

TIME AND PROCESS IN NEUROPSYCHOLOGY

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SUMMARY

Temporal order in perception and memory has been conceived as realized within a mind/brain state or over a succession of states. Serial order might involve a concatenation of states with a blurring of the boundaries between them. However, succession alone cannot map directly to passage, i.e. perceived succession in the world does not give that in the mind, since objects and entities perish on actualization. The perception of temporal order requires that past, no-longer existent objects recur in memory. However, to attribute serial recall to short-term, working or episodic memory merely re-states the problem without explaining it. A succession of perceptual states may be necessary for serial order but it is not a solution to the consciousness of succession. Moreover, succession is as essential to change as to stability. Object stability occurs when replacements are similar, change when recurrences are novel. Serial order is required both to see a tree and hear a sonata. For epochal theory, events arise within non-temporal spatial wholes, with the simultaneity within a state replaced by its successor. This article argues that perception develops out of memory through the effects of sensory constraints on a memorial infrastructure. The state lapses to its precursors in the incomplete revival (decay) of perception in a series of replacements. The transition from simultaneity to succession within a state and the layering of the state in the graded revival of past states, i.e. the orderly regress from a prior object to a present image, transposed to a temporal series within the virtual present, is the basis of serial order in memory and perception.

INTRODUCTION¹

To common sense, the perception of serial order is not a problem, since we have a direct perception of the changing sights and sounds of the world, which simply impinge on the mind/brain in the order of their occurrence. For

¹ The term, *sense-data*, is used for the data of sensation, extrinsic to perception, i.e. sensory constraints, not as in philosophical texts ingredient in or equivalent to perception. The term *transition* is used for process within the mind/brain state, while *passage* is for process in a physical or mind-independent world. Phases in the mind/brain state conform to the transitions that underlie the mind and to passage in an entity, the brain, which is mind-independent in that brain activity is extrinsic to consciousness. *Objects* are internal or external contents of mind. *Entities* are mind-independent.

many cognitive scientists, serial order is just the causal sequence of events in the world mirrored by events in the mind. From the standpoint of movement, serial order is explained by associative chains, just one thing after another, whether a person playing a game of basketball or chess, or a computer playing a sonata. What chaining does not explain is the memory of antecedents and the anticipation of consequents, which is no less essential to perception as to memory. The theory of causal chains applied to actions and (perceptible) events in the world extends, by implication, to memory, which is conceived as recurrent perception. However, chaining cannot explain the chunking of serial wholes prior to their sequential enactment, the apprehension of the whole of an event, from beginning to end in vision or audition, hearing stretches of language or music, phrases and melodies, even an entire work, a poem or piece of music in the mind.

Temporal chaining and spatial assembly derive from the same theory. The concept of causal chains entails that the brain not only directly perceives an object sequence but pieces the object together from its perceptible features, such as color, size, shape and movement. Functional components for such features are inferred from what is observed in perception. Parts of objects are internalized in the machinery of their construction, just as bricks and mortar are the constituents of a wall. We see the wall put together from its parts, and assume that objects in perception, such as the perception of the wall, are put together in the same way. We see color and postulate a functional area or system that adds color to the final object. We see motion and postulate that it is perceived by way of detectors that add motion. The finding of brain cells that detect motion leads to the assumption that change and serial order are outcomes of the operations of functional units dedicated to their detection². This implies that objects are aggregates of smaller elements in the physical world, in the physical brain and, finally, in the mind of the perceiver. The isolation of atomic solids in space – wholes as sums of parts – is comparable to the isolation of solid objects in time – duration as a compilation of instants.

An object moves or changes in relation to the world around it, and at every moment there is a changing relatedness of the world. The interlocking motion of the totality is missed when interest settles on one object or its features. If one postulates a brain area or function for objects, is there such a correlation for the space between them? The inability to study the entire field, and the inclination of science to ever greater precision and analysis, explain why the study of the mind/brain tends to isolate the simplest psychic or neural elements and proceed from there to a theory of the complex. But starting with

² More generally, the activation of neurons by external stimuli does not mean the neurons are responsible for the perception of those stimuli. Levitan (2006) gives the example of regions in left hemisphere shown to be active in the perception of musical structure that are also active in the perception of sign language. If acoustic noise and silent motion activate the same regions, clearly the experiment is tapping into something more general than the stimuli. This is no doubt true for most, if not all, studies that purport to map brain areas to cognitive function.

elements conditions theory and reinforces the notion that a field is an aggregate, or that the world-manifold is a composite held together by external relations. All these accounts are of a piece with the concept of succession as a causal chain in mind or world, while the real questions are how the mind/brain perceives succession, the nature of implicit and explicit change, and the relation of past to present.

Categories individuate particulars that float in the soup of perceptual space. An object is singled out by attention, the focus of which can go from field to object, or from an object to a particular, a feature or an attribute. The object is whatever is attended to, a landscape, a horse or a fly on its back. Elements in perception are contrasts at different levels of detail, not building blocks. The space between objects is not a vacuum or void, at least not in visual perception, but is itself an object, albeit lacking in density. We perceive an enormous gestalt in which figural elements specify according to interest or value. This leads one to ask, is the pattern of whole to part in mind, in its complexity, a microcosm of universal law?

Conventional theory is at risk when objects are conceived as events, for then change is prior to stability. When I close one eye, then the other, or tap my eyeball and the world jumps to one side, I do not think the world is moving. When my eyes flicker in microsaccades or move in voluntary gaze, and the world remains motionless, I do not think the world is a static picture. When I lift my hand to my eyes, it does not increase in size to the extent anticipated in optical geometry. In such instances, motion or change and its absence are attributed to the mind, to constancies, to categories, to the eyes or to feedback systems that control eye movement, all of which have evolved to keep the world and the self as stable as possible. This raises the question, does the dynamic of actualization lead to a world that, even as it changes, is artificially stabilized, or is the changing image of the world a succession of static pictures?

The capacity to arrest change and apprehend solids, or to perceive change as something that happens to an object, or to perceive objects as instigators of change, is fundamentally the problem of change itself. The perception of objects as things, not events, or the perception of an event as the change an object undergoes, or the sequence of object occurrences, or the collection of states of the same object (or self), is possible when a series of actualities - or mental states - contracts to an object or expands to an event. To perceive the momentary history of an event as a whole, or as a collection of slices, entails that snapshots of varying thickness are perceived in a certain order. Every instant an object changes, inwardly, outwardly, in relation to the field and the observer's perspective. These snapshots, if that is what they are, have to be summed or averaged over some duration just to be perceived.

