This is a portion of the eBook at doi:10.7551/mitpress/13474.001.0001

6 Automatic Attention: Effortless, Perceptual, and Personal

Automatic attention processes and automatisms are examined, together with organismic processes that in normal individuals codetermine them. Such processes differ in facilitating versus misleading situations, as shown by brain dynamics. We look at organismic factors affecting automatic attention and automatism, such as the Schemes' Overdetermination of Performance (*SOP*—neuronal spreading of activation and convergence), the brain's "internal field" factor (*F*-operator), learning factors (*C, LC, LCLM, LA*), attentional inhibition, affective and personal factors, and automatic spatial and temporal resource-factors. When automatic and mental attentional processes combine harmoniously, a mental flow and efficiency appear in performance. We discuss contemplation and meditation as ways to optimize this flow in mental processes and performance.

> Attention as an activity implements a relation of a human to oneself, rather than to one's environment.
>
> —Dormashev, 2010, p. 309

> [B]y impression, and not by comprehension, is man primarily open to himself and other things.
>
> —Zubiri, 1966/2001, p. 195, translated by JPL

> [I]n the state of flow the goal of each action is the following action. *Action and awareness merge.*
>
> —Dormashev, 2010, p. 313

Attention is defined in the *New Oxford Dictionary of English* as "the mental faculty of considering or taking notice of someone or something: [e.g.,] *he turned his attention to the educational system*" (p. 108). This definition and example suggest that within common sense two assumptions are made: (1) the object-content of attention is always outside the person and (2) attention itself is always willful and mentally conscious. We disagree with these two assumptions, as do many psychologists and philosophers

Downloaded from http://direct.mit.edu/books/oa-monograph/chapter-pdf/2242190/c000500_9780262363082.pdf by guest on 23 June 2024

This is a portion of the eBook at doi:10.7551/mitpress/13474.001.0001

(Bruya, 2010). As Dormashev's first epigraph states, and contrary to the first assumption, attention is best understood as applying activation to internal information-bearing processes, which we call schemes. Attention, as a source of added activation (we call it a "booster" function), should be studied "from within" the person. This is the constructivist perspective we have called metasubjective (Pascual-Leone, 2013; Pascual-Leone & Johnson, 2017). Further, "considering or taking notice" is an organismic function that precedes mentation, because it can be found in lesser mammals and birds, including animals that seem to lack a preconscious or conscious "functional organ"—a mind for mediated thinking.

This evolutionary perspective and the realization that attention must exist prior to consciousness (making possible, eventually, the emergence of both consciousness and self-consciousness) indicate that there must be two sorts of attention. As the reader knows, we distinguish *automatic/effortless attention* versus *mental/effortful attention*. The term "effort," introduced by William James (1892/1961), refers to the subjective experience of requiring careful focusing, together with the notion that there is some source of brain energy that functions as a scheme's activation booster. Both James and Pierre Janet (1889) identified this function with the Will, which heightens activation of whatever "idea" the person is pursuing (induced by affects or executive schemes). *Volitional attention* is James' name for the intentional act of applying this effort. "This strain of the attention is the fundamental act of will. And the will's work is in most cases practically ended when the bare presence to our thought of the naturally unwelcome object has been secured" (James, 1892/1961, p. 319). James later adds, "It is in one word an *idea* to which our will applies itself.… *Consent to the idea's undivided presence, this is effort's sole achievement"* (James, 1892/1961, p. 319).

For James, as for many classic philosophers beginning with Plato (e.g., Leibniz, 1966), "idea" refers to a unit of meaning (in our terms, a scheme or compatible cluster of schemes) stored in the person's knowledge repertoire. Thus, James' voluntary attention comes very close to the construct of mental attention (many would wrongly call it "working memory") effortfully mobilized by the executive (i.e., the currently dominant set of executive schemes) and allocated to suitable action schemes. James distinguished explicitly between primary or perceptual attention, which is effortless and more or less automatic, versus volitional attention. This distinction is the key early precursor of our own distinction between *automatic attention* versus *mental attention.* Another precursor was Pierre Janet, who adopted a dynamic developmental (psycho-genetic) perspective and influenced Piaget's theorizing. In his classic doctoral thesis book, Janet (1889) described dynamic variations of a person's functioning, as it is affected by two mutually complementary but contradictory organismic

Downloaded from http://direct.mit.edu/books/oa-monograph/chapter-pdf/2242190/c000500_9780262363082.pdf by guest on 23 June 2024

This is a portion of the eBook at doi:10.7551/mitpress/13474.001.0001

resources: *automatisms* versus *mental effort* (and mental energy). According to Janet, mental effort can expand the person's *field of consciousness* (Piaget's "mental centration," related to current notions of working memory) and so boost various distinct situation-relevant schemes (Janet's schemas) that together can bring about novel or "creative" dynamic syntheses, generating good performances and, in normal people, regulating unwelcome automatisms.

Automatisms (James' habits, good or bad relative to the person's life-coping or conscious intentions) are instincts, strong habits, affects, or subconscious sources of activity and agency—all usually self-propelling and difficult to regulate by the person's own conscious control. When persons are immersed in their automatisms, levels of active mental energy and effort tend to be low. However, performance, good or bad for the person, may still occur as a result of instincts, habits, or behavioral states occurring under low vigilance (sleep, somnambulism, catalepsy, narrowing of field of consciousness—e.g., amnesia, distraction). Claparede (1915/1946), the medical doctor and educational psychologist mentor of Piaget, explained the relationship between automatisms and consciousness as follows: consciousness does not usually occur until adaptation of the individual can no longer be achieved automatically, when a difficulty arrives that requires effortful attention. He then formulated a law of "taking into consciousness" ("lois de prise de conscience," 1915/1946, p. 206), saying that the more a person has automatized and used automatically (unconsciously) some knowledge relations, the longer it will take for the person to take it into consciousness.

It is important to emphasize that automatized processes, habits in particular, which may cause automatic attention, can be either good or bad for the person or animal's life and living. An example of good habits appears in what Claparede somewhere called the "paradox of the Will": when one needs the Will in praxis, one does not have it; and when one already has the will, one does not need it in praxis. One does not because, with practice, good executive and operative habits will have been developed that facilitate this particular activity, which may even cause a "flow" of performance, making exertion of Will unnecessary.

Bad habits are illustrated by psychological addictions. A nonuseful habit is illustrated by our cat, Luna. Luna previously was mistreated by a male owner. When we received Luna into our home, she was fearful, in particular of men, and she took more than a month to feel at ease and close to her owner, Janice. Soon after her arrival to our home, she developed the habit of jumping through the stair railings to escape (initially in panic) every time Juan climbed to the second floor and she was sitting at the top of the stairs. As Juan came close, she ducked behind him and jumped through the rails to run down the stairs. Now, after eight years, she is well adjusted and no longer afraid

Downloaded from http://direct.mit.edu/books/oa-monograph/chapter-pdf/2242190/c000500_9780262363082.pdf by guest on 23 June 2024

This is a portion of the eBook at doi:10.7551/mitpress/13474.001.0001

of Juan. However, she still feels compelled, when he climbs the stairs, to calmly stroll through the rails and walk down the stairs. Luna cannot correct this old bad habit.

Generalizing and simplifying a concept of Jung, we call unconscious and compelling habits such as this one *shadow schemes*. Shadow schemes have three characteristics: they are initially unconscious, they are compelling (often haunting us), and they often are distracting or misleading (although they can be facilitating in certain tasks). Shadow schemes may interfere with, bias, or prevent, executive-driven processes. Notice that conscious misleading schemes will remain shadow schemes if they are not fully mastered. Perhaps executive-driven processes of mental attention appeared in evolution to control or correct performance errors, biases, and difficulties induced by automatized shadow schemes. Already Janet and James seemed to contrast habits and automatisms to volitional attention and intentional processes, assuming the latter may control the former.

