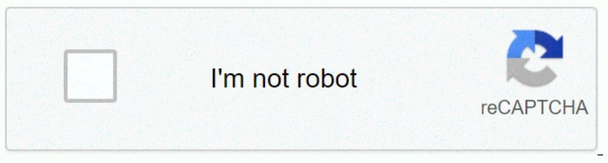

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Dynamic systems theory motor learning

Skip to Key Content [Online] 03 August 2017DOI: Dynamic systems are a theoretical framework used to understand and predict your own organizational phenomena in complex systems that are constantly changing, reconfiguring, and progressing over time. Often, mathematical formulas are used to capture the change process within a given system. The term dynamic system is used to refer to various phenomena in living and living systems that display nonlinear behavioral changes over time. Behavioral changes can occur in cloud formation or chemical reactions in the sky. It may reflect a sudden transition of gait patterns from biological systems, or changes in flight pattern formation in flocks of birds. Dynamic systems aim to study the complex processes that drive this change. Whether it occurs in a single system/organism or group of individuals, these changes are complex because they are the product of multi-step interactions between the various elements that make up these systems. Collectively, these are ... This is a preview of the subscription content, access confirmation login. Albert, J. R. (1978). Huddled by rat pups: a group action mechanism of temperature control and energy conservation. Journal of Comparative and Physiological Psychology, 92 (2), 231.CrossRefPubMedGoogle ScholarsAtun-Einni, O., Berger, S. E., Ducz, J., & Sher, A. (2014). The intensity of the amniotic fluid reach pattern in infants is associated with the onset of straight movement. In early childhood, 19 (1), 82-102.CrossRefGoogle scholars Casey, M.B., and Martino, C.M. (2000). Asymmetric hatching behavior affects the development of postpartum laterality of domestic chicks (Galus Gallus). Developmental Psychology, 37 (1), 13-24.CrossRefPubMedGoogle ScholarsChiel, H. J., & Beer, R. D. (1997). The brain has a body: adaptive behavior emerges from the interaction of the nervous system, body and environment. 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Tthe The premise is that the movement behavior is the result of complex interactions between different subsystems of the body, the task at play, and the environment. Given this complexity, system theory is a good tool for analyzing how movement behavior changes and learning occurs. In this post and follow-up, review some basic concepts of DST and how it can be used with clients. After reading this, you can conclude that DST helps explain the practices and intuition of a good athletic coach. (By the way, if you want more background on some of the concepts in this post, you may be interested in this post about how it applies in the context of pain and the system perspective on chronic pain.) Think about the intelligent behavior of insect colonies, such as honeycombs. There is not a single bee that knows how to do all the important things that need to be done: making a honeycomb; Make honey. raising a baby; Repel predators and more. Instead, this is done as a result of complex interactions between thousands of different bees, with simple algorithms for behavior almost in mind. Similarly, the intelligence that controls our movements comes from the complex interactions between millions of body parts and the environment. But what about the central nervous system? Isn't it the central controller of the body? In a sense, yes – CNS issues all commands that cause the firing muscles in a meaningful pattern. However, CNS is itself a complex system with many parts. And that behavior depends on interactions with many other systems in the body like the immune system, the immune system, the exoskeleton system, the musculodkeleton, and the environment. Because of this, DST emphasizes the role of top-down crystals in movement, such as CNS and motor programs, and focuss more attention on bottom-ups such as the structure of the body, the environment, and the nature of the task at play. For example, check out this video of a robot walking without an onboard computer or motor, for example, how important these factors are for coordinated movements. The intelligence to control the robot is built into the structure. If its structure is put in the right context, it only does its job: the main premise of complex systems, self-organization and top-down control DST is that it is a complex system consisting of millions of parts that the body interacts with. The intelligence to adjust the body is not limited to one particular part, but it comes from the complex interaction of all different parts. Therefore, unlike simple machines such as thermostats, complex systems represent controlled operation without a central controller. To illustrate this paradox, DST use terms such as self-organization, emergence, and multi-cause relationships. This term sounds pretty exotic, but there's no magic Self-organization does not mean a kind of vital life energy that defies the laws of physics. But how can you control it without a controller? The robot didn't have to learn to walk, it needed a little push from the right environment (sloping ground) and dad. Is the baby different? Some interesting studies by Esther Terence have shown something similar about babies walking. Structure, Environment and Stepping BehaviorEsther Thelen was an innovative thinker in the field of developmental psychology. (Interesting side note: She also became a Feldenkrais practitioner after learning that the Feldenkrais method was an effective practical application for many of her ideas.) One of her major studies concerned changes in stepping behavior in infants during development. The researchers observed that as long as young infants are held upright, they will start stepping, just as they want to walk the pace. This behavior then disappears for several months, but reappears later. The dominant