In order for an object to exist as a "solid," or for a solid to become an event, it must recur over successive durations. This is true for all perceptions, though it is more emphatic in some modalities than others. It may not be obvi-

ous that a tree, like any visual object, must be perceived over a succession of occasions for it to be perceived at all. To perceive a continuous series, not a succession of flashes, and to be aware of the succession, temporal order must be sustained by the recurrence of the object. As mentioned, this is no less essential to visual perception than to audition. For vision, we usually say the object is just there and perceived as it is, while in audition, the difficulty is finessed by saying that words or tones are held in memory over a period of time. To hear language or music supposes that temporal-order in memory accounts for time-order in perception. The usual idea is that the order is first perceived and then transferred to short-term or working memory. But since an "instant" no longer exists when the next occurs, "working memory" is merely a technical term to mask explanation. What does it mean for something to be held in memory if the immediate past no longer exists in actuality? If the past must be revived in the present, how is order maintained, revived, perceived? If the past fully perished and could not be revived, every object would be a momentary and unfamiliar novelty, as would the self that perceives it. Without an implicit memory of antecedents there would be a stroboscopic succession of disconnected selves and worlds. Clearly, the past must be within the present – indeed, the major part of the present – for both the stability of an object and its change over time³.

CONSCIOUS AND UNCONSCIOUS

Change in the motion from one event to another in the observer's world reflects the temporal order of events as they actualize in the mind. We know, *inter alia*, from the lag in perceiving an object, or from the image that results from binocular disparity, that perception is not *on-line* with physical nature. We perceive mental images that model physical events, not the physical events themselves, which are inferred from the images. Object and space are the outcome of the sculpting and externalization of phases underlying image-formation. The transition to objects from the intra-psychic and unconscious to the conscious and external is so obvious and so often stated it should be accepted as a starting point for speculation. Let us begin with the transition in the mental state from depth to surface or onset to termination in relation to time and change.

Many thinkers since von Hartmann (1868/1931) and Freud have claimed a transition from timelessness to temporal order. Since timelessness is non-existence, and the unconscious does not have the instantaneity of a durationless slice, it is preferable to speak of simultaneity, which has extension or thickness. If unconscious process in a conscious person is conceived as a subliminal transition, i.e. if the *psychic* unconscious is beneath or outside consciousness though essential to it, and if the unconscious exists when the

³ Whitehead (Cobb, 2008) is close to this idea when he writes of the first stage of concrescence as the conformal inclusion of past occasions supplemented by conceptual feelings.

mental state actualizes, what would be the form of an unconscious transition that actualized without becoming conscious? On the microgenetic account, consciousness is always preceded by, and enfolds, an unconscious transition, so that an attenuated mental state could exist without realizing consciousness. For most psychologists it is the other way around, i.e. experience first passes through consciousness in order to be revived in the unconscious. A memory is the record of a perception, as the imagery of a dream is a memory (true or distorted) of prior conscious experience. On this view (which is not uncommon among those hostile to psychoanalytic excess, in which content in the *un*-conscious is dependent on, is a copy of and secondary to consciousness, without which, *qua* unconscious, it would not exist) the unconscious is merely a physiological storehouse of past conscious experience (Pachalska & MacQueen 2008).

For microgenetic theory a memorial unconscious underlies and is *antecedent* to conscious experience (Fig. 1). Consciousness is an endpoint of unconscious process – actually, a relation of early to late phases in this process (Brown 2008, Pachalska et al. 2009). An image develops out of memory to externalize as an object, while a perception sinks or decays beneath consciousness. Microgenetic theory holds that the perceptual rim is uncovered to reveal underlying memory or dream, as pre-terminal phases re-actualize to varying degrees of completeness and in conformity with immediate experience. In brief, *instead of perception laying down memory, memory lays down perception*. Further, it is necessary to avoid a preoccupation with the *contents* of the unconscious – memories, images, dreams – for it is the *process* of unconscious mentation, not the content into which the process

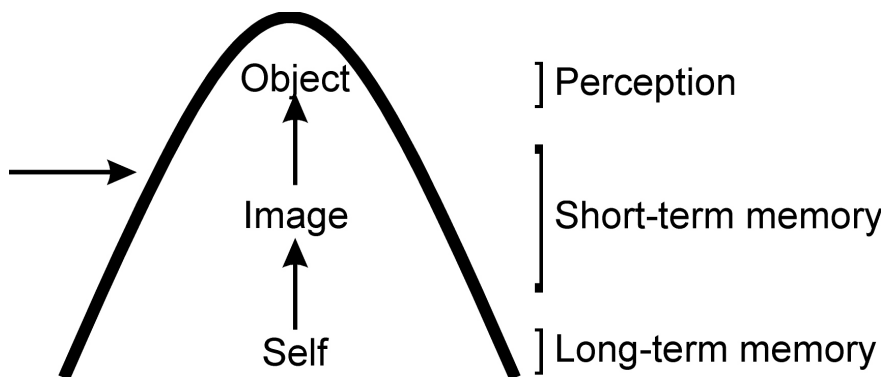


Fig. 1. The transition, or process of becoming, from core (self) to perception (world) frames a mind/brain state. Consciousness is the relation of early to late or depth to surface in this process. Visual and verbal imagery, including conceptual or intentional feeling, arise at intermediate phases so long as an external world is realized. The arrow represents sensation acting on the phase of imagery to externalize and adapt the state to the physical world. The phase-transition is non-temporal until it terminates. The mind/brain state and immediate present develop in a fraction of a second, replaced by overlapping states.

deposits, that is common to organisms lacking human consciousness. Content varies, process is uniform⁴.