Ideas explicating aspects of James' and Janet's notions of attention have been articulated in neuroscience by Posner and his collaborators (e.g., Petersen & Posner, 2012). Posner distinguishes among three sorts of attentional control (or attention): alerting, orienting, and executive. His alerting and orienting attention are, together, instances of what we call *automatic* (perceptual, personal, or cognitive) *attention*, which often is effortless. His executive attention is what we call *mental or focal attention*, which is effortful. We prefer to call it mental and not executive attention (although executives do control this sort of attention as soon as they appear in ontogenetic human development), because mental attention seems to exist in babies after 2 or 3 months of age, whereas executives do not emerge until about 12 months (see chapter 3). Thus, mental attention already exists before becoming executive attention.

An example of an alerting task is cue detection used with humans, monkeys, and rats (Petersen & Posner, 2012). Such a task can separate effects of alerting/warning signals (telling *when* something is going to happen) from orienting signals (telling *where* it will happen). As described by Petersen and Posner (2012), to illustrate this difference one uses three different cue conditions presented prior to a target when a rapid response is required. These are an alerting cue (inducing general attention arousal), a non-cue, or an orienting cue condition (inducing modality- or location-specific arousal), prior to the response-releasing target. Brain activity corresponding to alertness (attention vigilance) and to orienting attention involves much participation of right hemisphere (e.g., Petersen & Posner, 2012), in particular in tonic (background, repetitive, persistent) processing that becomes overlearned. This is important, because it is likely that right hemisphere is where automatic processes tend to be stored and mobilized (see chapters 10 and 11; Arsalidou, Pawliw-Levac, Sadeghi, & Pascual-Leone, 2018). This

Downloaded from http://direct.mit.edu/books/oa-monograph/chapter-pdf/2242190/c000500_9780262363082.pdf by guest on 23 June 2024

This is a portion of the eBook at doi:10.7551/mitpress/13474.001.0001

finding agrees with our claim that Posner's two forms of nonexecutive attention are instances of automatic personal/perceptual attention.

In contrast, mental-attentional (or executive attention) processes may take place predominantly in the left hemisphere, where truly novel performances, particularly in problem solving, are synthesized (Pascual-Leone, 1989). Schemes difficult enough to be synthesized via problem solving may emerge as *ephemeral schemes*, that is, not-yet-schematized but momentarily synthesized or coordinated in neuronal activation patterns, in the left hemisphere. However, if the situation repeats and the ephemeral scheme becomes learned, it would make an *LM*-scheme in the left hemisphere; and then, with more repetition, when overlearned/automatized, it would appear in the right hemisphere, because processes of automatization occur more easily there (Arsalidou et al., 2018; Pascual-Leone, 1989; see chapters 10 and 11). The biological distinctiveness of automatic personal/perceptual attention versus mental attention is shown by another difference: whereas automatic attention processes use the neurotransmitters norepinephrine for alerting and acetylcholine for orienting (two neurotransmitters involved in processing external inputs), mental attention clearly uses dopamine as the dominant neurotransmitter (Petersen & Posner, 2012), which is more involved in feelings and mentation. We present a constructivist semantic model of these neurotransmitters in chapter 11.

Notice that the key function of automatic (cognitive, perceptual, personal) attention is to promote arousal in contexts that signal affective or perceptual-cognitive situations[1] (as when an event releases an orienting reflex; Howard, Johnson, & Pascual-Leone, 2014; Im-Bolter, Johnson, Ling, & Pascual-Leone, 2015). In contrast, mental or executive attention is mobilized to investigate and solve affective and cognitive problems in situations, perhaps brought up by prior arousal and orienting.

These two sorts of attention are complementary and may apply in coordination. However, when they apply in contradiction, effortful attentional inhibition is needed. An example of this sort of task is the antisaccade, an established attentional inhibition measure in the cognitive literature (e.g., Howard et al., 2014; Miyake, Friedman, Emerson, Witzki, & Howerter, 2000). In one version of this computer-based task, a fixation point (+) is presented in the center of the screen followed by a blank screen (50 ms). Then there is a brief appearance of a black square on one side of the screen, which elicits a strong, instinctive orienting reaction (or saccade) toward it. As instructed, participants must willfully inhibit this saccade to solve the task (Agostino, Johnson, & Pascual-Leone, 2010; Howard et al., 2014). Indeed, signaled by the square, the participant must immediately look to the opposite side of the screen to discriminate and respond to a target stimulus. Thus, alerting attention is automatically activated by the

Downloaded from http://direct.mit.edu/books/oa-monograph/chapter-pdf/2242190/c000500_9780262363082.pdf by guest on 23 June 2024

This is a portion of the eBook at doi:10.7551/mitpress/13474.001.0001

black square, which activates an orienting reaction to look at it. However, solution of the task prescribes looking in the opposite direction to find the fast-disappearing target and respond. Such cancellation of an automatic orienting reaction demands use of effortful/mental attentional inhibition that we discuss in the next chapter. Without this gaze control, the required response would not occur better than chance. This task illustrates situations when automatic attention is irrelevant or distracting and must be inhibited, by mental attention, to succeed. Problem-solving tasks, and other (cognitive or affective) misleading tasks, often present such competitive or conflict formulas. Automatic attention and mental/executive attention function complementarily within facilitating situations, but they compete in misleading situations.

Automatic Personal/Perceptual Attention Can Be Simple or Complex

Automatic attention is the normative way of functioning in familiar, facilitating situations. Recall that a situation is facilitating if it does not elicit schemes inconvenient to cognitive goals of the current executive (i.e., the dominant executive set of schemes) or the current affective tendency (affective goals or motives). In these situations, no misleading cues are present, and salient cues induce appropriate responses or interpretations. Effortless (and often subconscious) performance in these situations is enabled by schemes (perceptual, motor, affective, figurative, operative, and executive) already coordinated by associative learning (*C, LC, LCLM,* see chapter 5). In facilitating situations, because schemes are self-propelling (Piaget's assimilation function—spreading of activation in the brain circuits), performance occurs easily, being overdetermined by all activated and compatible schemes. Mental effort is not needed: subjective consciousness may occur (the "core self" of Damasio, 2012), but self-consciousness proper is often not there (see chapter 3).

When experiential-and-conceptual content is well practiced and overlearned, an often subconscious automatic mode of performance occurs because misleading schemes are no longer elicited (i.e., difficulties were ironed out by prior learning). In this case, both personal schemes (which combine within themselves affects and cognitions—often called feelings or emotions) and purely cognitive schemes (sensorial or representational perception, mentation, planning, or action) are together, activated or synthesized in the "flow" of subjective, experiential activity. This processing occurs along a continuum from unconsciousness to more or less explicit consciousness, but usually without self-consciousness. The partly or fully compatible schemes involved do not compete but combine to overdetermine performance, producing effortless attention that is automatically personal-perceptual-cognitive.

Downloaded from http://direct.mit.edu/books/oa-monograph/chapter-pdf/2242190/c000500_9780262363082.pdf by guest on 23 June 2024

This is a portion of the eBook at doi:10.7551/mitpress/13474.001.0001

Cognitive complexity demands resources such as mental/executive attention to open to consciousness schemes that are not spontaneously salient or dominant in the inner or outer situation. Freud or Jung's construct of an *active unconscious* may now be interpreted (as Piaget and others did) as a *field of activated schemes* of any sort, within the person's *repertoire of schemes* (i.e., long-term memory), together with the hidden resource operators and principles that regulate the schemes' function. Effortful mental attention and suitable executive schemes often are needed to contain or control manifestations of unconscious self-propelling schemes, which haunt consciousness (i.e., shadow schemes).

Intelligent-perception, personal (i.e., affective and cognitive) insights, and reflective intellective or intellectual (high-cognitive) thinking are tools in this control and clarification of the dynamic unconscious. Thus, automatic-effortless attention (often driven by unconscious schemes and hidden operators) and mental-effortful attention (often driven by conscious executives) are in dialectical opposition. Together they regulate schemes' access to consciousness, as Claparede's "consciousness law" anticipated. This common idea of dialectically contradictory processes regulating access to consciousness owes much to Freud's and Jung's work (if deconstructed).

