NEMZETBIZTONSÁGI SZEMLE
Volume 10 (2022) Issue 3 44–56. • DOI: 10.32561/nsz.2022.3.4

Ferenc Horváth[1]

"From Top to Toe": Choosing the Appropriate Training Method

Education is an investment in the future. An investment is only good if it pays off, and education is only effective if the resources used to result in the necessary increase in knowledge and competence. It is easy to make the mistake of investing less energy than necessary in choosing the appropriate training methods, which ultimately fails to have the desired impact. It is especially important in professions where theoretical knowledge must be converted into practice, such as in national security activity. The present study proposes a method to help adult education providers assess the depth of training methods that need to be deployed to achieve a given type of training outcome to avoid wasting money and energy on training. The essence of the idea is that a form of training can only be truly successful if it works through all the physical and psychological processes that are relevant to the actual manifestation of the knowledge, skills and competencies to be acquired. In this paper, I will review which nervous system levels may be involved in information processing and which training methods can be used to involve them in the learning process.

Keywords: *training methodology, competence development, situational learning, learning*

1. Introduction

There are often conflicting demands relating to adult learning in a corporate environment. It must be fast, it has to educate large numbers of people through the training in a short time, it must allow wasted working time to be kept reduced, and to do the job applying as few instructors and as few resources as possible, but at the same time it must have a profound impact, and the trainees must be able to put the knowledge they have acquired into practice immediately. We all feel that this

[1] PhD, Psychologist, e-mail: fhorvath25@gmail.com

is impossible. However, the demand from employers for training to be as resource-efficient as possible is legitimate.

My study is based on the hypothesis that adult education methods must affect all the neurological levels involved in the development of competence to be improved to have practical results. I will review in which neurological levels can occur a change of state that makes our adaptation to the environment more effective, i.e. it can be interpreted as learning. I will then outline the basics of my "Top to Toe" model, which helps to determine the depth at which changes in the nervous system need to be induced to achieve the desired state change and the training methods that should be used to achieve this.

A human newborn baby must be born with a relatively undeveloped brain, otherwise it would not be able to leave the birth canal naturally due to the size of the skull. Therefore, at birth, the child does not have a fully developed human nervous system, so it has to start learning and adapting with a different strategy than adults do. Developmental psychology and pedagogy have done much to explore the developmental process by which the child's psyche unfolds into an adult psyche. In the present study, I am unable to take into account the ever-changing stages of this dynamic, complex educational process, so I limit my reasoning about the acquisition of knowledge and skills to the fully developed human nervous system and, accordingly, to adult education.

2. Neural levels and learning

Learning can be understood in biological terms as a change in the nervous system that makes us adapt more effectively to the challenges of the environment. Concerning the forms of learning, during the classical and operant conditioning neural connections, associations develop between certain stimuli and responses, reinforcing certain behaviours, and weakening others. Rewards and punishments increase or decrease the strength of these links. The importance of these in practical learning should not be underestimated; for less complex tasks consisting of simpler work sequences, this level of learning may be sufficient. However, for more complex task systems – and these are increasingly dominant in the world of work, as they are less automatable – typically a deeper level of adaptation is required. In the most advanced form of learning, in the case of complex learning, we form mental representations or schemas of phenomena and then use these to perform mental operations in our heads, so we can prepare in advance for contingencies that we have not yet directly experienced.[2] In my study, I analyse the latter level of learning.

According to the point of view of cognitive psychology, the human intellect is based on a series of information processing steps, during which input information from the environment becomes the object of internal mental operations that finally results in a reaction, a behavioural output.

[2] Atkinson et al.: *Introduction to Psychology.* 12th edition, Harcourt Press, 1996, Chapter 7.

We handle the information in our environment through processes of observation, perception, cognition, thinking and memory, but the accurate perception of reality is a fragile process, distorted by a number of cognitive and emotional-motivational phenomena.[3] The basic source of the problem is that our attentional functioning and short-term working memory can only extract a limited number of stimuli from the whole of reality, and it is vital for our correct adaptation which facts we highlight and how we interpret them. To solve this problem, human information processing has evolved in a direction that is based on mental operations with internal representations, so-called cognitive schemas, that are formed in our nervous system during the experience.

