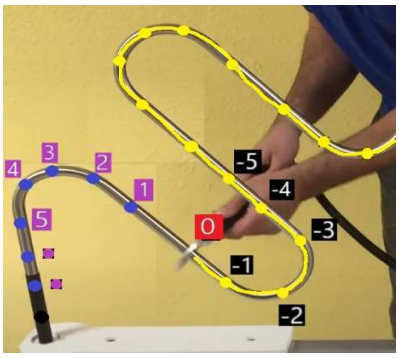
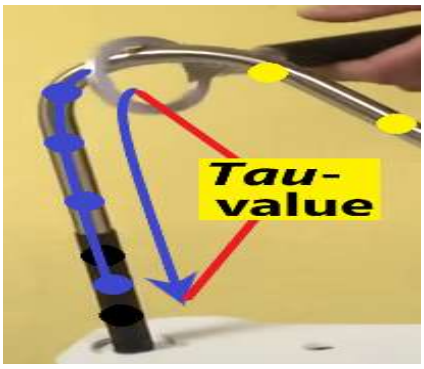
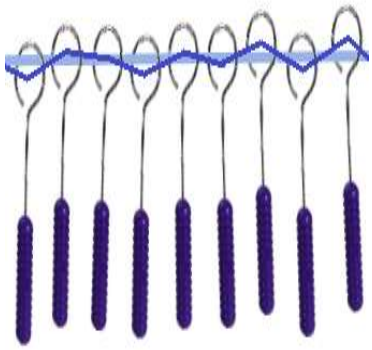
The complete clarification of all functional perception processes within the nerve spiral







Caught In A Line
The explanatory model of all motoric movement actions

N.J. Mol
July 2024 ©

Contact: kwillinq@gmail.com
https://www.researchgate.net/profile/Nj-Mol/research
https://www.explanatorymodel.nl/

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Introduction

In 2016, a comprehensive explanatory model was developed that offers the possibility to appoint all functional perception processes involved in any conceivable goal-directed motor action. It compels a revolutionary paradigm change and provides a universal explanation, demonstrating that the execution of any action always requires the simultaneous perception of three autonomous foci. Whether it involves catching a ball, the grasping of a coffee cup or manipulating a ring along a nerve spiral, one autonomous focus continuously tracks the movement of the ball, the coffee cup or the spiral as the environmental object, universally representing a catching action. The other two autonomous foci are concerned with perceiving the movement within the egocentrically executed action: i.c., the movement of the hand (fingertips) or the ring along an action trajectory shape (towards the ball, coffee cup or spiral), which universally represents a throwing action.

So the essence of the perception processes encompasses the fact that two autonomous movements, as part of a catch and a throw action, will have to come in contact with each other. In relationship to which it compels a fact that, within our worldly dimensions, the sequential positions P of any conceivable object are always interconnected c.q. must always sprout from each other. This factually means that, for example, with an incoming tennis ball within a catching action, the perceptual images of all positions P of the tennis ball will always form a line c.q. will always represent solely one line segment shape. This constrains the perception to such an extent that we can already precisely know within which global fluctuation boundaries the actual catching will have to take place. According to which it is important to realize that all manifest positions of the tennis ball create the actual line shape, but more essentially, the latent part of the tennis ball's action trajectory shape must (!) emerge from the manifest part.
This applies not only to catching actions but also to all throwing actions. So also when moving a ring within a nerve spiral game, all positions of the ring will always be interconnected and construct just one sole action trajectory shape, will the actual position of the ring always represent the precise division between the manifest and latent parts of the action trajectory shape, and must the latent part of the action trajectory also (!) emerge from the manifest part. Which facts are clearly not to be refuted.

Contact: kwillinq@gmail.com Website: https://www.explanatorymodel.nl/ – N.J. Mol

The explanatory model is based on the paradigm that, in its evolutionary development, the perceptual organ first functioned as a comparison mechanism that could record the autonomous movement of the animal and the autonomous movement of the environment c.q. the environmental objects in line segment shapes. In relationship to which it is important to emphasize that the ability to perceive movement arose long before the more advanced cognitive skills were developed that gave us insight into the nature of what exactly moves[1]. Thus, perceiving movement essentially has nothing to do with perceiving what exactly moves, and it can also be established that perceiving mere movement must be placed close to the origin of the evolutionary development of the perception processes.

This premise aligns entirely with the findings of J.J. Gibson, who, in addition to indicating the autonomy of the animal, also indicates the autonomy of the environment, while also showing that in the execution of every action, a touching process between the animal and the environment always takes place. If we then take the aforementioned paradigm as a starting point for the execution of a goal-directed action, it can be shown that the animal and the environmental object must at least come into contact with each other first in most motor actions. Which within our perception processes means that 1. a perceptual image of the movement of the environmental object within an action trajectory shape of the catching action, and 2. a perceptual image of the egocentric movement of the animal within an action trajectory shape of the throwing action, will at least have to lead to a perceptual image of a latent intersection point of those two line segment shapes.

As within any conceivable action then solely two universal possibilities arise:

1. **The environmental object (e.g., the spiral or the tennis ball) is standing still**[2]. The perception records this as a zero-movement within a zero-line segment shape within the catching action, and a perceptual image of a latent egocentric action trajectory shape out of the perspective of the ring within the throwing action must be formed to construct a perceptual image of an intersection point of the two involved action trajectory shapes.
2. **The environmental object (e.g., the spiral or the tennis ball) is moving (towards us).** The perception records this as a movement within an incoming action trajectory shape within the catching action. This also necessitates forming a perceptual image of a latent egocentric action trajectory out of the perspective of the ring. Which finally should lead to the creation of an autonomous perceptual image of a future (latent) intersection point sprouting from the two latent parts of the involved action trajectory shapes that are constructed separately.