Freud distinguished primary from secondary modes of processing (e.g., Rapaport, 1960). A sort of liberalized Freudian primary processing (automatically self-propelling schemes) recently has been described as Type 1 or System 1 thinking (Evans & Stanovich, 2013; Kahneman, 2011). The dialectical counterpoint of Type 1 thinking is Type 2 thinking, produced by executive-driven mental-attentional intellective processes (Freud's secondary processes). When, through experience and mental growth, automatic (primary) and initially effortful (secondary) processes evolve to be coordinated harmoniously within given situations, a new high point of mental processing is reached: easy and spontaneously well-adjusted performances. When that happens, intellective/intellectual personal (affective and cognitive) processes can occur quasi-automatically, because they are often overlearned (our *LCLM* learning). Thus, complex and potentially misleading activities (motor or otherwise) can become easy and well controlled with insightful practice. This is the mode of goal-aligned activities and experiences called *flow* (fluent performance) by Csikszentmihalyi (Bruya, 2010; Csikszentmihalyi & Nakamura, 2010). This flow experience within the domain of action, although different, has interesting convergences with the sort of state often described as *contemplative meditation*.

Complex automatic attentional processing, such as flow, may lead to personal activities embedded in feeling (perhaps unconscious affects, calm emotions). This may bring up into performance an important bipolar dimension of feeling that has been called

Downloaded from http://direct.mit.edu/books/oa-monograph/chapter-pdf/2242190/c000500_9780262363082.pdf by guest on 23 June 2024

This is a portion of the eBook at doi:10.7551/mitpress/13474.001.0001

impression versus expression (Cassirer, 1944/1966, 1940/1996; Zubiri, 1999, 1966/2001). *Impression* is the state of being affectively or emotionally touched by feelings spontaneously induced by the encountered situation, object, or event. Any impressive experience is as such, with its own distinct characteristics of feeling that correspond to the particular reality (objective and subjective, cognitive and affective) encountered. Zubiri (1999), the Spanish philosopher, called this state *impression of reality*. He considered it a foundation (a Reality-based aspect) of intelligence; for this reason, he characterized intelligence as *feeling-sentient intelligence* (Zubiri's "inteligencia sentiente"). For him, this impression function was essential: "By impression, therefore, and not by understanding, is how a human is at first open to himself and to other things… an essence that is an opening" (Zubiri, 1966/2001, pp. 195–196; JPL translation).

This impression function is dialectically intertwined with *expression* (Cassirer, 1929/1957, 1944/1966, 1940/1996), an open representation or manifestation in direct acts, art, poetry, communication in flow, and so on, of a person's feelings and thoughts. Expression can be signalic or symbolic. It very often is iconic (epistemically reflective—epireflective), that is, configurally congruent with aspects of the Reality encountered and its inner-feeling states. Expression, as a mode of communication or artistic creation, takes preeminence in history of art as *expressionism* (forms, colors, relational compositions that impressively induce ideas and feelings, which artists unconsciously or consciously "want" to express). Notice again that impression and expression use iconicity, the function of semiotic representation that Peirce described (see chapter 4) and which we have explained as produced by the neo-Gestaltist internal field-factor (*F*-operator), together with the principle of Schemes' Overdetermination of Performance (*F-SOP*, see chapter 1 and below). Spontaneity and openness of impression/expression dispositions often are found in spontaneous low-cognition personal processing, as happens with babies and young children. It also can be found, however, within (often personal) high cognition, in some sensitive or creative adults—artists, or people caring for others, often in spiritually developed individuals.

In the remainder of this chapter, we examine brain resources and generic processes that can cause automatic attention in the organism, fostering coordination with mental attentional processes, until flow and contemplative meditation become possible. We begin with differences in the cortical pathways monitoring attention. We then revisit the neo-Gestaltist field factor and discuss the space-structuring causal factor, the time-structuring factor (also involved in object identity), affects and personal emotions, and learning resource-factors, all of which together can explain emergence of flow and meditative contemplation.

Downloaded from http://direct.mit.edu/books/oa-monograph/chapter-pdf/2242190/c000500_9780262363082.pdf by guest on 23 June 2024

This is a portion of the eBook at doi:10.7551/mitpress/13474.001.0001

Automatic Attention in Facilitating Situations versus Mental Attention in Misleading Situations: Their Differential Expression in Brain Processes

As mentioned, facilitating situations are those in which all schemes activated are relevant or neutral (not inconvenient or misleading) for the task at hand. Misleading situations, in contrast, activate schemes distracting for, or contradictory with, the task at hand.[2] In misleading situations, because competing schemes must be suppressed and controlled, mental/executive attention is necessary. In facilitating situations, automatic attention (with automatized schemes) may suffice for task solution, although mental attention also is used.

Lower lateral (or ventral-lateral) cortex suffices when the task is facilitating and all activated schemes are relevant for the task, which may allow automatic processing (particularly with the right hemisphere). Middle (dorsolateral and often prefrontal) cortex is involved in misleading situations, particularly if they are complex. A phylogenic study of brain evolution (e.g., Striedter, 2005) shows that dorsal pulvinar (in the thalamus) and lateral prefrontal cortex are more developed in humans than in other primates. This is consistent with the importance in humans of both low-lateral prefrontal areas (complex automatic-attentional processes) and dorsolateral prefrontal areas (complex effortful attentional processes, often in misleading situations, a site of truly novel performances, Striedter's "unconventional" performances, p. 329ff.).

There is now recognition (e.g., Christoff & Gabrieli, 2000) of different prefrontal areas activated according to the complexity of tasks at hand. (1) Facilitating situations that demand more or less complex, automatic attentional processing engage low-lateral prefrontal regions. (2) Misleading situations, which involve complex and effortful attention to produce truly novel performances, engage the dorsolateral (middle) prefrontal cortex. (3) More complex and temporally deep mentation, often engaging the future, involves the anterior region of prefrontal lobe (frontopolar or Brodmann area 10). This graded arrangement of prefrontal regions for processing progressively more complex cognitive tasks illustrates two important ideas. First, automatic-versus-mental attentional processes are distinct and complementary. Second, there is in the brain a functional local-gradation of sites related to both degree of interference found in the task at hand (having more or fewer distracting or misleading schemes) and the spatial-temporal (or computational) complexity of the task. In every case, the more affect and personal/emotion schemes are elicited by the task/situation, the more the lateral prefrontal activity is accompanied or preceded by activity in medial and ventral cortical regions. Further, the more automatized or habitual is the required process (and

Downloaded from http://direct.mit.edu/books/oa-monograph/chapter-pdf/2242190/c000500_9780262363082.pdf by guest on 23 June 2024

This is a portion of the eBook at doi:10.7551/mitpress/13474.001.0001

the less it demands truly novel performances), the more this processing will engage the right hemisphere—the site where, we believe, automatized schemes are preferentially stored (Arsalidou et al., 2018; Pascual-Leone, 1989).

Schemes' Overdetermination of Performance (*SOP*) and the Brain's Internal-Field Factor (or *F*-Operator Resource) as Causes in Automatic Attention and Automatisms

To explain automatic attention in perception and mentation, we must assume existence of self-propelling schemes that apply together to codetermine actual performances, including representations. Again, we call this co-application the principle of Schemes' Overdetermination of Performance (*SOP*). This dynamic resolution is indexed in the brain by spreading of neuronal activation over interconnected neurons, an activation that converges to form an actual and momentary neuronal *final common path,* a variable-path outcome first discovered with motor neurons but occurring with all dynamic brain-activity resolutions.[3] First formulated for human motivation and performance by Freud, the *SOP* principle is consistent with current neuroscience. We describe *SOP* as a causal-organismic construct using five rules. These rules (here with schemes) resemble the interrelations found among people who form dynamic groups of opinion in meetings, politics, or society.

(**SOP1**) Schemes activated within a situation, when they are semantic-pragmatically compatible to codetermine performance, coordinate into functional *compatibility clusters* because of the neurons' dynamic grouping. This is Edelman's (1987, p. 169) "group selection."

(**SOP2**) Every compatibility cluster has a different activation weight (assimilation propensity or strength) that combines/adds the assimilation strength of its members in the current context situation. This is their *total assimilation strength*.