Our schemas define the whole information processing procedure. Instead of the “seeing is believing” principle, the reality is often “I see it if I believe it”. It is difficult to perceive information for which we have no schemas. In Bruner and Postman’s 1949 experiment,[4] the subjects were flashed French cards and asked to name the exact card they saw. However, some tricky versions were hidden among the cards: red spades and black hearts. At low exposure times, the subjects did not notice the trick and classified the fictitious cards into one of the known categories. Increasing the exposure time, however, made the participants increasingly confused and they noticed that something was wrong. Further increases in time they exposed the deception, and eventually the subjects were able to verbalise what they saw and, knowing that new cards existed, successfully detected them even with reduced exposure times. We can see, therefore, that even at the level of perception, it is difficult to capture information of which we do not have the appropriate schema.

Schemes are dynamic elements; they can be changed and also can affect each other. We try to organise our internal map of the world to a coherent unity.[5] If we succeed, it might give us a convenient feeling of security, but on the other hand, sometimes we have to sacrifice reality on the altar of the sense of this coherence. As a series of scientific experiments prove, our schemes determine the entire information processing procedure. At the very beginning of this process, our attention is strongly affected by our schemes. They determine which part of the whirl of information is filtered out or selected for further processing. We perceive information that is in concordance with our knowledge rather than those that are in contradiction with our internal representations, so our attention is selective; we try to maintain the coherence of our schemes. Our existing schemes organise and sometimes distort our memory functions. If we cannot recall the details of an event that happened earlier, we build up our afterimage using associating mental models that were formed in connection with similar situations in the past. This psychological phenomenon is called the ‘constructive memory’. That is why a false or outworn cognitive scheme can restrict or even distort our thinking for a long time, and obstructs adequate handling of reality.

3 Summary in József Forgács: *A társas érintkezés pszichológiája.* Budapest, Kairosz, 1996.

4 Quoted by László Mérő: *Észjárások. A racionális gondolkodás korlátai és a mesterséges intelligencia.* Budapest, Tericum, 1997.

5 Atkinson et al.: op. cit. Chapter 7.

The success of our accommodation to the world is determined by the appropriateness of our mental schemes, cognitive maps, internal models and representations of reality that – through correct information processing – finally lead to adaptive behavioural output. Generally we can state that the more numerous and complex schemes an individual has in connection with a given topic (for example a science or profession), the more successful he or she can be in it.[6] This is why it is also important in adult education to work with as many and as precise professional schemata as possible to support the processing of information.

At the 'beginner level', when we start to learn some sciences, and technicalities, we know only a few dozen simple professional schemes. We try to handle problems based on our habitual civil solutions, but most of the problems remain unperceived due to the lack of adequate knowledge. On the 'advanced level' possessing a few hundred of professional schemes with conscious concentration we can apply methods developed by others to specific problems, but sometimes they interfere with our amateur schemes; therefore, the result can be an incoherent or illogical solution. Further years of diligent study can lead to the 'candidate level' of particular sciences. This level is approximately equivalent to the MSc level of higher education which means a few thousands of partly compound professional schemes. At this level following the logic of the profession, using professional jargon adequately, autonomous problem solving becomes possible, we own a conscious knowledge; we can explain our decisions step by step and we are able to argue for it.

To the next grade, the 'master level' way is not that straight. To reach this level talent, devotion and at least ten years of practice are required. A 'Master' has ten thousand complex professional schemes. A person educated at this high level (minimum PhD Degree) approaches professional problems in a different manner than those with minor levels of knowledge. Knowing the internal nature and logic and the underlying principles of professional challenges, a kind of synthesis and specialisation of this knowledge appears. Professional thinking is often based on analogues, and an intuitive form of decision-making starts to dominate. The Master can anticipate possible steps, outcomes and consequences several moves earlier, and recognises the possibilities of errors or corrections. Conscious deduction or explanation appears only after the solution; during work timesaving, heuristic decision-making strategies prevail. Conscious processes of information collecting and mental testing of the possible methods in preparation stage are followed by an incubation period and finally in the so-called illumination stage suddenly unique, creative solutions would appear as a result of the combination of possessed professional schemes.[7] At this level, there is already a high degree of problem sensitivity, so these people have efficient sensors to detect important possible developmental directions, not seen by others. They are able not only to react to problems indicated by the organisation, but also to proactively raise new needs.