theory that explains these changes means the development of the nervous system. According to this view, infants will somehow lose the motor control program required for stepping, as the next reflexive neurosydrever and other motor control patterns are developed. However, Thelen was able to create stepping behaviors for children who felt they lacked the necessary CNS maturity. She partially locked her legs in the water and effectively lightened them so she began to tread spontaneously. Therefore, the decisive factor in controlling stepping behavior is not a change in top-down programming in the CNS, but basically a bottom-up change in the effective weight of a fattening and lazy leg for a while becomes slim and pleasant. Thelen was also able to change the stepping behavior by changing the environment. Check out this video of a toddler walking on a treadmill. From a conventional perspective, this type of stepping behavior is probably impossible given their level of nervous system development. But put him on the treadmill and he is ready to rock. For Thelen, this is a direct challenge to the idea that development has fixed rules or steps that infants must pass. Instead, development is very personal, relies heavily on context, and has multiple paths to success. These ideas are in contrast to traditional development perspectives that optimal development should take place step by step based on top-down, gene-determined, and CNS intervention programs. Maybe not. There are many roads in Rome, not all of them pass through crawling villages. Phase shifting and shift pattern changesBoxy theorists use the term state to refer to all the different ways complex systems can arrange on their own. Changes in state are often nonlinear, which When entered into the system, it produces a large output, or vice versa. Important nonlinear changes are called phase shift. For example, water doesn't change its behavior much because it gets cold, but when it's cold, it suddenly undergoes a phase change and turns into ice. Here's an example of a phase change in motor control: As the horse speeds up walking, the default adjustment pattern for the limbs remains the same. However, when the critical speed is reached, the movement pattern suddenly moves to the trot. Adding more speed and gait will remain the same for a while, but will eventually go back to gallop. You can experience something similar while walking. This means that you walk without using the cross-side pattern of your gait, such as your shoulders and arms don't move or turn your hips and legs in reverse. Now you can speed up your walk. When you're speeding up enough (you may East Sea to do this with a jog), you'll find that your shoulders and arms start moving across your hips. Changes in speed create a phase transition to a lateral pattern of sudden, almost unconscious gait. From an exercise teacher's point of view, this will be interesting how to change exercise patterns – we want to change the movement behavior of our clients, and the most interesting changes are in the nature of step change – the actual qualitative changes in movement patterns. The DST perspective emphasizes that a step change in exercise behavior can occur without specific intent for the student to change or specific instructions from the teacher. Instead, changes can occur as long as you change the nature of the task or environment. If you look around, you'll see examples of this teaching everywhere. For example, the recent interest in barefoot running is due to the fact that some runners will voluntarily change their foot strike patterns. This shows that even without direct instruction or motor learning, you can quickly change the movement behavior that is deeply ingred by changing the environment or work constraints. Many classic exercise interventions are based on exactly this idea. Think of the zansquat that Dan John was popular with. This new demand for work often improves rapidly in the pattern of squatting without specific guidance. Here's another example: Gray Cooks use a corrective exercise strategy called RNT (Reactive Neuromygingal Muscle Training), which can work as follows: If someone is crouching on their knees inwards, Cook will feed the mistake by kneeling, putting the band on his lap and driving further inwards. This new constraint will immediately encourage students Kneel more outwards - no words are needed. And let's go back to running again. Check out this video by Chris Johnson, which shows how he changes his client's foot strike pattern by making her increase stride frequency: again, an immediate step change in movement behavior without specific instructions. It should also be noted that Exo's Performance Training Director Nick Winkleman is doing a great job of applying these ideas in a performance context. Bottom line I need to pack this post now because I fear it may be running with too many tangents (especially Gabriel Wolfe's work showing excellence in external cues through internal cues.) And in future posts I will review more DST concepts such as the stability, flexibility and variability of childish, control parameters and movement patterns. But for now, here's a simple take suggested in this post. Humans are complex systems with incredible ability to self-configure. With the right motivation, environment and work done, you can often find a good moving solution with great speed and efficiency. The proper role of a coach is often not about telling people how to move, but about making the right conditions for learning and then getting off the road. This model for education is actually very common sense, and most of the best coaches and teachers use it intuitively. DST can be a good theoretical model to explain why this approach works, and that's a good reason why I keep learning and writing. Let us know what you think in the comments! Comments!