the process. *All fleeting experiences may be vague, but not all vague experiences are fleeting.* Since a TOT can be relatively long-lasting, we cannot explain its vague character by appeal to fleetingness alone. One would hope that attempts to understand the character of the experience would keep pace with other developments in the field.

Evidence of rightness also crops up in the subliminal perception literature. So Marcel (1983) remarks that in his unconscious priming experiments, the effect was most significant on so-called "passive" subjects, who, Marcel reports,

were more inclined to select (unconsciously primed) words "which 'felt' right" (Marcel, p. 204) even though they had no conscious criterion for their judgement.

There is a lingering puzzle about just what it is that can allow subjects to recognize that something is right, when they are nevertheless unable to identify any specific criterion for their judgement. So Weiskrantz (1992) wonders how "one can deal quantitatively with the phenomenon of 'switched' or 'gut' awareness? For example GY, a blindsight subject, sometimes says (but this is not true of all blindsight nor GY under all conditions) that he 'knows' that a stimulus has occurred, but insists that he definitely does not 'see.'" *In some cases, simply having right/wrong information in the fringe would seem to be sufficient to guide performance in blindsight tasks*; and subjects do at times report correlative experiences of "just knowing."

Although the situation is complex, and anomalies abound, it is worth noting that an evaluative signalling system in the fringe bears an intriguing relation to an analysis of pathological states of consciousness made by researchers such as D. L. Schacter (1990). Certain amnesiacs are unaware of information that they nevertheless use implicitly: they can learn to solve a new problem, say learn to execute the *right* moves on the Towers of Hanoi puzzle, but are unable to remember their previous training: the problem *never seems familiar*. Those afflicted with anosognosia are unaware of a cognitive or physical deficit, denying, for example, that anything is *wrong* with a paralyzed arm. Schacter suspects that these two kinds of "unawareness" are quite different and need to be accounted for. The contrast between implicit knowledge (in fact knowing how to solve a problem, but not knowing beforehand that one can solve it) and anosognosia (in fact having a deficit, but *not* knowing it) does seem to reflect a cognitive distinction in consciousness involving different mixes of deficits in the control experiences of rightness, familiarity, and wrongness in the fringe.

On this account, some amnesiacs with only implicit knowledge have apparently lost the ability to feel retrieval accessibility over a certain cognitive domain, and in consequence the fringe "target" experience (toward which attention would otherwise normally focus to begin retrieval) would be absent. Similarly, in anosognosia, the pathological inability to feel wrongness in a given domain would interfere with the conscious recognition of deficits, and at the same time may remove the fringe target used to call detailed information about a deficit into consciousness.

I want to avoid detailed speculation about these sorts of deficits here. My point is simply to raise the possibility that fringe deficits may in themselves help account for neuropsychological incapacities: that at times the appropriate component of the cognitive "menu-bar" in consciousness is, as it were, too dim; the locus of the debility in such cases is in the conscious representation of retrieval accessibility and not the absence in memory of the specific information in question.

Connectionism and rightness. To return to Weiskrantz' query. Using connectionism, it would seem possible to *quantify* "gut feelings" of rightness (and the more explicit serial processes that are influenced by them) indirectly via computer modeling. This may also offer a new way to study the interaction of nonconscious

and conscious processes in general: goodness-of-fit could work as a feedback link between the serial and parallel components of the model, boiling down the level of integration of the *entire* parallel/sequential system at a given moment into a single value. Over time, this summary index should help in selecting among possible sequential operations, by showing which serial operation would most increase the goodness-of-fit of the system as a whole. This architecture would then direct sequential processing through a process of parallel "intuition" feedback.

To appreciate the underlying plausibility of this proposal, consider again the basic structural limitation on consciousness/nonconscious interaction: If consciousness does perform the cognitive functions it appears to perform, it must somehow take into account vast amounts of unconscious information that it cannot itself contain; *consciousness' articulation limitations make detailed representation of context information impossible*. On the account sketched out above, rightness represents, in consciousness, perhaps the single most important mechanism controlling the conscious/nonconscious interaction: for rightness represents the degree to which an explicit content in consciousness is compatible with its vast unconscious context; rightness links these two cognitive subsystems into a constant and reciprocal interaction.