6 László Mérő: *Észjárások – Remix. A racionális gondolkodás ereje és korlátai.* Budapest, Tericum, 2008. 151–166.

7 Péter Scharle: A kognitív pszichológia sémafogalma és a többciklusú felsőoktatási képzés szintjei. *Magyar Tudomány,* 49 (111), no. 7 (2004). 743–753.

Adult learning must therefore help to ensure that those who are trained can acquire as many and as realistic schemas as possible. How does this process take place, how are schemas formed, what neural levels are involved and what determines whether they accurately represent reality?

The answer is that there are two ways to get new patterns: either we create them, or we get them. Some of the internal representations in our nervous system are originated from personal experiences, but plenty of them stem from our social environment and we simply adopt them without real personal involvement.[8] At this point I must refer back to the false expectations regarding training mentioned in the introduction. Why do not we always take the easy road and adopt ready-made templates? Because it makes a quality difference whether we *learn* from someone else or whether we *develop* the knowledge ourselves. Therefore, acquiring knowledge at a theoretical course, cannot entirely substitute practical, experience-based learning, direct forms of internal representation making.

In andragogy the dominant form of education is theoretical, based on lectures and notes. The transmission of knowledge is carried out in a descriptive, elementary, explicit and declarative way. The students learn the operational framework of the subject, and acquire a semantic memory of knowledge in the form of a statement, but do not yet know how to behave in a given situation. A more profound experience is provided with a form of learning that goes further and also uses episodic memory, where the context of learning is part of the procedure, so this knowledge is more personal. An example of this is a training session where the participants themselves collect and share knowledge through an experience of togetherness. Beyond this, there is also a non-declarative, non-conscious, complex, implicit, fully practical form of the learning process, called procedural learning, which is experiential and skill-based.[9] How much more does this add, and how does it contribute to a deeper and more accurate understanding of the environment?

The declarative, descriptive knowledge of overt norms and socially shared schemas can be received via verbal communication, encoded in linguistic symbols. We use our own existing mental representations to decode them, and we try to incorporate them into our own personalities. There is no personal, direct experience associated with these schemas; the thought units are stored in our cerebral cortex, wrapped in digital codes, in linguistic symbols.

According to Benjamin Whorf's linguistic relativity concept,[10] the language itself basically determines how we process information, in what dimensions we perceive reality, and what categories we use while thinking.

Since our left hemisphere that mainly underlies our conscious operations uses a verbal code system, the structure and elaboration of the language we use (for example the differentiation of possible tenses) during our socialisation confine the possibilities of mapping reality. Learning the jargon of a job, and the differentiation of linguistic codes within a profession is an important aspect of occupational development. By

8 Forgács: op. cit. Chapter 7.

9 Atkinson et al.: op. cit. Chapter 8.

10 John B. Carroll (ed.): *Language, Thought, and Reality. Selected Writings of Benjamin Lee Whorf.* Cambridge, Mass., MIT Press, 1956.

acquiring the official terminology of any science, the communication that is based on the mutual knowledge of the parties becomes economic, concise and strict. Through the function of internal speech, the learning of jargon makes thinking, learning, recalling and problem solving more effective and differentiated.

The disadvantage of these indirect impressions is that they are not connected with either visceral or sensational experiences, so the final map of reality within our minds reflects only personal connotations conditioned to these specific words not direct impressions about the object itself. According to the researches of Osgood on semantic differential scales,[11] personal shades of meaning of each expression can be surprisingly heterogeneous. For example the word 'dog' can mobilise different elements of knowledge, and might induce various feelings, emotions, motivations and reactions in every individual since our personal experiences conditioned to this series of letters are obviously different. The knowledge transmitted via symbols that we get from our social environment can be a well-based and useful pack of information, but a biased belief, stereotype and prejudice, too. In these cases we accept the representations of the communicator believing that they are exact and right, so this process is based on a kind of faith or trust. A much deeper neurological involvement of the trainees is triggered when the mental representations are based on direct, personal experience, and complex impressions of analogous information deriving from a variety of sensory modalities.