What is the status of the unconscious in the absence of consciousness? Since a mental state is not conscious until its antecedents are transformed, the unconscious achieves a retroactive existence on becoming conscious. Access to unconscious cognition in conscious subjects is limited, for it is transformed by sensation to adapt to conditions in the physical world. Symptom formation in cases of brain damage is helpful in this respect. So is dream, but the paradox of dream is that the unconscious takes on existence only when the individual awakens. If dream and REM dissociate with no definite markers of dream in a sleeping person, certainly not of its content, the only direct knowledge of the unconscious is when it becomes conscious, at which point we can no longer say it is unconscious. Does a dream that fails to achieve consciousness exist in actuality⁵? One would have to postulate "degrees" of actuality, with acts and perceptions having more actuality than thoughts, thoughts more than dreams, and dreams more than dispositions.

Perhaps one should speak of differing states of actuality, or the extent to which particulars are specified in a given mental state. Existence is more readily applied to the external, the distinct and specific, rather than the internal, non-specific and categorical. Existence is being, but whatever becomes, i.e. actualizes, achieves being for the moment of its existence. If we believe that thoughts, images and dreams exist, a thing does not have to be real, substantive and external to have existence. The transition from concept to object is one of increasing clarity and actuality. Concepts seem vague and impalpable, objects real and substantive, but we would not want to say concepts do not exist. Here, the idea of existence clashes with that of the real (Brown 2004). We might not want to say that dream images are real, but would we say a dream, even if unreal, does not exist?

A dream is an endogenous perception that lacks sensation to carry it outward. If the difference between dream and waking perception is degree of exteriorization, and if exteriorization occurs when sensation is applied to endogenous images, is this sufficient for objects to have greater existence than images or dreams? It is also the case that the existence of a thing depends on the duration over which it actualizes. If a non-conscious mental state can have an animal, even vegetative, existence, the subjective duration of the state depends on what is realized. If the actual is epochal and if existence is existence in time, each actuality has a unique temporal character.

⁴ The focus on content rather than process lead researchers to prematurely discard the regression hypothesis in early language and cognitive development (Brown, 1996).

⁵ Behaviors such as sleep-talking, somnambulism, cries, laughter, which imply mentation in the individual who is sleeping, challenge this argument. However, in personal studies of sleep-talking, in which individuals are awakened and asked about their dream, concordance to the dream report is inconsistent. Anecdotally, this is also the case when someone is awakened during bouts of crying or laughter. This implies that on waking, the simultaneity of the imagery is retrofitted to a linear narrative.

THE PERCEPTION OF CHANGE

The shift from cause to effect has usually been postulated as simultaneous, though for some it is successive. Causal sequence in the world is perceived as a transition of a continuous event or event series. If the process account of this shift is correct, i.e. as the appearance of a transition from one conscious endpoint to another, with change occurring in the derivation of the endpoint in an epoch of consciousness, the causal shift would be simultaneous if occurring within an epoch and successive if occurring across epochs.

Some writers have looked at the shift from the simultaneity of spatial cognition to the successivity of the temporal in speech or action. This has also been framed in terms of a shift from the (spatial) right to the (temporal) left hemisphere (e.g. Teuber 1956; Luria 1966), or from posterior to anterior brain processes in language, as inferred from aphasia (e.g. Jakobson 1968). There may also be a transition from the simultaneous to the serial in the microgeny of a mental state. If the inception of the mental is simultaneous, and temporal order occurs at the conscious endpoint, simultaneity and seriality refer to earlier and later in a single epoch. While the shift from spatial to temporal, or simultaneous to successive, has been discussed in neuropsychology, the philosophical difficulties and implications of such a shift, as well as the nature of simultaneity and succession, have not received sufficient attention.

Not just the simultaneity of the unconscious can be posited, but that of the mind/brain state as a whole, which is simultaneous over the epoch of its existence. Entities have a temporal extensibility over which they become what they are. In mind, late phases are not the outputs of early ones which, having been traversed, disappear, but rather early phases are embedded in late ones and all phases actualize together on completion of the final phase. There are conditions in which the core might be the endpoint of the state, say when processes mediating subsequent phases are inactive or destroyed, as perhaps in coma or dreamless sleep. There are cases in which an intermediate phase actualizes briefly as a pathological symptom, but a phase *in transition* does not exist in isolation. A phase is not a temporal object. An object is the minimal cycle of phases that constitutes one epoch. Thus, a hypothetical atom is not a collection of slices in the orbit of an electron or the sum of its positions at every slice, but is one complete revolution. Existence is all or nothing, and the existence of the all is simultaneous when an entity becomes the being that it is.

How is temporal order in consciousness achieved? Is it by unpacking the spatiality of the unconscious to the seriality of its termination? Is it a result of the replacement of individual states? If serial order derives from simultaneity or potentiality, simultaneity would forecast succession in the derivation of a state. If a succession of states is required, experience is still confined to the virtual present of a single state. The now, the present moment, arises in the disparity between the endpoint of an actualization and a phase to which the

past is revived, so that successive states are required to stratify the phase-transition as well as to sustain it.

If serial order in consciousness is coupled to the phase-transition leading to consciousness, as deduced from the state on completion, with memories of recent events revived in the order of their occurrence – the transition activating earlier, then later phases in memory up to the final perception – the sequence of activation could provide the basis for a *line in time* from the immediate past to the present endpoint. When we listen to speech or music, the words and tones continue to resonate for some period of time as each new sound is perceived. This is explained by the strength (degree) of revival – usually cast as decay – of preceding states in novel ones. The earlier events are incompletely revived in relation to their pastness or, perhaps, the feeling of the relative pastness owes to the degree of revival. A transition leading through memory to perception that is apprehended as a *horizontal* sequence from past to present would explain sequencing in action, music, language, in the world and in the mind (Fig. 2). Since the duration laid down by the phase-transition enfolds the memorial remnants of prior states that provide the posterior boundary of the now, both perceived and remembered event-series fall within the present duration. Since this account explains order in both memory and perception, it has a parsimony not found in rival theories.

As mentioned, the mental state lays down serial order, yet has a spatial character, actualizing as an epochal whole. The simultaneity or spatial totality of the present epoch distributes into the order it realizes. Regardless of whether temporal order in a mental state develops from the totality of an epoch or an iteration of totalities, in the transition from initial simultaneity (core), through the before and after of the phase-transition, to the now that arises with a conscious endpoint, the state incorporates three modes of time-discourse:

1. Simultaneity, which entails temporal thickness or extensibility,
2. Physical passage in the becoming of the mind/brain state, which gives mind but is itself mind-independent, and
3. A subjective present (past, future) that gives being or existence to the transition.