(**SOP3**) Compatibility clusters that are mutually contradictory in their application compete to codetermine performance by applying their schemes and excluding schemes of other clusters.

(**SOP4**) Actual performance emerges by progressive application of different clusters of schemes to the task or situation (via application of, assimilation by, all compatible schemes activated in the situation). Priority order of their application results from the relative magnitude of clusters' total assimilation strength or propensity: stronger clusters will apply first, pre-empting application of other contradictory clusters—group competition. Subsequently, other applying clusters adapt their expression (they accommodate) to be compatible with the scheme clusters that have already applied to inform ("inject" form into) performance. As a result of this repeated process of

Downloaded from http://direct.mit.edu/books/oa-monograph/chapter-pdf/2242190/c000500_9780262363082.pdf by guest on 23 June 2024

This is a portion of the eBook at doi:10.7551/mitpress/13474.001.0001

selection-competition-adaptation, the to-be-produced final performance emerges with many diverse characteristics contributed by the successively applying clusters. Let us call *characteristic set of constraints* (or degrees of semantic-pragmatic "freedom") the variable total array of defining compatible characteristics that together will make up the actual concrete performance being produced (these characteristics should change with the *SOP*-selected scheme clusters, or with their total assimilation propensity). Thus, progressive application of different compatible clusters to complete performance adds semantic-pragmatic constraints (subtracts degrees of freedom) to the possible performance—until the performance (action, representation, or mentation) is fully actualized. Actual performance is overdetermined by all compatible characteristics available in schemes currently active in the person's unconscious or conscious mind (his or her total repertoire of schemes).

(**SOP5** or *processing-F rule*) Schemes that overdetermine performance combine by accommodating one another according to two rules. First is by minimizing (*F-min rule,* Pascual-Leone & Goodman, 1979, p. 314) the number of distinct schemes in the resulting performance (i.e., reducing redundancy among schemes applied). Second is by concurrently maximizing (*F-max rule*) the semantic-pragmatic and structural connectedness, the hierarchical organization and integration, of schemes that overdetermine this performance (including figurative representations). Less explicit versions of this *mini-max rule* were pioneered by Gestalt psychologists and neo-Gestaltists (*Pragnanz principle*, Koffka, 1935/1963; Rock, 1983; *minimum principle*, Attneave, 1959; Hochberg, 1964; *stimulus-response compatibility*, Proctor & Reeve, 1990; *field factor,* Piaget). This rule can be explained by what is called neuronal *lateral inhibition* in the cortex, which functions as the brain's *field* (*F*) *regulation operator* that automatically biases performance in this mini-max manner (conjointly with causal overdetermination, *SOP*).

Consider, in a simplified way, how this cortical lateral inhibition functionally affects the integration of scheme clusters. Activated neuronal circuits and networks (clusters) that carry and transmit relevant information also make lateral contact with inhibitory interneurons, which will tend to inhibit neighboring competitive circuits and networks. Consequently, activated neurons and circuits that fail to receive enough activatory neuronal connections (perhaps because they are not within a strong-enough compatibility cluster) will tend to lose degrees of activation and eventually be automatically inhibited. Thus, this lateral inhibition will preserve mostly neuronal circuits that carry semantic-pragmatic features rich in compatible/functional connections with other related circuits. Analogously to what happens with meaning within social groups (or within hereditable features in our genes), aspects (neuronal connections) that are not "popularly" shared (in the brain, across neuronal circuits), that is, not compatible

Downloaded from http://direct.mit.edu/books/oa-monograph/chapter-pdf/2242190/c000500_9780262363082.pdf by guest on 23 June 2024

This is a portion of the eBook at doi:10.7551/mitpress/13474.001.0001

with related meanings or features held by other brain circuits (or other people, in the case of social groups) will tend to drop out from competition; they will not contribute to define semantically the final common outcome.

A good example of this *F*-resource mini-max rule within figurative representation and perception was offered by Kanizsa (1955; Rock, 1983). Figure 6.1 shows sample Kanizsa triangles. Two equilateral triangles appear in an area with incomplete solid circles when three corner angles are added (left-hand figure). The triangles appear as ghosts, integrating and bringing closure to these incomplete parts, making gaps appear as occlusions produced by the ghost triangle. This automatic and effortless perceptual transformation that perceptually "creates" the triangles (caused by the *F* regulation operator) minimizes complexity of round parts, turning them into occluded full circles and resolves the three separate corners into another triangle partly occluded by the main ghost triangle. Thus, the number of distinct objects/aspects has been minimized (*F-min rule)* and, simultaneously, connectedness and integration (hierarchical organization of this perceptual whole) has been increased (*F-max rule*). Local neuronal lateral inhibition (cause of our *F*-factor) explains this effortless perceptual transformation that automatically creates Kanizsa triangles.

Similar automatic mini-max rules of transformation appear in motor action. A good example is found in the inferential water-level task (WLT; Morra, 2008; Pascual-Leone, 1969, 1989; Pascual-Leone & Morra, 1991) that originated with Piaget and Inhelder. In WLT the child is presented with an actual or drawn tilted bottle and asked to imagine that it is half filled with water and to draw the water line and mark the water location. Young children distort their water line, influenced by the tilt of the rectangular bottle shape. A related effect (the influence of the immediate irrelevant context on the

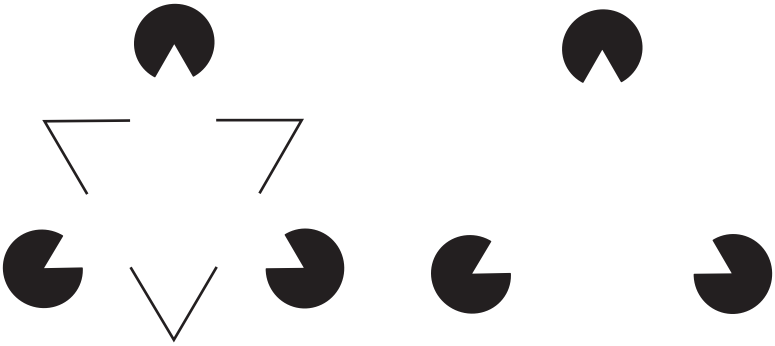

Figure 6.1
Sample Kanizsa triangles.

Downloaded from http://direct.mit.edu/books/oa-monograph/chapter-pdf/2242190/c000500_9780262363082.pdf by guest on 23 June 2024

This is a portion of the eBook at doi:10.7551/mitpress/13474.001.0001

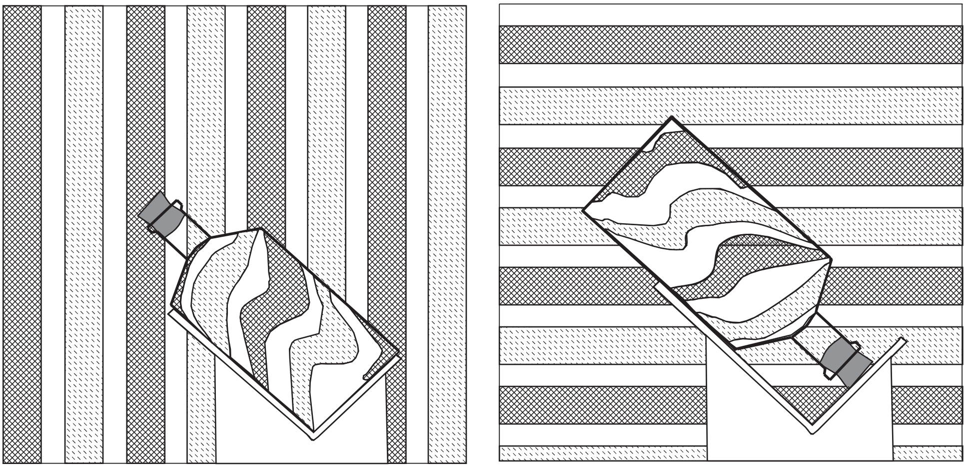

Figure 6.2

Illustration of the water-level task and copy-the-stripes task.

response) can also be seen in a purely perceptual-copying task, the copy-the-stripe task (CST) of Pascual-Leone, which can be used as noninferential task control for the WLT (Pascual-Leone, 1969, 1989; Pascual-Leone & Morra, 1991). Figure 6.2 shows sample items used in the WLT and the CST. Note that in the CST, the stripes are distorted when seen through the actual glass of the physical bottles. Thus, when older children are asked to copy the stripes as they see them through the bottle, they copy the stripes as wavy, not straight (although the background stripes are straight).