In pursuance of the generally appreciated works of the Swiss psychologist, Jean Piaget, the cognitive development of the individual is basically determined by sensorimotor experiences. During their interactions with the world, children begin to map the consequences and experiences of their own actions in the form of cognitive schemes. This procedure is called interiorisation. These schemes are dynamically changing elements of cognition. If it is possible, we match the new experience to our existing schemes (assimilation), if not, we have to alter our existing knowledge to reality and change our schemes (accommodation). The cognitive achievements of children start to grow spectacularly when they become able to execute mental operations based on their existing schemes. During our cognitive development, mental processes are getting more and more independent from any physical simulation and by the age of 12–14, in the stage of 'formal mental operations' an abstract, systematic-logical way of thinking becomes possible.[12]

However, even a fully developed human brain does not mean that rationality and consciousness have taken over the organisation of human behaviour and learning.

According to Paul D. MacClean's Triune Brain Theory,[13] our brains evolved as a three-part unit (see Figure 1). These interdependent brain levels are organically linked and through their integrated functioning and coordinated work, determine

[11] Charles E. Osgood et al.: *Cross-Cultural Universals of Affective Meaning.* Urbana, IL, University of Illinois Press, 1975.

[12] Atkinson et al.: op. cit. Chapter 3.

[13] Paul D. MacLean: Man and His Animal Brains. *Modern Medicine,* 32 (1964). 95–106; Paul D. MacLean: Alternative Neural Pathways to Violence. In Larry Ng (ed.): *Alternatives to Violence.* New York, Time-Life Books, 1968, 24–34.

the uniquely complex spiritual functioning of humans, the animalistic depths and divine heights that Homo Sapiens is capable of experiencing.[14]

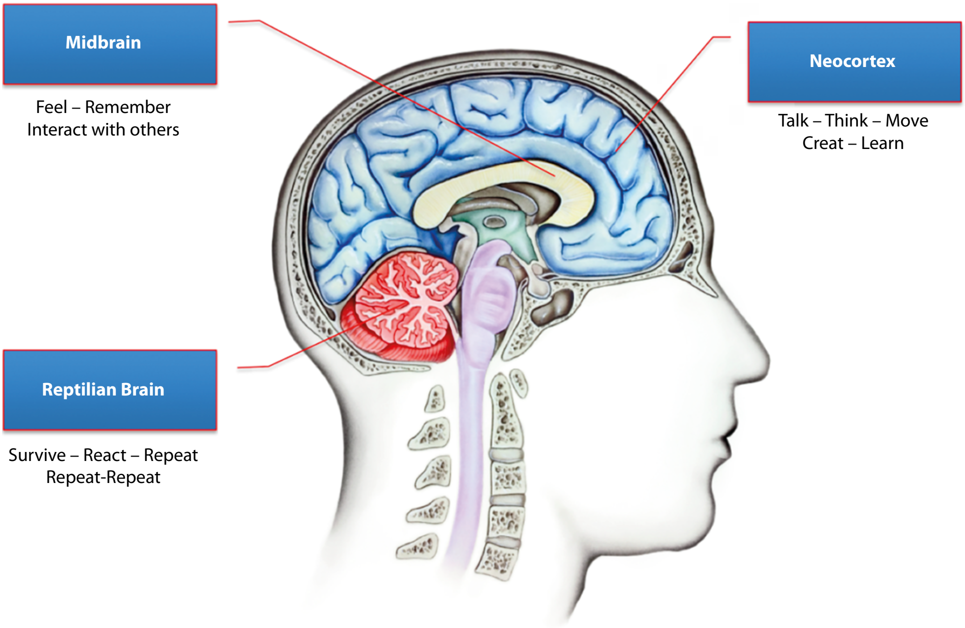

Figure 1: Triune Brain Theory
Source: www.seekpng.com/ima/u2q8u2w7e6w7a9q8/

The most ancient area is thought to be the region around the brainstem (R-complex), which controls the bound, stereotyped, species-specific responses and basic autonomic functions responsible for individual and species survival, as well as the level of alertness that underpins our consciousness. These include the so-called 4F instincts of Feeding, Fighting, Fleeing and Reproduction.[15] Important regulatory functions such as stress, aggression, territoriality, power struggles, and so ritual posturing, pretence, deception and other non-verbal communication traits are associated with this. An important principle at this level is the maintenance of routine, following pre-established examples and social conformity. At the level of concrete examples, this is where the roots of xenophobia, paranoia, revenge, war, military formalism, hierarchy, symbols, etc. can be found. As this is the most stable and vulnerable region of our brain, it is the default system in the event of a disruption in the functioning of the other two systems (e.g. stress, poisoning, injury, illness), to ensure our survival.