The simultaneity (1) that is the spatial whole of the core, or the epoch it generates, leads to and embraces a transition over phases (2) that is the bridge to temporal order. This transition, and the duration of the present that is its outcome (3), correspond to the two series of McTaggart (1927). Since the transition does not exist until it is complete, at which point the entire transition actualizes, every temporal moment or mind/brain state – whether a static picture or an event-sequence – occurs against a backdrop of simultaneity.

Ordering depends not on perceived succession but the implicit role of succession in the layering of memory and the replacement of one state by the next. But is it possible that serial order is just the perception of linkage made fluid by the rapidity of shifts? This assumes that a mental state, as an epochal

whole, is simultaneous through its phases, with change in the causal shift from one epoch to the next, i.e. in the linkage of states, not their *replacement* or overlap. We are conscious of the final contents of a state, not the transition from state to state or depth to surface, nor are we aware of interstices in the linkage. Even if temporal order is not dissociable from oncoming and antecedent states, any account based on rapid succession must return to events *within* the state itself.

Consider the phase-transition *within* the state in relation to replacement *across* states. If order is laid down in the distribution of spatial objects, or if it is derived serially from the outpouring of the core, the array of objects in the world would be a static grouping with a leading edge of change, i.e. micro-events fused to an event-sequence in the overlap. An object would then be an incipient event that becomes continuous when the next state appears. The perishing of the state would support the anticipation of the next and avoid a succession of pictures. If the clock duration of a mental state of 50-100 milliseconds is insufficient to generate serial order within the state, like the flash of a tachystoscope (stroboscope), it might permit a perception of forward momentum. Order and continuity would then depend on the overlap of recurrences.

Is conscious succession – the sequence of events in observation, or the motion of the world in perception – an illusion of causal transition? Is it like the *phi* phenomenon, in which illusory change results from the rapid replacement of static images? A series of causal pairs may explain fusion from one state to the next, but not memory of preceding pairs to give a continuous event or narrative. Some have noted differences between real and apparent motion but others (e.g. Frisby 1973, in Schiffman 1976:262) have argued they "are mediated by the same movement detecting mechanism." There is an inter-dependence of intensity of stimuli, distance between them and time (Schiffman 1976). In a movie, continuity requires a frequency of around 40 milliseconds per frame, which is close to the estimated duration of a mental state, thus the rate postulated for the replacement. This rate is likely governed by a pacemaker and is relatively constant, but there are individuals with brain damage in whom events appear to be speeded up or slowed down (Hoff & Poetzl 1988). The acceleration and deceleration of events in pathological cases, as in the speed of a film projector, might reflect the frequency of replacement.

The conclusion of this line of thought is that states are not concatenations but superimpositions on the remnants of predecessors that are embedded as memorial residues (Fig. 2 above). The graded decay of memory is its graded revival in conformance with the occurrent state. We see a tree as persistent because of the similarity across recurrences. If the recurrence differs from its predecessor, the object is perceived as changing. In psychology, decay (revival) is assumed to account for serial order in memory, as in episodic tagging or stacking in forgetting, at least for short-term memory. However, what accounts for serial recall in memory must apply to perception.

PERCEPTION AND MEMORY

In order to understand temporal order in perception it is necessary to understand the relation of perception to memory. An incomplete perception has the character of a memory. The decay of perception to short-term memory, which is dogma in psychology, is ordinarily conceived as the transfer of perception to a store that retains many of the physical features of the original stimulus. One problem with this theory is that it posits a trace that is degraded rather than one that is incompletely revived. The persistence of a dead past is the heart of the problem under study. As soon as an object is past, it no longer exists except as an echo in memory. The concept of perception as externalized memory, or forgetting as incomplete revival, puts the relation of memory and perception in a different light. On this view, the transition is *from* long-term *to* short-term memory *to* perception. The trajectory is the opposite of that assumed in psychology. A perception grows out of phases in memory uncovered as incomplete recurrences within a momentary actuality.

The greater part of perception is memorial, the endogenous infrastructure of which is modeled by sensory data to represent objects in the world. To understand subjective time and serial order, it is necessary to conceive perception as a form of exteriorized memory. Russell (1921) wrote of the relation of image to object, but Whitehead (p. 69) pointed directly to the memorial basis of perception: "there is no essential reason why memory should not be raised to the vividness of the present fact; and thus from the side of mind, what is the difference between the present and the past"? Again, (p. 73): "what we perceive as present is the vivid fringe of memory tinged with anticipation." The difference owes to the effects of sensation on an endogenous process of image formation.

The claim here is that serial order in memory underlies serial order in perception. The recall of the order of past events, so-called episodic memory, develops in a setting (some would say out of a store) that is simultaneous until it partitions. Whether memories are conceived as associative chains, circuits, networks or configural potentials, whether they are localized or distributed, until they are activated they are dormant possibilities, not actualities or existents. An event in memory is a potential for activation. The search for the memory *store*, *trace* or *engram*, has a long disappointing history. This is the because the accuracy of recall is determined by the extent to which the phase-sequence of the initial encounter is revived. In what other sense can we even write of the existence or temporal location of the memory of a long-forgotten face that is suddenly revived in a chance encounter? *In what sense is a memory in the brain waiting to be activated?* On the other hand, how does something come into existence from non-existence?

A difference between episodic memory, in which an event is ordered in time, and semantic memory, which is for knowledge rather than events, that is, for thought or language rather than perceptual experience, is that epi-

sodes become parts of categories, shifting their allegiance from occurrence to family resemblance. An event absorbed in a category, say by repeated exposure, loses its exceptionality. The recurrence strips the event of episodic context for the relational system of thought. If I travel a certain route only once, I may remember it as an event in time. If I travel the same route every day, it becomes part of my knowledge, and is recalled as a specific occasion only if something unexpected happens. The unexpected creates novelty by decontextualizing an event from a family of like-occurrences.