The actual physical bottles presented in either task were tilted 45 degrees to the right or left, vertical, or sideways. As mentioned, in the CST the task was always to copy as they saw them, on a paper outline of the bottle, the thick stripes participants could see through the bottle. In the WLT, which had bottles with and without a striped background, participants had to imagine the bottle half-filled with water and draw the water line on a bottle outline, placing a mark for the water location. WLT is inferential, a problem-solving task, whereas CST is a simple copying task. In both, however, similar illusory effects occur. In WLT there was a significant tendency in children and in field-dependent adults (Pascual-Leone, 1989; Witkin & Goodenough, 1981) to draw the water line tilted, making it more or less parallel to the bottom, the walls, or corners of the bottle. These drawn water line patterns covaried with the bottle's orientation.

In items where WLT had the striped screen behind (as illustrated in figure 6.2), the water line drawn by most participants was also influenced by the stripes. A related, even stronger effect occurred in the CST's copied line (Pascual-Leone, 1989). CST lines

Downloaded from http://direct.mit.edu/books/oa-monograph/chapter-pdf/2242190/c000500_9780262363082.pdf by guest on 23 June 2024

This is a portion of the eBook at doi:10.7551/mitpress/13474.001.0001

drawn drastically changed toward the background stripes' (vertical or horizontal) dominant direction, with the wavy patterns being ignored. In this task there is no conceptual inference, the illusory distortion is clearly perceptual, yet (like the inferential WLT effect) it follows a mini-max *F* rule: lines are distorted toward the dominant contextual features of bottle or background stripes, and the response minimizes number of different aspects and maximizes structural integration and "simplicity" of the whole.

Another common motor effect of the mini-max *F* rule is found in dancing. Good dancing consists of matching temporal sound patterns of music with the spontaneous or prescribed temporal patterns of dancing movements. A key process here is this mini-max *F*-factor, which effortlessly induces congruence in the sequence of temporal matches between music rhythm and dancing movements, ensuring flow and good dancing.

Let us examine now how this automatic *F*-factor intervenes in mental problem solving. Consider the classic liquid-transfer task, wine and water problem (Pascual-Leone & Johnson, 2017; the following description includes a small correction in task analysis). This is a brain teaser, popular on Internet sites and perhaps first described by W. W. Rouse Ball (1905). The qualitative findings are already well established (e.g., Case, 1975). A common version of this problem asks participants to imagine two containers, one (C1) with only water (Wa) and the other (C2) with only wine (Wi). The problem assumes (although this is not needed) that wine does not initially contain water. A spoonful (S1) of wine is taken from C2 and transferred to C1. A spoonful (S2) of the C1 mixture then is transferred to C2. *Is there now more wine in the water container* (Wi[C1]) *or more water in the wine container* (Wa[C2])*?* If unfamiliar with this problem, readers may try solving it before reading on.

There are different strategies for solving this task, both quantitative and qualitative. The basic one that we shall mention is qualitative and metasubjective, focused on the core causal process: the content carried back and forth by the spoon, which brings about change. This task is *misleading*, because a superficial look at the spoon transactions suggests that there is more wine in the water container than water in the wine container (i.e., Wi[C1] > Wa[C2]), because S1 carried only wine, whereas S2 carried both wine and water. Such incomplete analysis is the most frequent error response that we and others have found. A deeper spoon-sequence examination shows that, because the same spoon is always used, the quantity of wine that S2 carried is the quantity of water that S2 did not carry, and the water that S2 carried is the same as the wine in C1 that S2 did not carry. In other words, the wine in C1 after the second transaction (S2) is the capacity of the spoon (S) minus the wine returned in S2; and the water in C2 after the second transaction is the water carried by S2, which is the capacity of S minus the wine

Downloaded from http://direct.mit.edu/books/oa-monograph/chapter-pdf/2242190/c000500_9780262363082.pdf by guest on 23 June 2024

This is a portion of the eBook at doi:10.7551/mitpress/13474.001.0001

returned in S2. Consequently, wine remaining in C1 is quantitatively the same as water in C2 at the end of the transaction (i.e., Wi[C1] = Wa[C2]). The algebraic form of the state description of this analysis, after the two (S1, S2) spoon transfers, is

$$(\mathrm{Wi}[C1] = S1 - \mathrm{Wi}[S2])\ \&\ (\mathrm{Wa}[C2] = S2 - \mathrm{Wi}[S2])\ \&\ (S2 = S1) \rightarrow (\mathrm{Wi}[C1] = \mathrm{Wa}[C2])$$

To understand this algebraic derivation organismically, we must imagine "from within" (i.e., metasubjectively) subjects in the mental act of problem solving. They have to represent intuitively essential task components by means of schemes. The three main constituents of this algebraic derivation are Wi[C1], Wa[C2], and S (spoon). They stand for three complex schemes that subjects must synthesize dynamically before a higher-level synthesis can coordinate them into the task solution. Notice that the algebraic formulation shows well why these three schemes are complex (having distinct coordinated constituents at different hierarchical levels). Indeed, each scheme mentioned in the equation requires an equality sign to be properly represented.

Six distinct constituents (subordinate schemes) may have to be boosted with mental activation to ensure the synthesis of task solution. These six symbolic constituents are:

$$\underline{S2 = S1}$$

$$\underline{\mathrm{Wi}[C1]} == \underline{S1 - \mathrm{Wi}[S2]}$$

$$\underline{\mathrm{Wa}[C2]} == \underline{S2 -}\ \underline{- \mathrm{Wi}[S2]}$$

In this representation, the underlines demarcate separate constituent schemes. The markers (= and –) are repeated to indicate semantic-pragmatic connections between the schemes. The three-line sequence demarcates the three sets of coordinated schemes: constituents of the three complex schemes Wi[C1], Wa[C2], and S. We have written the scheme Wi[C1] with two constituents (marked by underlines), whereas we write scheme Wa[C2] with three constituents, because we assume that process analysis-and-synthesis of Wi[C1] took place before, and its constituents are now partly chunked. In contrast, chunking in scheme Wa[C2] should be more confusing, since in it Wi[S2] is an integral part of S2, now considered separately. Such mental demand of six symbolic schemes to be coordinated can be handled by children only when formal operations begin, at about 13 to 14 years of age, as we shall discuss in chapter 7.

The role of the brain's internal-field *F*-resource in this problem and its solution can be seen in our algebraic analysis. Indeed, repetition of Wi[S2] within two different contexts (i.e., S2 – Wi[S2] and S1 – Wi[S2]) shows that the same entity Wi[S2] takes two distinct meanings in the analysis: *water not carried* and *wine carried*. This state of affairs strongly contravenes the *F*-operator's simplicity constraint or mini-max *F*-rule (i.e., a minimum principle here describable as "when one scheme, one meaning (and vice-versa)," which

Downloaded from http://direct.mit.edu/books/oa-monograph/chapter-pdf/2242190/c000500_9780262363082.pdf by guest on 23 June 2024

This is a portion of the eBook at doi:10.7551/mitpress/13474.001.0001

corresponds to an instance of stimulus-response compatibility, in which the scheme is seen as stimulus and its meaning as response). Notice that this organismic constraint to assign to every scheme just one meaning was formulated in chapter 5 as postulate of schemes **Sch4**. The failure of the wine-and-water problem to maintain this particular constraint induces a major misleading factor (a brain bias against retaining both meanings of Wi[S2]), which is the functional core of this problem. This misleadingness imposes a need to use mental, effortful attentional capacity to maintain two semantically distinct schemes for the same entity, thus clarifying the issue for the subject who can reach the solution synthesizing six schemes. This task's solution demands the effortful mental-attentional processes that we discuss in chapter 7. Otherwise, during problem solving in misleading situations (such as this task), automatic attention (and its factors, such as *F*) would lead to error. This need to inhibit misleading automatic factors may be a major reason why effortful mental-attentional resources evolved, as Janet (1889) may have implied.