This explanation demonstrates that, contrary to the current state of science, the explanatory model shows that the perception processes within any conceivable motor action originate much more from a single universal source and illustrates that in all actions, an intersection point c.q. contact point between the animal and the environmental object must first be realized, and that after this contact, a pressing or pushing process usually follows. The model shows that the perception processes involved in the contact process when grasping objects are identical to the perception processes when pressing a button (e.g., piano key, touchscreen, elevator buttons, electric stove, light switch, etc.), pushing away a billiard ball, or kicking a football towards a goal. The contact process is perceptually identical in all cases. When grasping a coffee cup, however, a pressing or pushing process must follow the contact process within the relevant fingertips, resulting in a total zero vector. Conversely, pressing a piano key requires the creation of an actual movement vector to press the key down. The same applies to the

1 Two important remarks: 1. Of course it is very important within evolutionary development of the perception processes that you can distinguish a lion from a zebra., and 2. Even till this day our visual perception processes observe the (external) movement of our body parts in the exact same way as they observe the movement of any other (external moving) environmental object. Solely due to internal perception processes in relationship to a causal connection with this external movement provides us the difference between the two.

2 In part 1 (page 4), the explanatory model of the motoric movement action demonstrates that perception always observes stationary objects moving in time, but through an active comparison process can conclude that the object in question is stationary. Therefore, even though it is concluded that the coffee cup is stationary, zero-movement is indeed observed on a timeline, which can create an intersection point with an egocentric action trajectory shape in relationship to the grasping hand.

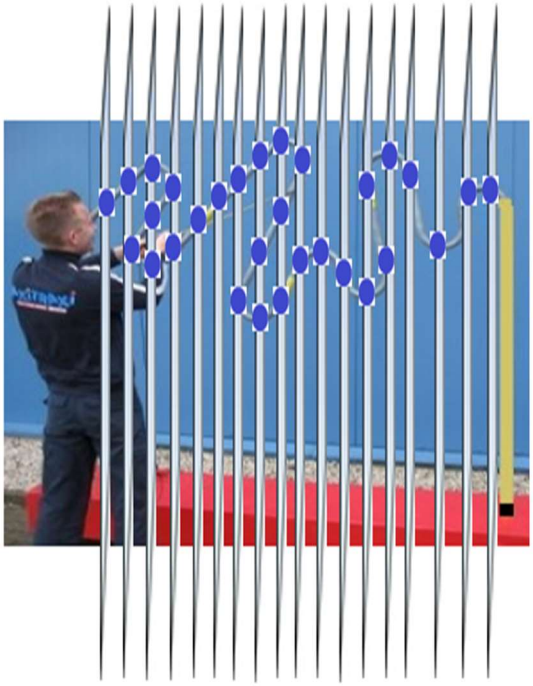
Contact: kwillinq@gmail.com Website: https://www.explanatorymodel.nl/ – N.J. Mol

other mentioned buttons and so the contact process within the nerve spiral involves the same perception processes as in ordinary grasping.

This overview document specifically addresses those aspects of the throwing and catching action within the execution of a nerve spiral that are barely recognized within science. A small part of the document focuses on the perception of the spiral within the catching action, but the vast majority of new insights are revealed concerning the egocentric throwing action that specifically focuses on the movement of the ring. It shows the scientific evidence that 1. a perceptual image of a latent action trajectory shape from the ring towards the environmental object is always created first, and 2. how this action trajectory shape can only be filled with the help of two autonomous foci. This overview document now summarizes all phenomena ever found within the movement sciences and forges them into one universal explanatory model. Based on logic, it can be concluded that this forms the complete and definitive explanation of all functional perception processes in relationship to the nerve spiral.

Contact: kwillinq@gmail.com Website: https://www.explanatorymodel.nl/ – N.J. Mol

Part 1 - Prior to executing a nerve spiral we always first construct a perceptual image of a latent action trajectory shape out of the perspective of the ring – The scientific evidence



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N.J. Mol
May 2024 ©

Contact: kwillinq@gmail.com
https://www.researchgate.net/profile/Nj-Mol/research
https://www.explanatorymodel.nl/

Introduction

The explanatory model of the motoric movement action provides a universal explanation of all functional perception processes within all goal-directed actions. It demonstrates that performing any conceivable action always requires the simultaneous perception of three autonomous foci[3], in accordance with J.J. Gibson's theory, which includes both the movement of the animal/organism and the movement of the environment. When playing the nerve spiral game, one autonomous focus remains engaged with (the movement of) the spiral as the environmental object, universally representing a catching action. The other two autonomous foci are concerned with the perception of movement within the egocentrically executed action, i.e., the movement of the ring attached to a handle along an action trajectory shape (toward the end of the spiral), which universally represents a throwing action.



This article specifically focuses on the two foci belonging to the egocentric throwing action of the ring in relation to playing the nerve spiral game. The explanatory model shows that every conceivable throwing action requires a compelling cooperation between an autonomous internal focus and an autonomous external focus. This insight, that two autonomous foci are present instead of a single undivided motor action, not only allows a final and ending specification of all individual perception processes but also reveals as a novelty that a coupling within the egocentric throwing action itself is capable to occur[4].
The explanatory model of the motoric movement action thus provides a complete description of the *tau*-coupling process, wherein the essence of the task, the primary focus, is executed through (the perception of) the movement of the ring over a pre-planned action trajectory shape[5] between the