The reptilian brain is surrounded by the paleomammalian brain, which includes the limbic system (hippocampus, amygdala and other subcortical nuclei) and the fibres

[14] Jaak Panksepp: *Affective Neuroscience. The Foundations of Human and Animal Emotions.* Oxford – New York, Oxford University Press, 1998.
[15] The creator of the 4F model himself replaced the F word this way.

connecting the two hemispheres of the brainstem. The integration of sensations from inside the body and stimuli from the outside world, and the mediation between the reptilian brain and the function of the neo-mammalian brain takes place through the transitory neural pathways. This is the area where the ability to perceive reality/truth, identity and the range of emotions – which allow for more flexible adaptation than reflexes – are rooted, because according to the two-factor theory of emotions, the emotion experienced is nothing more than the cognitive interpretation of visceral sensations and the general level of arousal they generate.[16] It plays an important role in the development of attachment, which is of vital importance for the care of offspring, in nurturing, in vocal communication, which expands the possibilities for contact, and in play, which helps to acquire behavioural patterns.

The neomammalian brain or human brain evolved at the latest, which is the outermost layer of our brain. Through the thalamic structures and the functioning of the neo-cortex, the possibilities for our interaction with the outside world are expanded. Through complex stimulus analysis, precise, variable and learnable movement patterns, advanced learning and memory functions, and abstract, rational thinking, we are able to expand our spatial and temporal perspective and become capable of tool use, planning, creativity, introspection and awareness. The development of Broca's and Wernicke's areas in the temporal lobe,[17] which represent the motorial and semantic aspects of speech, was an important factor in the evolutionary success of the Homo Sapiens. This cortical functioning is experienced as consciousness: verbalisation brings stimuli experienced and processed at lower levels of the nervous system into the conscious sphere. The neocortex is fully developed by the early twenties,[18] so the way information is processed in childhood and adolescence is quite different.

So Thus, this human-specific region is the key to our conscious, rational functioning, but it cannot provide effective adaptation by itself; in practice, it is the complex interaction of the brain and the lower levels of the nervous system that has made Homo Sapiens the most adaptive creature on Earth, and we cannot avoid this pattern in learning.

According to Antonio R. Damasio, paradoxically, rational human thinking can be perfected by integrating emotional aspects and bodily sensations. In his work "Descartes' Error",[19] based on the experiences of his career as a clinical researcher, he argues that rationality is inconceivable without the integration of emotional components that are constantly mediated by the nervous system, and that the concept of dualistic, separated body and soul is therefore fundamentally wrong: spiritual qualities can only emerge through the integration of bodily experience. In his concept, the function of emotions is to inform the regions of the brain that are responsible for rational decisions about visceral feelings in connection with the situations one has to cope with through the signals of the peripheral nervous system, so they actually contribute to the final reaction with a preliminary classification.

16 Stanley Schachter – Jerome Singer: *Cognitive, Social, and Physiological Determinants of Emotional State. Psychological Review,* 69, no. 5 (1962). 379–399.

17 Atkinson et al.: op. cit. Chapter 2.

18 Beverly McMillan: *Illustrated Atlas of the Human Body.,* Sydney, Weldon Owen Pty Ltd, 2008.

19 Antonio R. Damasio: *Descartes' Error.* New York, Avon Books, 1994. 12–17.

This 'visceral reaction' can contain either inherent components or can be an imprint of previous experiences; leastwise it is an important part of the internal representations of situations, since it has a fundamental orientating role. The fastest judgement about a particular situation is determined by our so-called 'primary emotions' that help us to decide whether we should approach or leave, whether the situation will be useful or harmful for us. This fast, automatised orientation serves our survival. 'Secondary emotional reactions' in which rational analysis of the situation already takes part are based on them, but these would not be launched without the primary process. It helps to connect sensations from the periphery to the visual, auditory, and kinesthetic association regions of the cerebral cortex, to our memory stores. As a result, we are able to perceive and interpret the stimuli we receive, and this is where a rational evaluation of the situation occurs, which, as we have seen, requires the primary processes to take place.[20] Perception, matching with our existing cognitive schemata and identification based on interpretation can therefore only take place afterward.