Learning Factors and Automatic Inhibition Involved in Successful Automatic Attention and Action

As Dormashev (2010) indicates in the second epigraph, attention (whether automatic or mental) carries activity of reflective, when not self-reflective, focusing. Attention highlights or activates schemes suitable for the current experience, available in the person's repertoire. These schemes tend to be adapted to the present circumstances by the participant's executive choice and by both *F*-operator and *SOP* principle, among other processes. Thus, attention, including automatic/effortless attention, expresses the working of the mind (i.e., mentation) and only indirectly informs about the experienced environment, as the first epigraph claims.

Automatic attention and automatic action are mediated by the repertoire of schemes. This repertoire was generated through personal life experiences by *C* learning and *LC* learning. *LC* learning includes *LCLM* learning. These often-complex schemes are part of the repertoire of mental habits that creates our "know-how." Know-how is knowledge that may encompass automatized high-cognition (e.g., *LCLM*), available for use without the need of problem solving and mental attention. These automatized complex schemes (schemas) are the foundation of spontaneous life experience and knowing. They are the data of our *intuition* (based largely, but not entirely, on unconscious automatized thinking). In intuition, affective and personal/emotive schemes are as important as pure cognition.

Downloaded from http://direct.mit.edu/books/oa-monograph/chapter-pdf/2242190/c000500_9780262363082.pdf by guest on 23 June 2024

This is a portion of the eBook at doi:10.7551/mitpress/13474.001.0001

Evolution has created two different resources to prevent automatisms from interfering with adaptive action or mentation. The simplest one is automatic attentional inhibition, which complements and partly controls excess of automatic attentional activation. The second resource is effortful attentional inhibition/interruption (our *I*-operator), a component of mental/executive attention. We discuss mental/executive attention in chapters 7, 10, and 11.

Thus, we distinguish between *effortful* and *automatic inhibition* (Howard et al., 2014; Johnson, Im-Bolter, & Pascual-Leone, 2003; Pascual-Leone, 1984). Other researchers have made a similar distinction (e.g., Munakata et al., 2011). The implicit "choices" of the brain are driven by the most highly activated (dominant) cluster(s) of compatible schemes that applies. However, when this solution is not congruent with the currently dominant executive schemes, inhibition of this solution may take place, automatically or effortfully, or both. Automatic inhibition spontaneously deactivates mental operations or schemes found outside the zone of controlled effortful attention (i.e., outside the field or focus of centration); this outside-of-attention set of schemes lacks clarity of consciousness but may still have a *horizon* (or possibility) of meaning, as Husserl (1973) indicated.

Such automatic inhibition reduces interference of distractors and increases mental/executive focus on task-relevant schemes (Arsalidou, Pascual-Leone, Johnson, Morris, & Taylor, 2013; Pascual-Leone, 1984). Schemes within the focus or field of mental attention (Piaget's centration) emerge as dominant for determining performance, using help from automatic inhibition. Automatic inhibition is released when alternative (task-irrelevant) competing schemes making incompatible courses of action are simultaneously activated. In misleading situations, like those typical of inhibition tasks, correct performance demands that task-relevant schemes be hyperactivated by means of effortful mental attention, while task-irrelevant schemes are inhibited (Pascual-Leone, 1984). Such intentional suppression of task-incompatible mental operations cannot just be the result of automatic inhibition (a global No-Go move) but demands use of more specific and effortful inhibition. Further, attentional inhibition (automatic or effortful) requires the prior existence of an automatic *criterion of relevance*, to help recognize schemes as relevant (to be boosted) or not relevant (to be inhibited). This issue has not been well investigated. A plausible criterion of relevance could be learned and automatized if there existed in the psychological brain/organism *a decision rule* such as the following (Pascual-Leone, 1984): schemes that have repeatedly been highly activated during a performance, serving particular specific goals (affective and cognitive), should be automatically treated by the organism as relevant for that performance. These

Downloaded from http://direct.mit.edu/books/oa-monograph/chapter-pdf/2242190/c000500_9780262363082.pdf by guest on 23 June 2024

This is a portion of the eBook at doi:10.7551/mitpress/13474.001.0001

implicit positive "ratings" would be proportional to the schemes' degree of activation during the performance. Schemes not so activated would be marked as irrelevant—and perhaps inhibited when these goals are pursued. One place in the brain where this sort of *affective-relevance* calculation could take place (in a context sensitive manner) is the amygdala, one of the most connected brain sites for contextualized affects and emotions (Pessoa, 2013; Sander, Grafman, & Zalla, 2003). Indeed, all cognitive goals are initially promoted by affective goals (Pascual-Leone, Pascual-Leone, & Arsalidou, 2015).

Mental attention (effortful activation and effortful inhibition) increases with age along developmental stages until 15 or 16 years of age (see chapter 7; Pascual-Leone & Johnson, 2005, 2011). In contrast, automatic personal/perceptual attention (automatic attention and automatic inhibition), perhaps related to the brain's default network (Arsalidou & Pascual-Leone, 2016; Arsalidou et al., 2013), reaches maturity at a younger age. Task-based research indicates that automatic inhibition reaches adult-like levels by 5 years of age (Ford, Keating, & Patel, 2004; Lechuga, Moreno, Pelegrina, Gomez-Ariza, & Bajo, 2006). At least two other findings force a distinction between automatic and effortful inhibition: (1) the neural network that underlies automatic inhibition differs from that of effortful inhibition (Cockburn & Frank, 2011; Lechuga et al., 2006) and (2) intellectually precocious children outperform their same-aged control peers on tasks requiring effortful inhibition but not on tasks of automatic inhibition (Johnson et al., 2003). This dissociation was found also in older adults (Collette, Germain, Hogge, & van der Linden, 2009) and in schizophrenics (Huddy et al., 2009).

Affective and Personal/Emotion Factors That Influence Automatic Attention and Action

Affects, cognition, and motivation are often intertwined in automatic performances and automatic attention. They must be differentiated to reach a deeper understanding of automatic processes, which may be much more complex than innate or acquired reflex reactions. Affective schemes differ radically from cognitive schemes, but both sorts of schemes carry out evaluations of experience. Evaluations done by cognitive schemes are *truth values*, whereas evaluations done by affective schemes are *vital values* (i.e., life-informing, biological, or psychosocial), positive or negative. Truth is an alternative sort of value that claims congruence or incongruence (match or mismatch, true or false) between ideas or representations entertained and their assumed counterparts within encountered reality. Thus, cognition assigns truth values to experience. Affective processes assign vital values, evaluating the importance of particular experiences for one's (past or present) life and living, and all is done by specific, positive or negative,

Downloaded from http://direct.mit.edu/books/oa-monograph/chapter-pdf/2242190/c000500_9780262363082.pdf by guest on 23 June 2024

This is a portion of the eBook at doi:10.7551/mitpress/13474.001.0001

affect systems—love, mastery-seeking, guilt, joy, fear, and so forth, which have their distinct innate determinations (e.g., Panksepp & Biven, 2012; Pascual-Leone, 1991b). Thus, feelings may carry values of affect that color subjective/objective situations with vital meaning relevant to one's biological and psychosocial life (Panksepp & Biven, 2012; Pascual-Leone et al., 2015). These feelings often are automatic and effortless, and they may come from unconscious habits (e.g., the person's character structure).

Truth and vital values are compatible, and they can co-exist inside the same schemes. Schemes that contain both of them are often called emotions or personal schemes, because persons are individual human beings who normally experience both of these values. Thus, emotions are hybrid schemes that conjointly carry both cognitive/truth and affective/vital values. However, affect and cognition are not well distinguished in the literature, and the term "emotion" often is taken as synonymous with "affect" (even though the latter only carries vital values). It is well recognized that pure cognition and affects (or emotions) have distinct complementary sites in the brain.