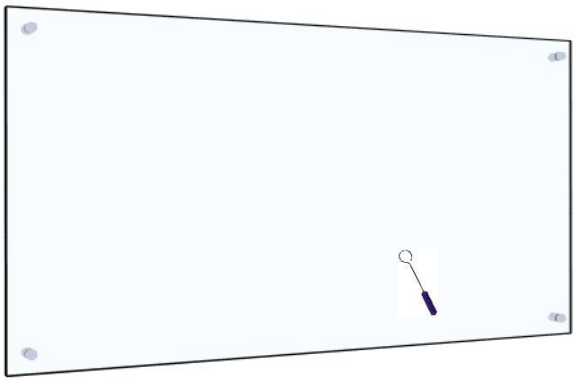
[3] The cortical streams mediate the grasping of a cup equal as they mediate within the nerve spiral (youtube.com) https://www.youtube.com/watch?v=QP4vPVAw-Yg
[4] D.N. Lee did indeed identify the *tau*-value associated with the primary focus, but he considered the egocentric action as one indivisible whole. His lifelong quest to find the phenomenon it should be connected to remained unsatisfied because he never realized that the coupling occurs within the egocentric action itself.
[5] It is essential to understand that the catching action (1 focus) and the throwing action (2 foci) are autonomous and entirely separate parts. Thus, even though we constantly see a spiral unfolding before our eyes (as part of the catching action) and it seems redundant, we still create a perceptual image of a latent action line shape from the perspective of the ring (as part of the throwing action).

Contact: kwillinq@gmail.com Website: https://www.explanatorymodel.nl/ – N.J. Mol

beginning and the end of a spiral[6]. This perceptual image is therefore determined in advance within a tactical consideration and involves identifying the future sequential positions the ring must occupy to achieve a successful action. Sequential positions of any object effectively always create line segment shapes, and when the action is actually executed, the current position of the ring is going to fill in that perceptual image step by step. Thus, it can be observed within a line segment shape that the *gap* of the latent positions P gradually disappears and, in full accordance with the findings of D.N. Lee, produces the *tau*-value, which plays a crucial role in the completion of the motor action in cooperation with the secondary focus[7].
The explanatory model of the motoric movement action partly relies on logical reasoning but also presents scientific evidence. This chapter provides scientific proof that within the nerve spiral game, we always first create a perceptual image of a latent successful action trajectory shape out of the perspective of the ring before we actually perform any action.

The scientific evidence

The evidence is very straightforward. You can verify it yourself through an empirical study where you are the test subject or you ask a test subject to execute the nerve spiral game. The only instruction given is to only execute the action if the test subject believes there is a realistic possibility of actually getting the ring to the end of the spiral.

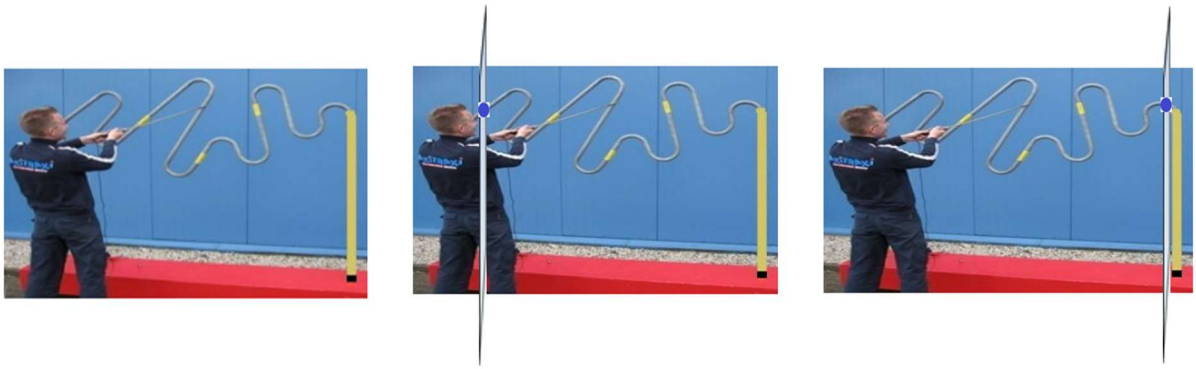


Images: The scientific proof is based upon the competence to visualize a giant huge glass shopping window. The left image shows a normal dimension of such a window. In relationship to the scientific proof you need to magnify that image 10 to 20 times. Like in the right image.

Choose a random nerve spiral game and create the following circumstances:

Situation 1:	Do not alter the environment (zero measurement). Let the test subject just execute the game.
Situation 2:	Place a giant huge glass shopping window (height 20 meter x width 30 meter) between the beginning and the end of the spiral, close to the beginning.
Situation 3:	Place a giant huge glass shopping window (height 20 meter x width 30 meter) between the beginning and the end of the spiral, close to the end.
Situation 4:	Place a giant huge glass shopping window (height 20 meter x width 30 meter) between the beginning and the end of the spiral, at any random position P.

[6] https://www.researchgate.net/publication/376888581_The_nerve_spiral_demonstrates_that_random_motor_activity_implicitly_generates_an_internal_and_external_focus_and_provides_scientific_evidence_that_the_external_focus_can_guide_the_action_due_to_the_in
[7] https://www.researchgate.net/publication/375902347_The_execution_of_an_external_action_trajectory_shape_over_which_the_ring_moves_dictates_all_internal_sensorimotor_perception_processes_within_the_nerve_spiral_The_tau-coupling_process_shows_that_we_do