According to it, the entire body is involved in forming internal representations of situations: "…the body, as represented in the brain, may constitute the indispensable frame of reference for the neural processes that we experience as the mind…".[21] As we can see, not only the incredibly complex human brain, but eventually the entire body takes part in the information processing. So we know not only with our brains, but – in accordance with Jean Piaget's theory – our entire being has taken part in cognition through practical, sensorimotor experiences.

To understand what is happening in practice, let us look at a concrete example that, because of its complexity, involves the whole nervous system and uses the same information processing channels as any other subject in our mental functioning. Joshua Greene, in connection with Damasio's theory, distinguished two interdependent processes in our moral judgements: a fast, automatic process and a slow, controlled one. Greene likens them to the automatic and manual modes of a camera.[22] The automatic mode, as measured, is based on the functioning of the brain's ventral-medial prefrontal cortex (VMPFC), it is emotion-based, fast and efficient but not flexible; it is survival-based. The manual mode involves increased activity of the dorsal-lateral prefrontal cortex (DLPFC), allows rational analysis, which can override instinctive judgement, and leads to "cold-headed", purely utilitarian moral judgements. The frequent dilemmas between our utilitarian and deontological moral, are mainly the results of our attempts to reconcile, often hopelessly, our two information processing systems, which operate at different speeds but in parallel.

Experience from the study of brain-injured patients shows that in front-temporal and ventral-medial prefrontal lesions, patients make almost purely utilitarian, rational decisions, which in many cases is alien to the social environment, does not help their integration, adaptation and impairs their moral judgement. Normally, the integration of emotions and rationality takes place in the frontal lobe, without which our adaptation to the outside world is impaired. The PFC is in fact the associative cortex of social

20 Damasio: op. cit. 149–169.

21 Damasio: op. cit. 17.

22 Joshua D. Greene et al.: The Neural Bases of Cognitive Conflict and Control in Moral Judgment. *Neuron,* 44, no. 2 (2004). 389–400.

behaviour, mapping the taxonomy of all sanctioned actions. If this fails, "moral agnosia" develops, and the patient is unable to adapt adequately to social situations.

Damasio's famous case study[23] is of the unfortunate mining engineer Phineas Gage, whose accidental destruction of the ventromedial prefrontal cortex (VMPFC) by an iron rod left the originally successful, sensitive-hearted and characterful man with a personality change, impaired ability to plan for the future, unable to behave according to previously learned social rules, to choose alternatives for survival. In his case, the VMPFC, through malfunctioning, was unable to process information about amygdala stimulus-reinforcements, so the learning processes that underpin adaptation were inadequate or not utilised at the cortical level. Normally, the VMPFC integrates both the bottom-up and top-down information required for deontological decisions involving a duty to the community. Utilitarian decisions do not require this kind of integration; the dorsolateral prefrontal cortex (DLPFC) alone performs purely rational reasoning and arrives at utilitarian decisions.

In an experiment at the University of Iowa,[24] healthy people and people with brain damage in different brain areas were used to studying the relationship between decision-making and risk-taking. The subjects were allowed to draw cards from four decks of cards while their emotional reactions were measured by the Galvanic Skin Response (GSR) on their fingertips. With two decks, the majority of cards resulted in a $50 payoff, while a few cards resulted in losses between $50 and $200. In the other two decks, there were winning cards of $100 and serious losing cards of up to $1,000. The experiment showed that healthy people and those with other brain injuries showed avoidance behaviour towards dangerous decks after 40–50 draws, and around the 80th draw, they were able to express consciously what was wrong with them. At the GBR level, however, they showed the first emotional reactions to the two dangerous decks long before they appeared at the behavioural level, around the 10th draw. Patients with lesions in the incriminated regions of the frontal lobe were also able to conceptualise and represent the problem at the rational level, but there was no change at the behavioural level, they were still as likely to reach for the dangerous decks as at the beginning of the experiment.