The temporal locus of a memory can be accurate in immediate recall, as in hearing and recalling a telephone number, but even here it is imperfect, and it becomes more fallible over time. I can say that my first trip to Paris preceded one to Barcelona, though the revival of other events may be required to reconstruct the sequence and locate a specific event in the correct order, especially if there are frequent visits to both cities. The specificity of encounters is in tension with the generality of categories. Separation in time is naturally important. I would probably not recall whether, on a first visit to Paris, I went first to the 5th or 7th arrondissement. In amnesia with a shrinkage of past (and present) duration, the inability to revive events, even implicitly, fails to articulate and expand past duration. Empty duration collapses on itself.

Do events in episodic memory have markers or relational indices of the perceptual history of their occurrence? To assign a temporal tag to events, or postulate a scanning device (Lashley, 1951) merely offers a mechanism as much in need of explanation as what it purports to explain⁶. In citing the Würzburg school, Lashley implied, as is developed in this paper, a hierarchical system of unconscious schema or constructs out of which serial order develops. His example of the final word of a lengthy sentence disambiguating the meaning evoked the problem of languages such as German, in which a sentence may not be understood until the final verb. This suggests that an episodic sequence in memory, i.e. the temporal order of past events in a mental state, or the basis on which we say A came before B, and B before C *in the past*, is the same problem as the temporal order – A,B,C – of ongoing experience (Fig. 2).

Lashley noted the problem of syntax and word order, and many subsequent accounts have focused on language production and errors. The difficulties illustrated by such phenomena as co-articulation, pronominal reference or Spoonerisms, and the various computational models they have led to, may seem plausible, but they make no attempt to relate the model to brain function and neuropsychology, nor do they address the more fundamental issues of a lost past that reappears in an actual present.

In perception, event-order is immediate, objective and external, in memory it is fuzzy, often effortful, internal and imaginal. This distinction, which is

⁶ There is discussion of the impact of Lashley's paper in Bruce (1994). See Houghton and Hartley (1995) for a cognitivist interpretation of Lashley's ideas.

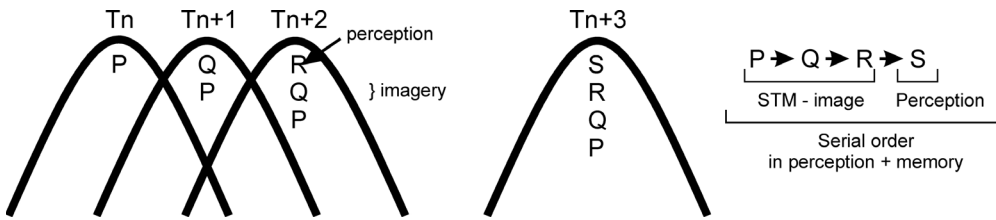


Fig. 2. The perception (P) at T_n is replaced at T_{n+1} by another perception (Q), which may resemble or differ from that at T_n . Perceptual stability depends on resemblance; change depends on difference. Within the perception (arrow, R), the mind/brain state at T_{n+2} revives T_{n+1} almost completely, such that the image of P at T_{n+2} is prior to the object (Q), and so on. Over a brief succession of mental states, P, Q and R represent images of past perceptions revived to a decreasing extent in the oncoming present, and graded according to this revival. An eidetic image is a near-complete revival. A memory image is a vague recurrence at some psychic distance from a present object. At T_{n+3} , the series of images, P, Q and R, forms an order antecedent to the perception (S). The perception and memory of serial order depend on the perception developing out of memory. Serial order occurs within the present, but depends on succession for the layering of prior experience

one of memory and perception, of inner and outer, mind and world, not serial order, helps us to know whether an experience is a memory or a perception. We get a glimpse of its fragility in *deja vu*. A unified theory is obligatory if perception, as Whitehead put it, always contains an element of memory. Merleau-Ponty was inclined to write that we remember events into perception (see also Bergson 1896/1959).

Probably, the experience of an animal is closer to the perception of a succession of scenes, bodily adjustments and anticipations than an apprehension of order over an extended series. It is doubtful that an animal is aware of a chase. Rather, there is a succession of acts and objects and a tacit computation of trajectories that are positions in static pictures without an apprehension of the ongoing sequence. We do not believe an animal has a past to compare with a present for the recognition of serial order. Obviously, animals learn from past experience, and there is implicit revival, even to the conditioning of response bias, for the recognition of danger and opportunity, as for the perception of change, but we do not presume the animal is conscious of its past. There is sensitivity to change even as the world is changing, e.g. the movement of a mouse to a hawk, a deer to a lion. A sudden shift in the detail of a static picture resonates more than overall change in the array. Similarly, humans are more sensitive to difference than sameness on experimental tests, possibly because sameness as a static picture is the background out of which difference resolves.

A NOTE ON DREAM REPORT

The argument that memory and perception have a common basis entails that processes underlying serial recall are the same as those for serial order

in perception. If the awareness of a series of *recalled* events is comparable to the awareness of *ongoing* events, one approach to the resemblance is through the phenomenon of dream recall, in which the memory of a dream appears to be coupled to the dream sequence, especially in a lengthy and complex dream. However, we also have the impression that the dream is first apprehended as a whole, with the constituent events taking on order as they fade. In dream and ordinary recall, as in perception, serial order is embedded in the present state, even if a succession of states is necessary for the embedding. For some, causal relations *between* mental states are assumed to fill the eventless, timeless gaps in succession and account for the continuity or continuous identity of perceptual objects. In dream, similarity of shape, function, signification and family resemblance appear to conserve identity and serial relatedness. In a strong, Laplacean causation, the world unfolds in time like a movie. Given a state of the world at any moment, all ensuing states follow of necessity. If the causal future of the world unfolds like a film from a reel, could a temporal series in the mind unfold out of simultaneity?

At any moment we live in the bubble of the immediate moment. Preceding states are a past that no longer exists; ensuing states are continuously becoming present (how the replacing state retains patterns of the state it replaces is discussed below). Serial order depends on succession, but mere correspondence is not explanatory. The absence of a past in dream may absorb succession in the thickness of the state on waking, but all images in dream or perception, present or past, exist in the present.

Some might argue that the entire past of the individual is revived in the present. The *Lebensfilm* phenomenon in near-death experience, in which one's life is said to pass before the eyes, suggests this possibility (Schilder 1950). McCulloch (1965) was led to similar conclusions based on hypnosis and other data⁷. To what extent is the seriality applied to dream an effort at meaning and plausibility as the awakened self grasps at narrative? If passing images are immediate on waking, i.e. if the entire dream is within a single mental state, how are images aligned in the order of their occurrence?