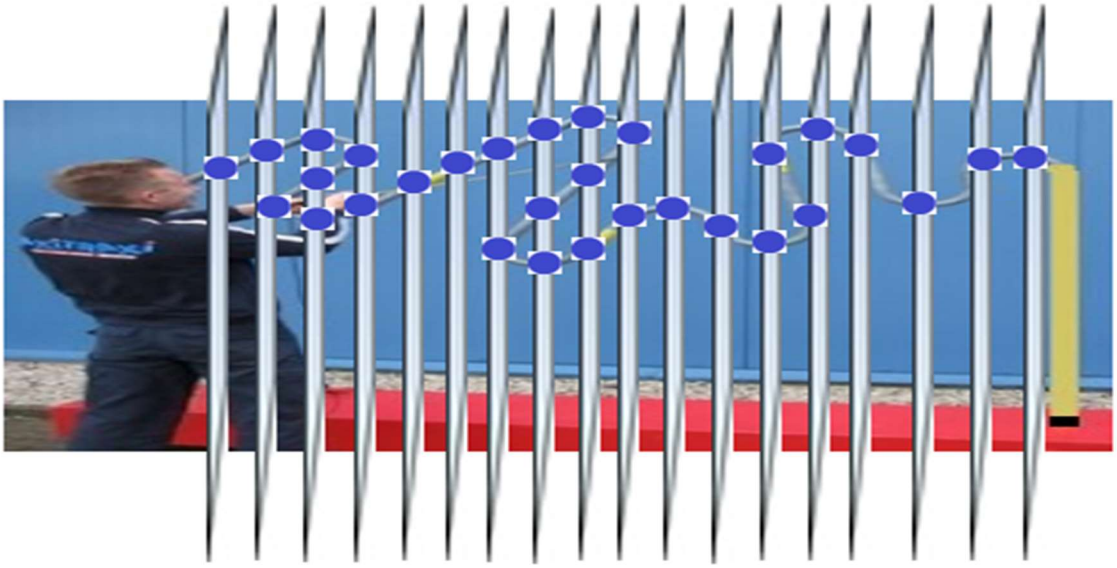


Situation 1 Situation 2 Situation 3

Images: In situation 1 a test subject will normally execute the nerve spiral game. In situations 2 and 3, where a giant glass store window is placed between the beginning and the end of the spiral, the test subject will not start a moving action with the intent to actually get to the end of the spiral. This is because there is *one* (!) position P that is perceived as blocking the ring.

Conclusion:

In situation 1, you and/or the test subject will just execute the nerve spiral game. In situations 2, 3, and 4, you and/or the test subject do not initiate any action with the intent to reach the end of the nerve spiral. Situations 2 and 3 do not provide significant insight on their own, but situation 4 clarifies everything. Whether the giant glass shop window is placed near the beginning or near the end makes no difference to the test subject. If there is a large shop window anywhere clearly present, the test subject will not initiate a motoric task with the intention to a successful action. This applies to every conceivable position P of the shop window, from the very first position P(0) near the beginning of the spiral to a shop window occupying the last position P(n) just before the end of the spiral.



Situation 4

Image: In situation 4, it becomes clear that prior to the actual execution, we consider all consecutive *future* (!) positions of the ring. It doesn't matter where the shop window is positioned between the start and the finish of the spiral; the action is not performed. Mathematically, one can argue that an uninterrupted series of consecutive positions P creates a line segment or line segment shape (action trajectory shape). The image provides a perfect visual representation that within a throwing action, we first form a perceptual image of an entire latent action trajectory shape before we actually execute anything.

Contact: kwillinq@gmail.com Website: https://www.explanatorymodel.nl/ – N.J. Mol

This means that we assess every position P(0-n) between the start and finish of the spiral beforehand, clearly determining whether each position P allows the ring to pass through so that it can ultimately reach the end of the spiral. In relationship to which it can be observed that if one position P is not *empty* (!), the mission is aborted. Upon which you can draw the factual conclusion that we will have to look at (!) c.q. we will have to perceive every position P(x) between the start and the end of the spiral beforehand if that specific position P(x) is also allowing the physical dimensions of the ring to pass. Mathematically, an uninterrupted series of consecutive positions P can be designated as a line or line segment shape (action trajectory shape). Which completes the scientific proof that when executing the nerve spiral game, we first construct a perceptual image of the entire latent action trajectory shape out of the perspective of the ring before we actually execute anything.

Contact: kwillinq@gmail.com Website: https://www.explanatorymodel.nl/ – N.J. Mol

Part 2 - The execution of a nerve spiral requires the compelling cooperation between an internal (secondary) and an external (primary) focus – The clarification of all grasping actions

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N.J. Mol
August 2023 ©

Contact: kwillinq@gmail.com
https://www.researchgate.net/profile/Nj-Mol/research
https://www.explanatorymodel.nl/

Introduction

Traditionally, science has assumed that one motor action encompasses one focus. This assumption has seemingly been so logical that it has never been questioned. However, this has led to the absence of a plausible explanation for the functional perception processes underlying the execution of all motor actions, even after 100+ years of movement sciences. In 2016, an explanatory model was found that is capable of identifying all functional perception processes within any imaginable motor action. Beyond any reasonable doubt it conversely demonstrates that every motor action can only be executed through a compulsory coupling of two foci: an internal (secondary) focus must always be directed at an external (primary) focus. In which it should be explicitly noted that these two foci represent entities that fundamentally differ from current scientific terminology.
The explanatory model emphasizes that the essence of a motor task always involves the movement of an action object outside our body along an action trajectory shape, but that the action object will never be capable to move on its own along that line. The action object is often an inanimate object (spoon, tennis racket, ball, letter, pointer (pc) etc.) that we hold during an action, and even though the fingertips, during a grasp action with the hand on the outside, consist of living cells, we absolutely aren't capable of moving them there. The explanatory model unequivocally shows that initiating the movement of an action object outside our body is only possible by using secondary perception of autonomous movements within our body.
Compared to the current state of science, the explanatory model represents a revolutionary breakthrough, revealing that two foci must enter into an obligatory connection simultaneously, and this universal stacking of two perceptions of two autonomous movements occurs in every motor movement action. They are clearly autonomous because they belong to two incompatible worlds. Observations of movement inside and outside the body are actually never able to overlap.