Based on the results of this famous "card experiment", Damasio formulated his hypothesis about somatic markers (bodily signalling emotions).[25] According to it, emotions stem from sensations that are generated by whole-body involvement. These sensations are transmitted to cortical areas that make rational decisions through the coordinated action of the amygdala and the VMPFC, part of the orbit medial prefrontal cortex (OMPFC). This provides vital information that helps to make the most survival-oriented decisions. Some of the somatic markers organise directly experienced sensations into a pre-warning emotion (body loop), while there are also cognitive representations of emotions that can be triggered by cognitive signals without a direct encounter with the stimulus (as-if body loop). Whole-body

23 Damasio: op. cit. 23–53.

24 Summary by László Mérő: *Az érzelmek logikája.* Budapest, Tericum, 2010. –.146–148.

25 Antonio R. Damasio et al.: Somatic Markers and the Guidance of Behavior: Theory and Preliminary Testing. In Harvey S. Levin – Howard M. Eisenberg – Arthur L. Benton (eds.): *Frontal Lobe Function and Dysfunction.* Oxford – New York, Oxford University Press, 1991. 217–229.

experience determines the somatic markers that emerge in relation to a situation, so the quality of the experience will influence subsequent behaviour.

To summarise, it is possible to learn schemas purely by involving the brain areas involved in rational thinking through the exposure of stimuli packaged in verbal codes (lecture), but there is also a different kind of learning (e.g. situational exercises, on-the-job) that involves the whole body, even the last cells, in the creation of internal representations. In the latter case, the internal change of state occurs on an unconscious, visceral level, so that the new knowledge is integrated much more deeply. As a result, for example, the retrieval of new knowledge is stable even when stress levels are elevated, as opposed to theoretical knowledge based on stress-sensitive neocerebellar functioning.

3. Recommendations for the top to toe method

The name of the method I propose refers to the fact that when choosing a training methodology, it is necessary to decide at which level or levels we want to achieve a change in the nervous system. The roof represents the most advanced areas of our brain, the abstract memory store with verbal encoding, and the base represents the visceral level of somatic markers. In what follows, I will illustrate with selected examples the combinations to consider when aligning training methods with the desired outcomes. I will not attempt to give a complete, precisely structured recommendation within the scope of this paper, but perhaps this is enough to convey the basic idea.

When choosing the training and related assessment method for the appropriate change of state, it is first necessary to determine at which level of the whole nervous system the new knowledge to be acquired should cover the practical manifestation. If it is enough that the new knowledge is stored in the memory bank (e.g. literacy), it may be sufficient to store it in the form of a lecture or a book, packaged in verbal codes, and then test it in the form of a written test or oral question. In such cases, it is worth practising not only the process of memorisation but also the recalling. If the aim is to synthesise and analyse these stored elements of knowledge in order to create new combinations, it is worth using training and assessment methods that offer the opportunity to do so (e.g. small lectures, essays, discussion groups, etc.). If the aim is to use the stored knowledge elements to solve concrete practical problems (e.g. medical diagnostic work) or to apply them in a practical situation (e.g. doing a company's accounts based on tax law), then success can be achieved through a more realistic case study analysis or a simulated task situation.

There are also cases where theoretical knowledge is not relevant because it is a purely practical skill (e.g. cycling, swimming). In these cases, development can be advanced at a purely physical level, with guided exercises, the success of which will be rooted in muscle memory; in this case, studying the history of the velocipede or the geometry of the bicycle's frame at a cortical level will not bring you any closer to the result. In other cases, however, such as integrity development, theoretical knowledge needs to be applied in emotionally saturated practical situations, in harmony with the beliefs of the individual as they are formed in the course of education. In such cases, the whole person with body and soul must be involved in the development process, so that the visceral alarm function can be based during the training, and can help to react well when a similar situation begins to rise in real life.

Once the training objective has been identified, the tasks to be carried out to achieve it need to be developed. The more practical the training method is, the more energy-consuming the process is. The key to success is personalisation and realism, for example, it is worth dramatising critical job situations identified in job analyses, which is a time-consuming exercise. The number of participants is also limited in practical training, as it is not possible to involve participants in the practice and its discussion in sufficient depth for more than 10–12 students. The small number of trainees in a group means that the organisation can educate only a low number of colleagues with a given number of classrooms and trainers. This is further complicated by the fact that it is much more time-consuming to experience the exercises individually, and to interactively analyse and discuss them together than to give a one-way communication-based lecture in a large classroom.