The content of dream differs from ordinary recall in its novelty, digression, derailment, substitution and symbolism, all features of early cognition. Consider a dream of a past vacation in relation to its conscious recollection. On the usual interpretation, recollection is for events that were initially conscious, and thus, even if spotty or incomplete, events are revived with a greater correspondence to the objective sequence. In contrast, dream is a secondary elaboration of what was first in consciousness, with the quality and order of events subsidiary to their meaning. The microgenetic interpretation deepens this understanding in claiming that conscious experience traverses a memorial infrastructure, which is tapped in memory and recurs to a

⁷ This notion is wonderfully evoked by Philip Roth in the depiction of a non-sensory after-life with total recall of past experience for an eternity that is timeless.

varying extent in dream. Content beneath the original perception that is revived in memory is uncovered in dream, with the lesser degree of realization and lack of sensation giving the unreality and precarious recall.

This account of order in dream recall is reminiscent of inspired thought in creativity, when a work is apprehended all at once, then composed or worked out over time. The description of Mozart hearing a work all at once in his mind, though disputed, conforms to my experience (Brown 2005) and that of other writers, composers and artists (Koestler 1964). Composition occurs in dream or transitional states, such as the *Kublai Khan* of Coleridge, or Wagner's *Prelude to Das Rheingold*. In fact, the ability to revive a poem or piece of music composed in dream is perhaps the best indication that waking recall preserves the order of visual and auditory images.

In creative insight, in dream, trance or transitional states (Brown 2008), the potential for order may occur in spatially-given parts. An example can be found in studies of iconic imagery when, say, a 3 X 3 matrix of 9 numbers is briefly presented and the subject asked to recall them. Usually, a few are recalled each time as the remainder fades, but it can be shown that in each exposure any set at any location has the potential to be recalled. The numbers are apprehended all at once but they cannot all be recalled in one exposure. The necessity to report items in a series gives an order to the report, but the order, not present in the stimulus, is chosen by the subject. The relevance to dream would be that on waking, the focus on a few images is at the expense of the many irrespective of where in the dream one begins. Any part of the dream can be remembered, but recalling what is focal in consciousness tends to occlude the remainder. In creative work as well, it is not unusual that the *Idea* spills into portions irrespective of the final order. Cut-and-paste revision sorts out order as composition is renewed. The waking self is felt to impose order on the *Idea* and, to a lesser extent, the dream content, in contrast to perception, in which order is felt to be independent of the observer.

The order of events in a dream, or in more distant memory, is relatively inessential, while in perception it is inescapable. Memories come and go in relation to current life experience, but the exact order or dating of a memory is less important than its content or effect on current behavior. Order is prominent in dream because the dream is closer to perception, but perception cannot occur without implicit order. Serial order shows decreasing emphasis from perception to (very) short-term memory to working memory to dream and to long-term memory.

Could one say that the order in dream on waking, or in memory, is reconstructed from the imagery, while in perception, order is time-creating? Put differently, serial order in perception mirrors objective time consistent with its external locus, while in the subjectivity of dream and memory, temporal order is less precise. Again, this confirms the thesis that *external images in perception are realized out of internal images in memory, with serial order occurring as an implicit thread – or explicit narrative – of change from one image to*

another. There is a deep commonality in the ability to recall the event-series of a dream, the ability to recall a series of events in memory, and the ability to perceive an ongoing sequence of events in the world.

In perception and re-perception (memory), time gives way to space, succession to simultaneity, and serial order becomes more elusive as one moves inward. The order of a subjective series (dream, memory) is not the residue of a perception, rather, the objective series is founded on the subjective one facilitated by sensation. The absence of sensation permits the pre-perception to develop along endogenous lines. The categories that prefigure the object give rise to unexpected images mediated by shared attributes, as in metaphor.

The memory of a face presupposes seeing the face before, but a face is specified out of categories and is or is not recognized, i.e, is familiar or not, before it is consciously perceived. In recall, the image of the face, to a varying degree of clarity, recurs when completion to an external object is no longer possible. This leads to the inference that the memory of the face is actually an uncovering of its terminal layer in perception. The difficulty for the *perception-first* account is that order is retained in short-term and immediate memory when the effects of sensation are over, an order that is essential to perceiving events in the first place. The challenge to the *memory-first* account is that episodic recall and temporal order in perception must arise out of a process of implicit learning in which the present is influenced by the past without awareness of the duration spanning the succession. In either case, a more fundamental problem concerns the transition from spatial to temporal and the realization of temporal order within a mental state in relation to state-succession.

UNCONSCIOUS CATEGORIES AND CONSCIOUS PARTS

Causation is the engine of conscious succession, as meaning is in dream. Serial order develops in the transition from relations of meaning to those of causation, or from spatial relations to temporal order, or from a position in a spatial pattern to a locus in a temporal series. This transition passes through agency as an intermediate phase. The categories and meaning-relations of unconscious process have a spatial character – this is why the unconscious is said to be timeless – while objects in the external world are temporal but largely devoid of meaning. Agent causation, deliberation, reason, decision, choice, commitment, are psychic phenomena midway in the conveyance of the psychic relations of meaning to the physical relations of cause and effect.

From a psychological standpoint, the relation of self to action in agency is the ground of object-causation, not the other way around. We do not perceive order in the world and internalize it as psychic causation. Instead, the impulse in voluntary action is transferred to objects as they externalize. For Guyau

(1988), the child's reach for an object is the seed of causation and the idea of the future. The internal or psychic limb of this process is the self and its intentional arc. The external limb is causal efficacy and the implementation of the intentional aim. For some, causation is mechanical passage. For others, it is guided by meaning, as in destiny, fate or the hand of deity. The common belief that things happen for a reason is, for externalists, the fiction of personal meaning inserted in nature's machine. For the internalist – to the observer – the meaning and value of external objects is the thread of feeling that accompanies their outward migration, while the process through which an entity recurs has the rudiments of psychic experience. This distinction is crucial to this paper, in that the presumed independence of external objects prevents a fuller understanding of serial order as an exemplification of mind's outward growth.