Another issue concerns the organismic functional distinction between affect/emotion versus motivation. Affect and motivation are related in that they involve values, automatic in some situations, and often are accompanied by automatic attention; nonetheless they differ markedly (Pascual-Leone & Johnson, 2004). *Motivation* has three conjoint aspects that often drive automatic attention. First is the *affect motive*, an implicit conative tendency or conation (i.e., a purpose-seeking, often unconscious, quasi-volitional tendency/disposition to do a particular something). Affective motives (conations) convert conscious or unconscious affective goals into conscious or unconscious cognitive goals. Second, the *strength* or energy (magnitude of activation) of this conative tendency is high when the person is motivated. Third, well-learned, purely cognitive schemes also have a strong tendency to apply, because schemes are self-propelling (this is Piaget's assimilation tendency), and so, they have a strong *intrinsic propensity* to apply, causing competition (if they are incompatible schemes) or overdetermination (with compatible schemes).

Cognitive goals are dispositions to do something known or believed congruent with the person's affective goals. *Affective goals* are dispositions toward the future to seek certain vital outcomes or consequences (e.g., escape with fear, approach with love, attack with anger). Coordination of cognition, affect, emotion, and motivation usually is automatic, until a misleading situation emerges that induces performances incompatible with current executive plans. This is apparent in the personal domains of life experience. Personal and interpersonal domains are not covered in this book. However, we briefly discuss at the end of this chapter some positive outcomes resulting from collaboration between automatic attention and mental-attention processes when they are compatible.

Downloaded from http://direct.mit.edu/books/oa-monograph/chapter-pdf/2242190/c000500_9780262363082.pdf by guest on 23 June 2024

This is a portion of the eBook at doi:10.7551/mitpress/13474.001.0001

Automatic Spatial and Temporal Resource Factors in Learning

Leibniz may have been the first to formulate *space* as the product of coordinated *relations of coexistence* between or among things or states. He defined *time* as resulting from *movements of change*, such as dynamic sequencing or duration of states/things. For Leibniz (1966; Alexander, 1976) both space and time were purely relational. Time or space by itself (i.e., without any reference to relations among states or things) was nothing and did not exist. This idea was taken up in modified form by Kant (1929/1965; Alexander, 1976), who claimed that "space and time are conditions of the objective reality of all our sense experience, given in intuition" (Jaspers, 1962, p. 13; Kant, 1929/1965). For Kant, space and time are the automatic forms of sensory organization that impose order onto external or internal experiences, and they produce emergence of *intuition* (which in Kant means actual experience of complex configural states represented as objects or things). This intuition serves as input to mental understanding and reason. This way of forming intuitions was, for Kant, a priori (i.e., not learned but innate to the brain). Neuroscience has confirmed in modified form this major insight of Kant's. The so-called dorsal representational network (see chapter 11), connecting among others occipital to parietal lobes, can be interpreted as neurological substratum of a liberalized Kantian space—functionally contextualized and relational, but innate in its original substratum (this innate substratum we call organismic *S*-factor or hidden regulation operator *S*). In continuous dialectical interaction with this system, the ventral representational network, which connects occipital with temporal lobes, is the neural substratum of Kant's liberalized time as representation (our hidden regulation operator *T*).

By virtue of these two resource systems, the brain can coordinate effortlessly (for the sake of perception and intuition—imaginal representation) relations of coexistence and relations of duration (dynamic sequencing) that exist among objects or configural patterns or states. These automatic coordinations propitiate perceptual or configural emergence of reality-based representational totalities. Using these durations (integrated sequences synthesized by the *T*-operator) helps to make salient the individual identities of objects (their relational, semantic-pragmatic characteristics beyond simple here-and-now perception), which allows distal-object identities to be learned. Leibniz (1966; Alexander, 1976) emphasized that space and time are organizers ("un ordre," Leibniz, 1966, p. 125) important for differentiating *things* (e.g., proximal objects), as well as their individuality and *identity*—this is their distal object. However, he added, "it is instead by way of the things that one must distinguish a site or a time from another" (Leibniz, 1966, p. 196, JPL's translation). In other words, space and time are purely relational, and the concrete content (*C*) of things is necessary to experience space (*S*)

Downloaded from http://direct.mit.edu/books/oa-monograph/chapter-pdf/2242190/c000500_9780262363082.pdf by guest on 23 June 2024

This is a portion of the eBook at doi:10.7551/mitpress/13474.001.0001

or time (*T*). On the other hand, spontaneous observation of temporal duration (or sequences) is needed to learn the true identity of things. The brain's ventral pathway usually is described as serving only to structure objects' identity, perhaps because the identity of things (for Leibniz, 1966, p. 196, their "*principle* of internal *distinction"*) is more concretely salient than the temporal sequences themselves.

In our view, the combined coordination of multiple effortless resources, for example, the operator *F* (field factor of simplicity), the operators of learning (*C, LC, LM, LCLM, LA,* etc.), the operators for space (*S* factor) and for time (*T* factor), automatic attentional inhibition, and so forth yield basic mechanisms for more or less automatic performance in ordinary, facilitating situations. Furthermore, when activated schemes are not compatible, competition can be solved in facilitating situations with automatic attentional inhibition. However, when the situation is misleading, the schemes' competition requires use of effortful mental/executive attention, as discussed in chapter 7.

Strong Automatic Attention and Action Aided by Mental Attention: Mental Flow and Meditation/Contemplation

The peak successful use of automatic attention occurs when it is functionally coordinated with mental attention, to foster efficient intuitive thinking and learning. This is done by using various brain resources: content learning (*C*), automatic structural/relational learning (*LC*), executive-driven mental-attentional capacities (*M* and *I*), mental executive-driven structural learning (*LM*), affective learning (*LA*), the internal-field factor of simplicity (*F*), and so on. There are moments in activities and experiences when automatic processing and mental processing are smoothly intertwined, and the activity unfolds easily in effortless self-propelling ("autotelic") ways. In this case, as our third epigraph indicates, "the goal of each action is the following action. *Action and awareness merge*" (Dormashev, 2010, p. 313). This fully conscious but not self-conscious engagement with activity, in which the self is empathically fused (happily synthesized) with the well-adjusted activity, is what Csikszentmihalyi has called a *flow experience*, "because so many of the persons describing it used the analogy of being effortlessly carried by a current—of being in a flow" (Csikszentmihalyi & Nakamura, 2010, p. 181). The flow experience is very familiar to high performers in creative activities in the arts or science (e.g., immersive acts of problem solving) or during successful, protracted and absorbing, sport performances (such as running, tennis, or soccer).

Intense concentration of attention, blending both the automatic and the mental kind, is critical for the flow experience. As Dormashev (2010) pointed out, "any activity can become autotelic [happily self-propelling] and the decisive role in this

Downloaded from http://direct.mit.edu/books/oa-monograph/chapter-pdf/2242190/c000500_9780262363082.pdf by guest on 23 June 2024

This is a portion of the eBook at doi:10.7551/mitpress/13474.001.0001

transformation is attention…attentional activity that provides for a cognitive restructuring of the problematic situation" (p. 307). Notice that the term *activity* as used by Dormashev (and by us) refers to Leontiev's key concept of activity: "We apply this term only to processes that, by implementing a certain relationship of a human to the world, answer a corresponding specific need" (quoted in Dormashev, 2010, p. 309). Such concept of "activity" is related to the Western concepts of agency or praxis. The experience of flow occurs when intention (motivation), attention (automatic and mental—executive driven but very well practiced), and actual performance get fused into the happy feeling of momentary achievement. Mental attention and thinking alone cannot reach this level of reborn ultimate spontaneity. We say reborn, because it occurs spontaneously in happy and unconcerned young children. However, it often disappears until, with a long labor of insightful practice, the older child's or adult's intention, attention, and actual performance become truly fused. This is an anticipation of moments when the *spirit* (not the religious one, but the brain's synthesis of a harmonious, psychologically integrated, and organismic "functional totality") emerges in us to make us wiser humans.