This article focuses entirely on the motoric movement action *nerve spiral*. In this action, you must move a ring connected to a handle from point A to point B without the ring making contact with the spiral. Although presented as a game, this action is entirely comparable to motor actions like eating. We move a spoon c.q. the bowl of the spoon, in exactly the same manner, respectively towards the food and towards the mouth. However, within the nerve spiral, a specific action trajectory shape is prescribed to go from A to B. Due to the fact that you cannot traverse the spiral without touching it with the ring, the explanatory model of all motoric movement actions demonstrates that every conceivable action comprises two autonomous focus points. As a result, we can never execute identical straight action trajectory shapes. Within which the model hastily adds that a parsimonious organism never had the ecological intention to develop in this manner. Performing similar forms instead of identical forms in action trajectory shapes is much more effective and efficient. The nerve spiral undoubtedly shows that every action encompasses two autonomous foci. This leads to the definitive conclusion that these focus points are merely components of an optimization process, and thus, we can never perform an action in an identical manner.

Contact: kwillinq@gmail.com Website: https://www.explanatorymodel.nl/ – N.J. Mol

Furthermore, the explanation demonstrates that all conceivable motor actions are based on the same two foci. Due to this universal character, the explanatory model creates the most ultimate ecological argument imaginable. The article does not delve deep into the differences with the current state of science, as there is still no clear consensus on this subject within the scientific community.

The primary focus in relationship to the movement of a ring along a spiral encompasses the perception of movement outside the body

The explanatory model of all motor movement actions, as demonstrated within the nerve spiral, shows that only the ring c.q. the movements of the ring, will execute the essence of the task and therefore represents the primary focus within this action. In relationship to which the explanatory model provides scientific evidence that a motoric movement action always involves two successive autonomous phases. The tactical consideration first aims to create a perceptual image of a latent action trajectory shape over which, in this case, the ring or the movements of the ring promises to become successful, and only then proceeds to actual action.

Images: The nerve spiral solely involves moving a ring attached to a handle from point A to point B. The essence of this task is thus executed solely through the autonomous movements of the ring, and that is why it is the main process we must observe. Just as within any conceivable motor action, the current position of the ring c.q. the action object will always mark the precise separation between the manifest and latent parts of the action trajectory. Completely similar to a marble within a marble run. The nerve spiral is a unique action because the trajectory form of the action is clearly prescribed and visible.

Despite the fact that the nerve spiral prescribes a mandatory action trajectory shape, we still create a perceptual image of a latent action trajectory of the spiral. In this case, we continuously visualize a tight straight trajectory form in front of us. However, even though this is the case, the ring will only be able to be moved by the perception of an entirely different autonomous movement, and the ring will inevitably deviate from the 'perfectly' suggested perceptual image at any point P within the trajectory form that is being mentally projected. This process, therefore, must be accompanied by the double and mutual process of the cortical streams, representing the body's ingenious ecological response to execute every motor action in the most efficient manner possible. The ventral stream and dorsal stream continually interact with each other to correct the inevitable deviations, but this interaction does require a small reaction time[8] that must be measured in tenths of a second. The result is that we (in

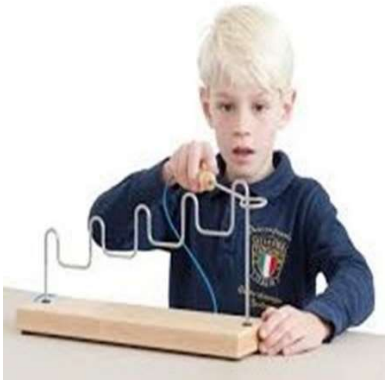
[8] The specific reaction time concerning cortical streams in relation to the explanatory model has never been examined. General information and empirical experiences provide an indication that the reaction time is estimated to be around 0.1 seconds; “It takes about one-tenth of a second for information about the visual scene to reach the back of the brain or the occipital lobes. During the next tenth of a second, the visual information is analysed in two separate ways. Figure 2 shows the two pathways of the dorsal stream and the ventral stream. The dorsal stream runs from the occipital lobes to three locations, the back of the brain at the top (called the posterior parietal lobes), a vertical strip of brain in the centre (called the motor cortex) and the front of the brain (called the

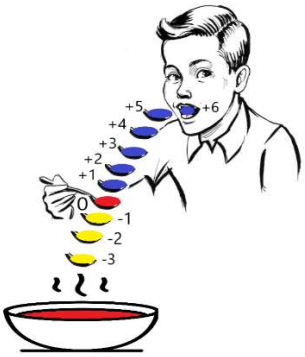
Contact: kwillinq@gmail.com Website: https://www.explanatorymodel.nl/ – N.J. Mol

accordance with Bernstein) can never execute one motor action identically, and when performing the nerve spiral, the ring will always follow a distinct zigzag pattern. This leads to the consequence that the ring will come into contact with the spiral at multiple points.