With regard to agency, which directs attention to an intentional object and is thus an implementation of value in action, the contrarian thesis and the kernel of truth in anthropomorphism is that feeling arises as energy in elementary entities to reach its apogee in human value (Brown 2005). The seeds of meaning are planted in mind-independent entities, in temporal extensibility, whole-part relations and primordial sentience, which evolve over millions of years to human modes of thought. In this process, nascent patterns of primitive existents are gradually transformed to a high level of incursion in human mentation. We see this in the genesis of meaning out of lower forms, its installation in objects and, in causal necessity (Hume), in the outward transmission of feeling and meaning.

The claim that unconscious wholes translate to conscious succession, in memory, in perception, in dream recall and in creativity, can be reconciled by attributing the whole to a category and the ordered items to its members or parts (sub-categories). An object is a final particularity, but also a category of parts, as well as of the recurrences or snapshots buried in its stability or fused into events. An action (or utterance) – in its derivation over a hierarchy of rhythms from postural and axial systems to the distal innervation - is equally a category, the parts of which are phases in its derivation. The transition from spatial to temporal parallels this fractionation, as virtual wholes elicit concrete members or parts.

In any category, prototypical items exhibit the most salient properties, e.g. chair, sparrow, while other items are atypical or less familiar, e.g. ottoman, rhea. If the category *furniture* partitions to chair, table, sofa and so on, the members are elicited in a temporal order that seems arbitrary. However, the list is not arbitrary in that it reflects word frequency, familiarity, emotional intensity, associative strength and psychic distance. Asked to give items of furniture, one does not ordinarily begin with ottoman, so there are constraints on the order of recall. If one takes a spontaneous category such as a *vacation*, the sequence of events, or items in the category, seems less arbitrary, such as planning the trip, packing a suitcase, the mode of travel, the voyage,

the destination, and so on, which have a causal or logical order. Does this sequence exist *in statu nascendi* before the vacation begins?

We think of distance from the center to the periphery of a category in abstract spatial terms, but eliciting members from typical to atypical to marginal or overlapping transforms the virtual space of a category to relations of serial enactment or recitation. When the images in a category such as that of a particular dream are aligned on waking, the category or meaning is discovered in the narrative. Often, it is only after the narrative occurs that we begin to understand the categories of thought that were driving the imagery.

SERIALITY AND THE STORE

If perception develops out of a non-temporal core, how is a sequence of events in the world maintained or forecast at an unconscious phase? The stacking of to-be-realized events in non-temporal planes supposes that a mental state is layered like a tea garden, with events peeling off in the order of their registration. We assume the sequence of observed events in a *single* state corresponds to that in reality. However, within a mental state, or with respect to the actualities the state delivers, if the first in a brief series persists until the last registers, the first will fade into memory when the last is perceived. In this scenario, events are like pigeons on a wire, in which the first flies off, then others, but none actually leave (exist) until the last in the series, i.e. the whole sequence, is traversed (Fig. 2).

Put differently, phases in a mental state exist when the state terminates, the sequence assuming order when the final phase is realized. If a single mental state encompasses an event or brief succession, all phases in the state, early and late, actualize together before any phase is perceived. The state can be thought of as a spatial whole parsed to succession on completion. Now, if events are perceived in the order of their occurrence, and the state is non-temporal until it actualizes, how is order preserved? How is a melody heard if the preceding tones no longer exist at the moment of the present one? A melody is a good illustration of this difficulty, since tones obviously perish, while visual objects appear to persist unchanged, but it is the same problem.

Listening to speech or music is an example of holding an ordered stretch of speech or musical sounds in memory. But to explain serial recall by saying we remember the tones or words, or that retrieval recurs over the path of the perception, merely describes the problem, since a memory of the past (tone, word) is a memory in the present. Moreover, the process that accounts for change also accounts for stability. Thus, the recurrence of a relatively unchanging visual object, such as a chair, gives the impression of permanence in the world even if the object is impermanent in the mind, i.e. the stability of the chair is sustained by the similarity of its recurrences, while change in an auditory object, which depends on the revival of past sounds, tones or

words, gives the impression of impermanence in the world and persistence in the mind.

Knowledge plays a role in the perception of temporal order, which points once more to the memorial or conceptual underpinnings of perception and serial time. A series of environmental sounds does not stick in the mind like a melody, and a melody stays with the listener *inter alia* in relation to its familiarity. In complex music, the more the piece is understood, the more the listener will recall what is heard. In less coherent music, the less a sequence can be anticipated, the less revival is facilitated. Even the recall of digits in a telephone number is accentuated if they are syncopated or given rhythmically, or with familiarity in the sequence. Widely separated tones are less easily revived. Intervening silence corresponds to intervening states. Music lacking melody or continuity is heard as a succession of rapidly fading sounds. Environmental noises show even less recall. In language, a sentence persists (recurs) in the mind in relation to fluency and meaning. Contents are revived out of categories. The conceptual relatedness of elements or their semantic coherence enhances revival. Conceptual structures, categories, meaning-relations, help to support serial order which, in each modality, depends on antecedent states being revived to varying degrees of incompleteness.

The concept of a storehouse of innumerable memories, some explicit, others implicit, some with the potential for activation yet destined to be forgotten, others lost or irretrievable, is widely accepted, though the nature of the store or trace eludes description. Even if a cell is re-activated by the same stimulus, most researchers do not think that an event is located in a single neuron, though in holographic theory the trace is everywhere (Pribram 1991). We conceptualize the "to-be-realized" as encoded in widespread systems of neurons and filaments that cohere according to probabilities latent in the connectivity. Memories emerge in the synaptic strength of configural possibilities occasioned by experience. A memory in the connectivity implies a circuit or configural potential. In microgenetic theory the trace is the entire sequence up to the penultimate phase through which the perception actualizes. If every mind/brain state in its entirety has the potential to be revived, what is ingredient in the trace? Is it what was formerly in consciousness, its unconscious precursors, the immediate and remote context, related events, relevant thoughts, shared meanings, feelings? Are billions of attenuated memories entrained in every cognition or is the connectivity quiescent or virtual in the latency of synaptic contacts?