Is there a way to propitiate emergence of this organismic spiritual balance? One such way is the practice of *contemplative activities* like meditation, yoga, or tai chi (Kim, Pascual-Leone, Johnson, & Tamim, 2016). All meditation/contemplation techniques (**MED**) can be formulated (Pascual-Leone, 2000a) as having in common six conditions or aspects that together constitute the practice: (**MED1**) they involve a *ritual* (routine) to be pursued. This includes a prescription to maximize willful and mentally energized, open participation in the contemplative ritual activity, without paying attention to (quietly ignoring) distracting thoughts, images, feelings, noises, and so forth that are not part of the ritual, and to do so without actively rejecting (indifferently accepting) distractors. (**MED2**) This ritual has an *object or target* that the meditator maintains and attends to. (**MED3**) There is a *practicing person* (the meditator's mentally calm and vigilant self-consciousness and self-agency) quietly contemplating the object and his- or herself, the subject, as the meditator pursues the ritual. This self-conscious practicing subject makes sure that the prescribed practice is regular (e.g., from 20 minutes to an hour, once or twice a day), because regularity is fundamental. (**MED4**) There is a *belief system or philosophical foundation* that highly motivates the practice and explains or justifies the method. This belief may or not be explicit within the ritual, but the practitioner tacitly keeps it in mind as the reason (organizer and motivator) for the practice. (**MED5**) The person should have a very *high motivation* for this regular practice. This practice requires mental (and playful) self-discipline and persistence over time. (**MED6**) Although quietly ignoring distractors and persisting in

Downloaded from http://direct.mit.edu/books/oa-monograph/chapter-pdf/2242190/c000500_9780262363082.pdf by guest on 23 June 2024

This is a portion of the eBook at doi:10.7551/mitpress/13474.001.0001

the meditation practice, the person chooses to practice in situations where distractors can be minimized.

Across various schools, examples of rituals (**MED1**) and object (**MED2**), include the meditator's repetition of a mantra (e.g., in transcendental meditation), attention to prescribed breathing or body postures (e.g., in yoga), attention to ritualized movements (tai chi), seeking and contemplating thoughtless awareness from which self/nonself distinctions end up vanishing (e.g., Zen Buddhism), and so on. Examples of belief systems (**MED4**) are the Vedic metaphysics and practices simplified and adapted by Maharishi, yoga philosophy, Zen Buddhist or Taoist philosophy, or related neuropsychological and neuroscientific contemporary theories about brain, attention, and consciousness. These and other belief systems (philosophical or scientific) are often combined and variously adapted by practitioners, but a belief system is always present in any successful practice.

Austin (2009) distinguishes in Zen meditation two different, but complementary, kinds of practice that have distinct expressions in the brain. In *concentrative*, or actively energizing, *meditation* the object of meditation tends to be more concrete and focused on. This type of meditation engages particularly the dorsal brain pathway of the attentional system, more "top-down" and voluntary. In contrast, in *receptive*, or passively enactive, *meditation* the object of meditation tends to be more global or changing (e.g., attending receptively to anything in the situation) and less focused upon. Receptive meditation engages in particular the ventral pathway of attention, more "bottom-up" and involuntary. This distinction is applicable to all sorts of contemplation/meditation. Both kinds, concentrative and receptive, may be intertwined and seem to involve both mental and automatic/spontaneous attention, but at the beginning of practice mental attention is likely to be stronger in concentrative meditation, and automatic attention tends to be more dominant in receptive meditation. With persistent practice, and possibly thanks to resource-operators mentioned in this chapter, meditation/contemplation of both kinds becomes progressively more flowing and automatic, although mental attention and a willful dedication may remain necessary in both. Some reflection suggests that meditation/contemplation and the experience of flow require spontaneous coordination of many dialectically interacting processes: automatic versus mental attention, concentrative versus receptive attending, cognitive versus affective/personal processing, spatial versus temporal coordinations, and so forth.

Conclusions

We have discussed automatic attention (effortless, often perceptual and personal) and emphasized that it can be simple or complex. Complex automatic activities in facilitating

Downloaded from http://direct.mit.edu/books/oa-monograph/chapter-pdf/2242190/c000500_9780262363082.pdf by guest on 23 June 2024

This is a portion of the eBook at doi:10.7551/mitpress/13474.001.0001

situations may bring special mental (and behavioral) states of high adaptation, as found in behavioral and subjective “flow” or states of meditation/contemplation. These complex states of automatic attention usually are achieved with harmonious coordination of mental (effortful) attention and much assiduous practice (constructivist learning). Brain processes distinguish between these modes of attention.

We have also discussed different causal-organismic factors that contribute to complex automatic attention, such as the organismic principle of Schemes’ Overdetermination of Performance (*SOP)* and the internal field (*F*) operator. The great adaptability of automatic attention is due to these *F*-*SOP* organismic constraints. The role of learning (*L*-operators), affective (*A*), personal (*B*), spatial (*S*), and temporal (*T*) organismic operators were also reviewed in relation to automatic attention. Flow and meditation/contemplation emerge when these organismic factors and mental attention combine, functionally harmonized in a stable manner, resulting from practice.

Automatic attention and mental attention are contradictory in many situations, but jointly complementary in others. They are always in continuous, dialectical interaction, tending to supplement, cancel, or replace one another. This is apparent in the tendency to find an inverse relation of activation between the brain areas that deal with mental/executive attention (such as dorsal and lateral cortical networks) versus those that index automatic/personal attention (cortical medial and ventral networks; see chapters 10 and 11). These two sorts of processes emerge separately in evolution; automatic attention appears first, and mental/executive attention later (e.g., Striedter, 2005). Mental/executive attention may appear in evolution to cope with misleading situations, in which automatic processes interfering with intended action can dominate and must be inhibited. Yet, if these two forms of attention are suitably combined and become well coordinated, performance turns efficient and flow appears.

Downloaded from http://direct.mit.edu/books/oa-monograph/chapter-pdf/2242190/c000500_9780262363082.pdf by guest on 23 June 2024

This is a section of doi:10.7551/mitpress/13474.001.0001

The Working Mind

Meaning and Mental Attention in Human Development

By: Juan Pascual-Leone, Janice M. Johnson

Citation:

The Working Mind: Meaning and Mental Attention in Human Development
By: Juan Pascual-Leone, Janice M. Johnson
DOI: 10.7551/mitpress/13474.001.0001
ISBN (electronic): 9780262363082
Publisher: The MIT Press
Published: 2021

The open access edition of this book was made possible by generous funding and support from Arcadia – a charitable fund of Lisbet Rausing and Peter Baldwin

The MIT Press

Downloaded from http://direct.mit.edu/books/oa-monograph/chapter-pdf/2242190/c000500_9780262363082.pdf by guest on 23 June 2024

MIT Press Direct

© 2021 Juan Pascual-Leone and Janice M. Johnson

This work is subject to a Creative Commons CC-BY-NC-ND license.
Subject to such license, all rights are reserved.

BY-NC-ND

The open access edition of this book was made possible by generous funding from Arcadia – a charitable fund of Lisbet Rausing and Peter Baldwin.

ARCADIA
A charitable fund of Lisbet Rausing and Peter Baldwin

This book was set in Stone Serif and Stone Sans by Westchester Publishing Services.

Library of Congress Cataloging-in-Publication Data

Names: Pascual-Leone, Juan, author. | Johnson, Janice M., author.
Title: The working mind : meaning and mental attention in human development /
Juan Pascual-Leone and Janice M. Johnson.
Description: Cambridge : The MIT Press, 2021. | Includes bibliographical references and index.
Identifiers: LCCN 2020027072 | ISBN 9780262045551 (hardcover)
Subjects: LCSH: Developmental psychology. | Cognition. | Task analysis.
Classification: LCC BF713 .P378 2021 | DDC 155.4/13--dc23
LC record available at https://lccn.loc.gov/2020027072

Downloaded from http://direct.mit.edu/books/oa-monograph/chapter-pdf/2242190/c000500_9780262363082.pdf by guest on 23 June 2024