The secondary focus in relationship to the movement of a ring along a spiral encompasses the perception of movement inside the body

When one starts to realize that the primary focus in regard to the nerve spiral solely concerns the movements of the ring, it implicitly becomes evident that the ring itself isn't capable to move at all. This analogy is strikingly similar to a ball during a free throw in basketball or various other inanimate objects like tennis rackets, bicycles, cricket bats, spoons, knives, bottles, pointers (pc) and more, which clearly never move on their own. But even when we grasp a coffee cup with our hand, the explanatory model demonstrates that the hand, and consequently the relevant fingertips, must also be considered as lifeless action objects. The outer layer of the fingertips does comprise living cells, but it is absolutely incapable of moving the fingertips in an action trajectory shape outside the body with those living cells. We can only induce movement in the outer layer of the fingertips through internal body movements. While they may approach the outer surface of the fingertips, they will always remain within the confines of the body. In the case of a ring attached to a handle, we can only perceive (the outer surface of) the handle through (the outer surface of) our fingertips haptically and we can only proprioceptively[9] perceive how movements within our body influence the haptic contact between the handle and the hand.





Images: While presented as a game, the execution of a nerve spiral is fully comparable to motor movement actions such as eating[10]. We move a spoon, or the bowl of the spoon, in exactly the same manner, respectively towards the food and towards the mouth. Even when we want to grab a coffee cup[11], you can imagine the presence of a ring, like within a nerve spiral, between the fingertips. For the

frontal cortex). The ventral stream runs from the occipital lobes to the back of the brain at the bottom (called the temporal lobes)": Cerebral Visual Impairment - Working Within and Around the Limitations of Vision; Gordon N Dutton; http://www.liv.ac.uk/~pcknox/Publications/trimble/CVI%20chapter%20for_hers-Dutton.pdf

[9] Proprioceptive perception comprises two autonomous aspects: Limb Position and Movement. The explanatory model makes a clear connection between these two proprioceptive phenomena and their relation to using the ring effectively. The overall ring displacement technique is influenced by our awareness of limb position, allowing us to control the general movement of the ring along the spiral. On the other hand, where perception is specifically transferred to the exact movement of the handle is essential for precise steering of the ring.

[10] https://www.researchgate.net/publication/372862585_Eating_requires_the_compelling_collaboration_between_an_internal_and_an_external_focus_-_Getting_the_bowl_of_the_spoon_to_the_food-mouth_along_an_action_trajectory_shape_is_the_sole_essence_within_eati?_sg%5B0%5D=-91TM-Ix27P2i2SjyMrxhg5WLBEHRhVJaDbk4LfyfAmxS8c05-M4XuLOF2jEon6g3nprbRU_xqKu-XGyIfXbkbQKP5L9KxxrbS5gFHI3.0Yxh_8H69KUDVmIWLp35lg6HMzN0qGlfB4xVNfySV3_QR-Y5HHJUsqhTvrZ5lRa9rGyeAnP42MhJXLz44m5b_w&_tp=eyJjb250ZXh0Ijp7ImZpcnN0UGFnZSI6InByb2ZpbGUiLCJwYWdlIjoicHJvZmlsZSJ9fQ

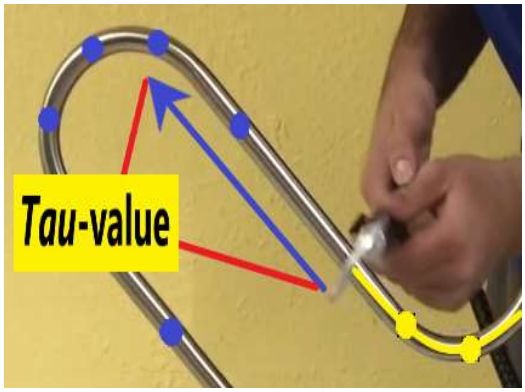
[11] The perception processes during the grasping of a coffee cup - YouTube

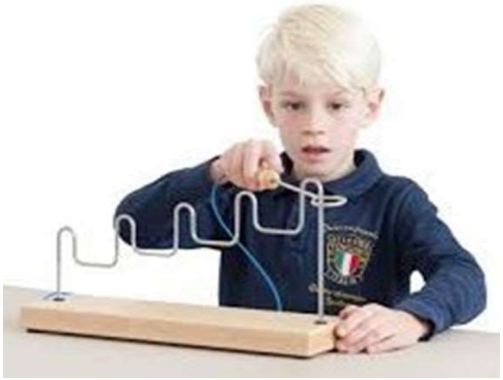
explanatory model It doesn't matter. The stacking of two autonomous foci will always reveal the same universal cooperation.

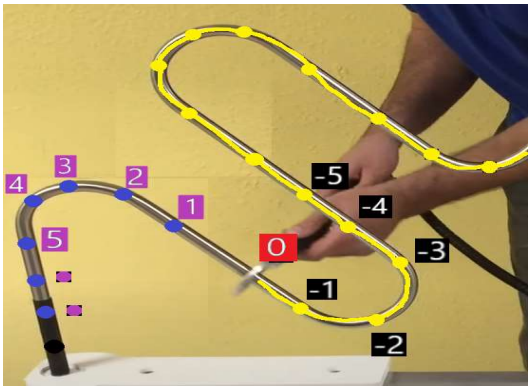
In the case of the nerve spiral, the goal of the task is also implicitly connected to the perception of the primary focus. As a result, we often are not aware of the secondary focus during many motor actions, especially because these often involve simple perceptions. However, in highly complex motor actions, such as a tennis serve, attention is exclusively directed towards the secondary focus, completely disregarding the fact that the primary focus pertains to creating an outgoing ball trajectory shape (OBT). With some practice, you can consciously perceive the two foci simultaneously within many motor actions. For instance, in a grasping action, you can perceive the action trajectory shape on the outside of your body while simultaneously focusing on movements on the inside of your body. This experience can be replicated during the execution of a nerve spiral as well.