SIMULTANEITY AND SUCCESSION

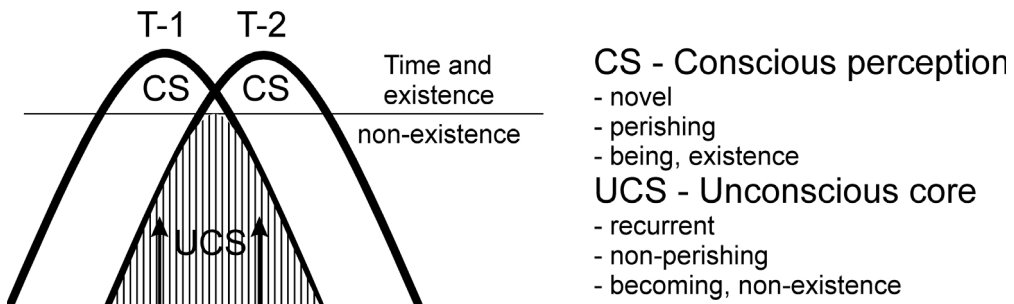
Object-causation is a narrative of change in the external world based on the replacement of internal episodes as one series of events replaces another. World events realized in the mind are ordered into past and present. From a subjective point of view, change

- (1) depends on the elaboration of temporal order *in the mind*;
- (2) appears when simultaneity becomes actual, so that order is spatially given in advance of perception;
- (3) depends, perceptually, on a past and future in relation to a phenomenal or specious present (Brown, 1996 *et seq.*), while objective time is that of earlier and later; and
- (4) derives from the unconscious succession of phases laying down temporal order, unlike the world that is the 'gathered-up' outcome of this transition (passage).

Sprigge (1974), after Whitenead, argued that change from one event to another is experienced in succession, that mental change is not real change and that only the extra-psychic is changing. Doubt about real change in the mind/brain comes from the fact that a mental state, as an epochal whole, in a Platonic moving image of eternity, cannot be divided into successive parts. The world is a stationary image with the continuity of motion depending on the rate of replacement. It is difficult to conceive that change and multiplicity in the world are apprehended simultaneously in the unconscious. This agrees with Sprigge's argument that in real change one experience gives way to another, and that an ensuing content "takes up the story told by the first content," or that serial order is in the replacement, not the state. The problem with this account is that, while it may work for perception, as in the *phi* phenomenon, it does not adequately explain serial order in memory, and there is no reason to think these are unrelated phenomena.

If order in the world successively comes into view, can non-temporality at the onset be reconciled with successivity at the outcome? In the epochal theory, temporal order is the unfolding into time of spatial diversity as novel worlds recur in succession. Either the core is partitioned to a seriality not anticipated at the onset, or temporal order in consciousness is a copy of that in the core, with unconscious events serialized *in situ* prior to actualization. A temporal order embedded in a simultaneity, with the potential for order at the surface, would yield a spectator who, in theory, could intuit the order of events before they actualize. However, individuals who descend inwardly in meditative practice or mystical states report unity or oneness, not serial order or multiplicity.

William James (1890) was the first to postulate overlap in the succession of mental states, which he termed pulses of cognitive consciousness. If the overlap is for early phases, later ones will perish before the tip of the oncoming state arrives (Fig. 3). More precisely, the early unconscious phases associated with long-term memory, character and the self are revived in the oncoming state before the present state concludes. Since the epoch does not exist until the transition is complete, phases trailing in the derivation would recur in the forward edge of the overlap, indeed, these phases would be continuously modified by ensuing states before they become actual. This is a solution to the non-existence of the unconscious, for while unconscious



CS - Conscious perception

- novel
- perishing
- being, existence

UCS - Unconscious core

- recurrent
- non-perishing
- becoming, non-existence

Fig. 3. Phases in short-term or working memory are generally revived in ensuing states in the order of their registration, i.e. in relation to their resemblance to the oncoming state and, thus, their capacity for revival. Images closer to the current perception, i.e. those in short-term memory that almost achieve re-perception, are most likely to be revived in the current state. The mind/brain state at T-1 is replaced by an overlapping state at T-2. The core of T-1 is overlapped at T-2 before T-1 terminates, i.e. before the epoch exists. This explains the recurrence of early phases in T-1 associated with individuality, self, character, dispositions, long-term and experiential memory, and the "persistence" of core beliefs, values and personality. Later phases perish on completion of the entire state to make way for novel perceptions. The re-activation of earlier phases by the overlapping state explains the sustained personhood behind succession. Early phases are ingredient across states, later ones are malleable to a greater extent as endogenous process is shaped by sensation [From: Pachalska et al. 2009]

phases never exist, they are constantly being replaced before existence is possible, while conscious phases exist but are continuously perishing. The paradox is that the non-existent survives and is perpetually transformed, while existents are novelties that do not mutate, for they are replaced as they arise.

The revival of proximal, unconscious phases before the state actualizes – before those phases have existence and temporality and, therefore, before they can perish – allows early cognition to recur across states. On the other hand, the distal or world-close phases vanish before they fully re-actualize. This, so to say, "wipes the slate clean" for oncoming objects, recalling Freud's magic writing pad analogy. On this interpretation, the persistence of early phases and the evanescence of late ones, i.e. the consolidation of long-term memory and the transience of short-term memory and perception, reflect the reinforcement of not-yet-existent configural patterns at early phases and the perishing-on-termination of late ones.

We are aware of change in the world, as well in ideas and feelings, but unaware of the process through which inner and outer develop. The *experience* of change lies in outcomes and replacements. For the observer, the mental state is all there is. This means that genuine change occurs *within* the state, even if the layering of the past, in imagery and perception, requires a series of states. If the outcome of a state is given at the onset, change within the state would be prohibited by its epochal character. An externalized world enjoys novelty in delimiting the endogenous. There is the novelty of the unexpected or creative, as in the departure from world attachment. Observed

events are outcomes of the becoming through which they are generated, the changing physical surround, and the individuality of response.

The changlessness of an epoch is a logical entailment of its holistic character, but the outcome of the epoch cannot be ordained at the onset because the facts of the final world depend on sculpting by incoming sensory data that guide the state to completion. In addition to these effects, the transit of proximal phases of endogenous process – less constrained by sensory data – through experiential memory and intentional feeling – mediated by limbic formation – are a source of spontaneity, originality and the creative imagination.

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