4. Conclusions

In my study, I tried to illustrate the importance of a trivial but often overlooked factor in education. The basic idea of the "Top to Bottom Model" is that the training methods chosen in adult education should not be adapted to the existing possibilities, but to the depth of the neural levels involved in the practical manifestation of the skills, abilities and knowledge to be acquired as a result of the training.

A common error of approach on the part of employers is to see training as an obligation to be met rather than an investment in the future. Hence, in the name of efficiency, the organisation tries to train as many employees as possible in as little time and as cheaply as possible. However, this energy is almost entirely wasted, as it will not achieve the desired results.

The solution is for the employer to create the infrastructure and personnel conditions to ensure that the choice of training methods needed to achieve the desired increase in competence remains a purely professional matter.

The choice of the appropriate training methodology depends on many factors, of which the one I have suggested is only one possibility, but perhaps the most fundamental. In my study, I have described in detail the possible physical and psychological processes through which changes in the nervous system occur during training, which result in a more effective adaptation of participants to new situations. We have seen that learning does not stop in the brain, but can involve the whole body in its own way.

With further research, it may be worth exploring in detail exactly what the basic types of adult learning can be, and these can be combined with a guide to what training methods can most effectively serve development at the different levels of the nervous system. It may also be useful to develop the same methodology for the different stages of child development, so that pedagogy can make use of these findings, too.

References

Atkinson, Rita L., Bem, Daryl J., Renner, Michael, Atkinson, Richard C., Smith, Edwin: *Introduction to Psychology*, 12th edition, Harcourt Press, 1996, ISBN10: 0155015540 ISBN13: 97801550155489780155436886.
Carroll, John B. (ed.): *Language, Thought, and Reality. Selected Writings of Benjamin Lee Whorf.* Cambridge, Mass., MIT Press, 1956.
Damasio, Antonio R. – Daniel Tranel – Hanna C. Damasio: Somatic Markers and the Guidance of Behavior: Theory and Preliminary Testing. In Harvey S. Levin – Howard M. Eisenberg – Arthur L. Benton (eds.): *Frontal Lobe Function and Dysfunction.* Oxford – New York, Oxford University Press, 1991. 217–229.
Damasio, Antonio R.: *Descartes' Error.* New York, Avon Books, 1994. ISBN 0-380-72647-5
Forgács, József P.: *A társas érintkezés pszichológiája.* Budapest, Kairosz, 1996.
Greene, Joshua D. – Leigh E. Nystrom – Andrew D. Engell – John M. Darley – Jonathan D. Cohen: The Neural Bases of Cognitive Conflict and Control in Moral Judgment. *Neuron,* 44, no. 2 (2004). 389–400. Online: https://doi.org/10.1016/j.neuron.2004.09.027
MacLean, Paul D.: Man and His Animal Brains. *Modern Medicine,* 32 (1964). 95–106.
MacLean, Paul D.: Alternative Neural Pathways to Violence. In Larry Ng (ed.): *Alternatives to Violence.* New York, Time-Life Books, 1968.
McMillan, Beverly: *Illustrated Atlas of the Human Body*, Weldon Owen Pty Ltd, Sydney, 2008, ISBN 10: 1740896483, ISBN 13: 9781740896481.
Mérő, László: *Észjárások. A racionális gondolkodás korlátai és a mesterséges intelligencia.* Budapest, Tericum, 1997.
Mérő, László: *Észjárások – Remix. A racionális gondolkodás ereje és korlátai.* Budapest, Tericum, 2008.
Mérő, László: *Az érzelmek logikája.* Budapest, Tericum, 2010.
Osgood, Charles E. – William H. May – Murray S. Miron: *Cross-Cultural Universals of Affective Meaning.* Urbana, IL, University of Illinois Press, 1975.
Panksepp, Jaak: *Affective Neuroscience. The Foundations of Human and Animal Emotions.* Oxford – New York, Oxford University Press, 1998.
Schachter, Stanley – Jerome Singer: Cognitive, Social, and Physiological Determinants of Emotional State. *Psychological Review,* 69, no. 5 (1962). 379–399. Online: https://doi.org/10.1037/h0046234
Scharle, Péter: A kognitív pszichológia sémafogalma és a többciklusú felsőoktatási képzés szintjei. *Magyar Tudomány,* 49 (111), no. 7 (2004). 743–753.