Contact: kwillinq@gmail.com Website: https://www.explanatorymodel.nl/ – N.J. Mol

Part 3 - Within the nerve spiral the essence of the task is solely executed by the movements of the ring; Within the primary focus the ring moves like a marble in a marble run producing the *tau*-value







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https://www.researchgate.net/profile/Nj-Mol/research
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Introduction

Traditionally, science has assumed that one motor action corresponds to one focus. This assumption was likely so intuitive that it was never challenged. However, this has led to the situation where, even after more than 100 years of movement sciences, a plausible explanation for the underlying functional perception processes guiding the execution of all motor actions had never been found. In contrast, in 2016, an explanatory model emerged that has the capability to identify all functional perception processes within any imaginable motor action. It demonstrates, beyond any reasonable doubt, that each motor action can only be executed through a mandatory coupling of two foci: an internal (secondary) focus that must always be directed towards an external (primary) focus. In which it should be explicitly noted that these two foci represent entities that fundamentally differ from current scientific terminology.
Regarding the external (primary) focus, it can be noted that science has truly missed everything until now. Therefore, within a wide spectrum of motor actions, it will now be comprehensively discussed, and this publication reveals all facets of the primary focus within the motor movement *action nerve spiral*[12]. This action is exceptional for several reasons. It is a game where the sole objective is to move a ring attached to a rod from point A to point B along a predetermined action trajectory shape. The (iron) ring must not touch the (electrically charged) spiral, or else a bell rings, and you lose the game. This shares similarities with writing because the action trajectory shape becomes visible, and it requires the precise execution of the entire trajectory, not just the final part. It also resembles actions like eating, where a spoon attached to a handle must be moved over an action trajectory shape.
What the motor action nerve spiral primarily demonstrates is that we absolutely cannot produce straight action trajectories. Future publications will convincingly demonstrate that traversing any action trajectory shape can only be achieved with the involvement of the cortical streams. In a double and mutual process, the ventral and dorsal stream must collaborate to mediate the perception-action coupling in any conceivable action. Due to the short reaction time involved in this mediation, the action object will always exhibit jerky progress. Which is so persuasively present within the nerve spiral and feels like scientific evidence.
This publication aims to clarify that we even construct a perceptual image of an action trajectory shape, even if there appears to be a plastic spiral in front of us. In the case of the nerve spiral, the action trajectory shape consists of continuous or contiguous positions P of only the ring, and only the movement of the ring within that action trajectory shape provides the essential *tau*-value which must be coupled to the secondary (internal) focus. This should also serve as evidence that this phenomenon occurs within any conceivable action.

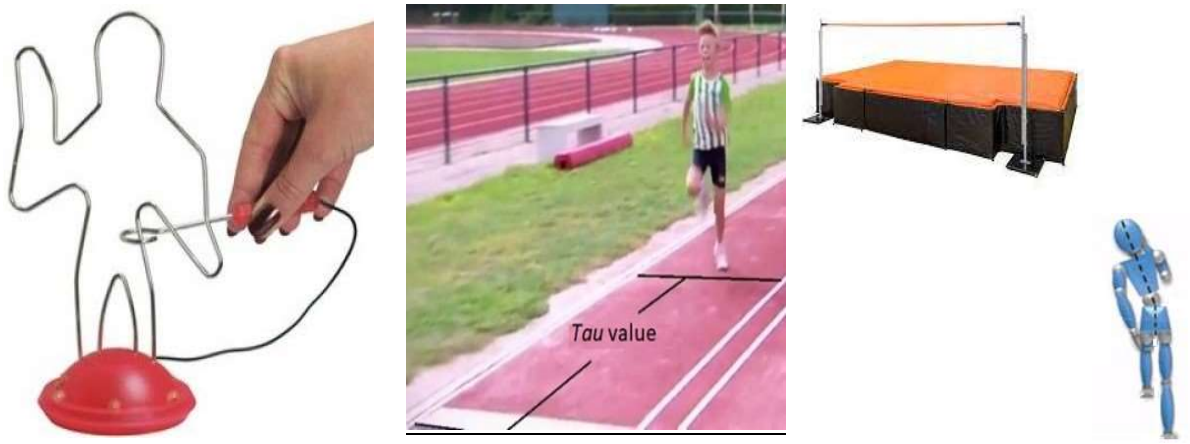
Solely the movements of the ring encompass the essence of the task c.q. the external (primary) focus

[12] https://www.youtube.com/watch?app=desktop&v=-BqjwDS6awM

Contact: kwillinq@gmail.com Website: https://www.explanatorymodel.nl/ – N.J. Mol

The category of motor actions discussed by the explanatory model pertains the conscious actions where it is assumed that there is always an initial formulation of an egocentric intent (an egocentric formulated will). Before picking up a coffee cup, for instance, there is always the desire to do so. The explanatory model of all motoric movement actions recognizes this as an undisputed factual aspect but adds a caveat. The egocentrically formulated intent does not, for example, concern picking up the coffee cup itself. The explanatory model reveals that this is factually incorrect and that we can only move our fingertips toward the coffee cup. Therefore, the movement of the fingertips toward the coffee cup constitutes the essence of that action.
In the context of the game related to the nerve spiral, we may indeed have a strong desire to win. However, the egocentrically formulated goal pertains solely to moving the ring from the beginning to the end, covering all positions P of the spiral. Only this aspect determines the essence of the task, and therefore, only this aspect should be considered as the external (primary) focus.

The tactical movement action (TMA) in relationship to moving a ring along a nerve spiral



Images: Firstly, an egocentric intention must be formulated that we want to move a ring from A to B over a nerve spiral. Next, from the current position of the ring, a perceptual image of a latent action trajectory shape is created how we will reach the end of the spiral. This occurs as part of a tactical action where two important objectives are considered. Firstly, it must lead to a successful action, and additionally, ecologically evolved organisms aim to execute actions as parsimonious as possible. -
In the case of the nerve spiral and in for example long jumping, it might appear as though the action trajectory shape is already formed due to the contours of the task, and that there is no need to further construct an action trajectory shape within that. This is an utter misconception. Even if there is a more or less defined path laid out for us, we still egocentrically construct an action trajectory shape out of the perspective of the action object. Which is notably evident in for example high jumping, when no visible approach is laid out. So this process also occurs within long jumping and in the case of the nerve spiral we also anticipate potential future problems which we will encounter.