If the last 30 years of cognitive research have taught us anything, it is that the structure of unconscious context information is more like a connectionist network than any other model currently available. Hopfield's (1982) discovery of goodness-of-fit (see Rumelhart et al. 1986, for a technical discussion of goodness-of-fit) shows that in many cases it is possible to condense into a single metric or index the level of global coherence resulting from an immense number of mutually interacting, neuron-like nodes. The "harmony" level of an entire network can be expressed as a single value that varies as harmony increases or decreases. If the connectionist model of nonconscious processing is roughly correct, we can go on to simulate this process, to a degree, on a computer, using goodness-of-fit as the interacting link between parallel (nonconscious) and serial (focal attentive) aspects of an inclusive cognitive model.

The experience of rightness does indeed seem to behave like a goodness-of-fit metric, indicating, as a global, summary signal, the degree to which the entire network (constituting a given conscious content and its parallel and distributed nonconscious context) constitutes a coherent and harmonious system. We have seen that many lines of evidence and theory converge on this interpretation: the feeling of rightness exists, that it is a distinct entity, and is not to be confused with any focal content in consciousness. Rightness signals a coherence relation between *whatever* content may occupy consciousness and *whatever* nonconscious context the content is embedded in. Ignoring habituation, as the content in consciousness becomes more integrated with its (presumably) parallel and distributed nonconscious context, the rightness "metric" should increase in intensity.

We would expect this process, for example, to be evident in the early stages of problem solving. Equating rightness with a goodness-of-fit metric, then, gives us a coherent picture of how "hunches" and "intuitions" work at both the conscious and the nonconscious levels. Rightness should be able to guide conscious activity before any clear content has appeared as an explicit evaluative criterion.

The findings of Bowers et al. (1990) illustrate just such a process: In the context of discovery, "tacit perception of coherence guided Ss gradually to an explicit representation . . . in the form of a hunch or hypotheses. Clues to coherence may automatically activate the problem solvers relevant mnemonic and semantic networks, and eventually the level of patterned activation is sufficient to cross a threshold of consciousness. At this point it represents a hunch or hypothesis."

From the standpoint of current connectionist theory, however, there is a serious problem with my analysis to this point. In their present form, networks do not themselves "compute" goodness-of-fit in order to settle into a stable, maximum goodness interpretation. In research at the moment, an actual goodness-of-fit computation is carried out for secondary, descriptive purposes and uses a standard sequential summation. The computation of the goodness-of-fit of a network is *not* itself carried out by a network.

But I believe I have shown that there is strong reason to hold that rightness exists. So then we must ask how it is that a summary feeling, based on an extremely complex, parallel context, could be produced somehow by our cognitive system. Given the complexity of a determination of context fit, we must assume this process is unconscious, and our best current understanding of unconscious processing is that it is network-like. This line of thought, then, *predicts* that some as yet unrecognized "goodness" network architecture is determining the goodness-of-fit of the "primary" network that settles into the coherent state as a direct consequence of the immediate content of consciousness integrating with its nonconscious context. In other words, some secondary process, goodness-of-fit determining network must be postulated in order for the cognitive system as a whole to have information about parallel coherence levels. We have seen that FOK may have its locus in the frontal lobes (Janowsky et al., 1989), and so perhaps the secondary or "goodness" network system is more in evidence there.

To search for secondary, goodness-of-fit determining networks, of course, neuroscience needs to have some idea of what to look for, what network architectures are able themselves to determine the goodness-of-fit of primary networks (a rough and ready version is good enough for now). So a search for goodness networks in the brain would do well to enlist connectionist theorists to work out what some likely versions of secondary networks would look like. And perhaps neuroscientists and connectionist modelers will mutually sharpen one another's ideas.

A final implication: If the fringe is indeed something like a menu-bar, then the structure of consciousness *itself implies that consciousness, qua consciousness, is doing cognitive work*. In other words, looking carefully at the operation of the fringe provides us with a new line of evidence against epiphenomenalism. In addition to our feelings of undertaking willful action, the functional analysis of the fringe shows that consciousness is, as it were, also equipped with a set of controls that seem designed precisely *for* willful action.

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