The explanatory model of the motoric movement action demonstrates that after formulating an egocentric goal, we always engage in a tactical consideration[13], prior to any execution, to determine how we can bring the action object to the goal location within successive positions P. In the context of the discussed action, we always create a perceptual image of a latent action trajectory shape, allowing the ring to be moved successfully from A to B.

[13] The scientific evidence has been unequivocally provided for all grasping actions and all throwing actions, and can be easily universally extrapolated to any conceivable action. N.J. Mol; *Grasping encompasses two consecutive autonomous phases – The scientific proof that we tactically construct an action trajectory shape prior to the factual execution of that exact same action trajectory shape.*

Contact: kwillinq@gmail.com Website: https://www.explanatorymodel.nl/ – N.J. Mol

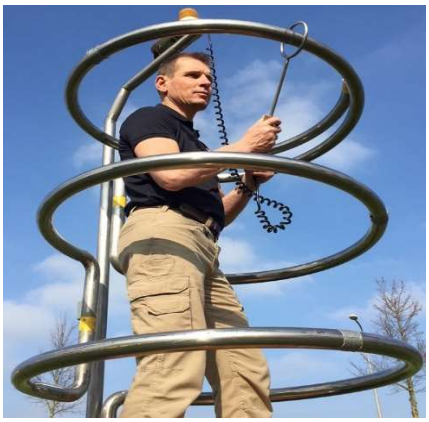
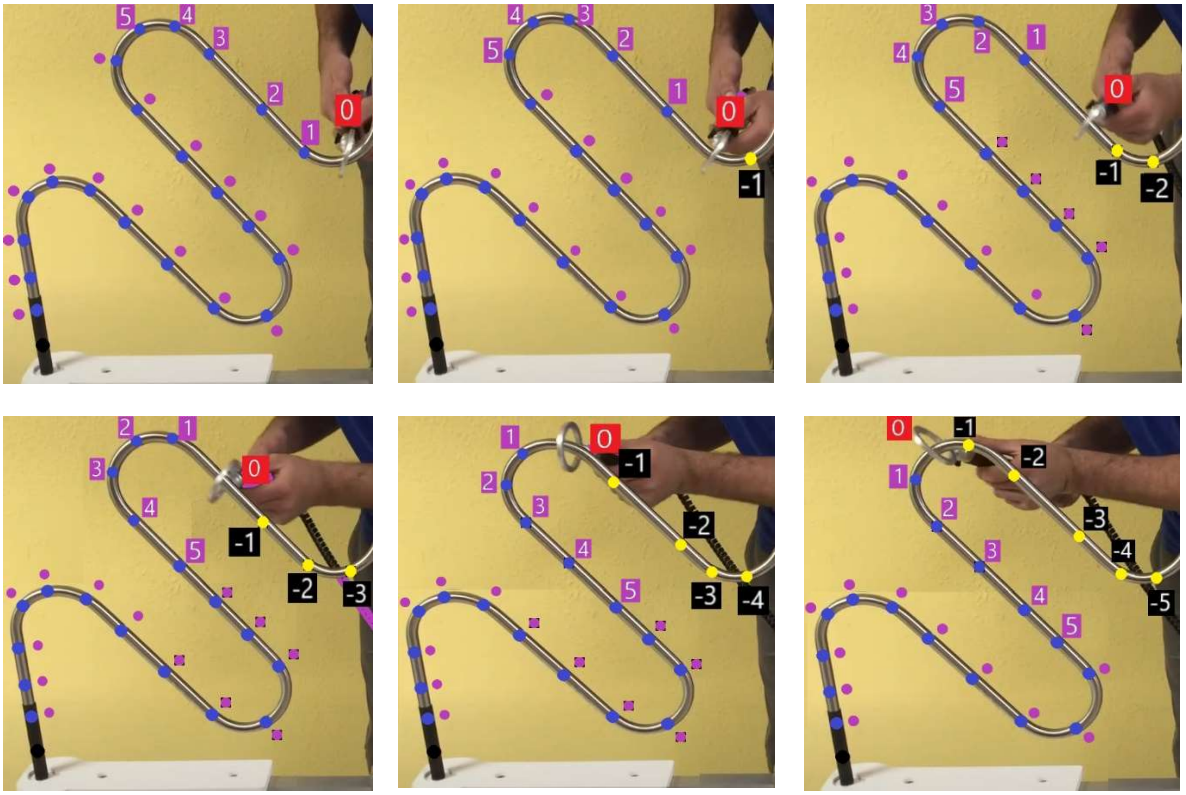


Image: In the execution of the nerve spiral, it may appear that the action object is the ring. However, that is not entirely accurate. You can clearly observe that we are merely moving the open space *within* (!) the ring from A to B.

The factual movement action (FMA) in relationship to the movement of a ring along a nerve spiral

After determining a perceptual image of a latent action trajectory shape, we proceed to actually carry out the action. This process effectively starts with bridging the gap from the current ring position P(0) to the next position P(+1) within the action trajectory. Although our ultimate intention of course is to reach the end of the spiral, the explanatory model clearly demonstrates that our perception processes in this phase are solely focused on traversing the space *between* (!) A and B. Which at a micro-level shows, that essentially only the positions P(-1), P(0), and P(+1) matter to us during this bridging process.



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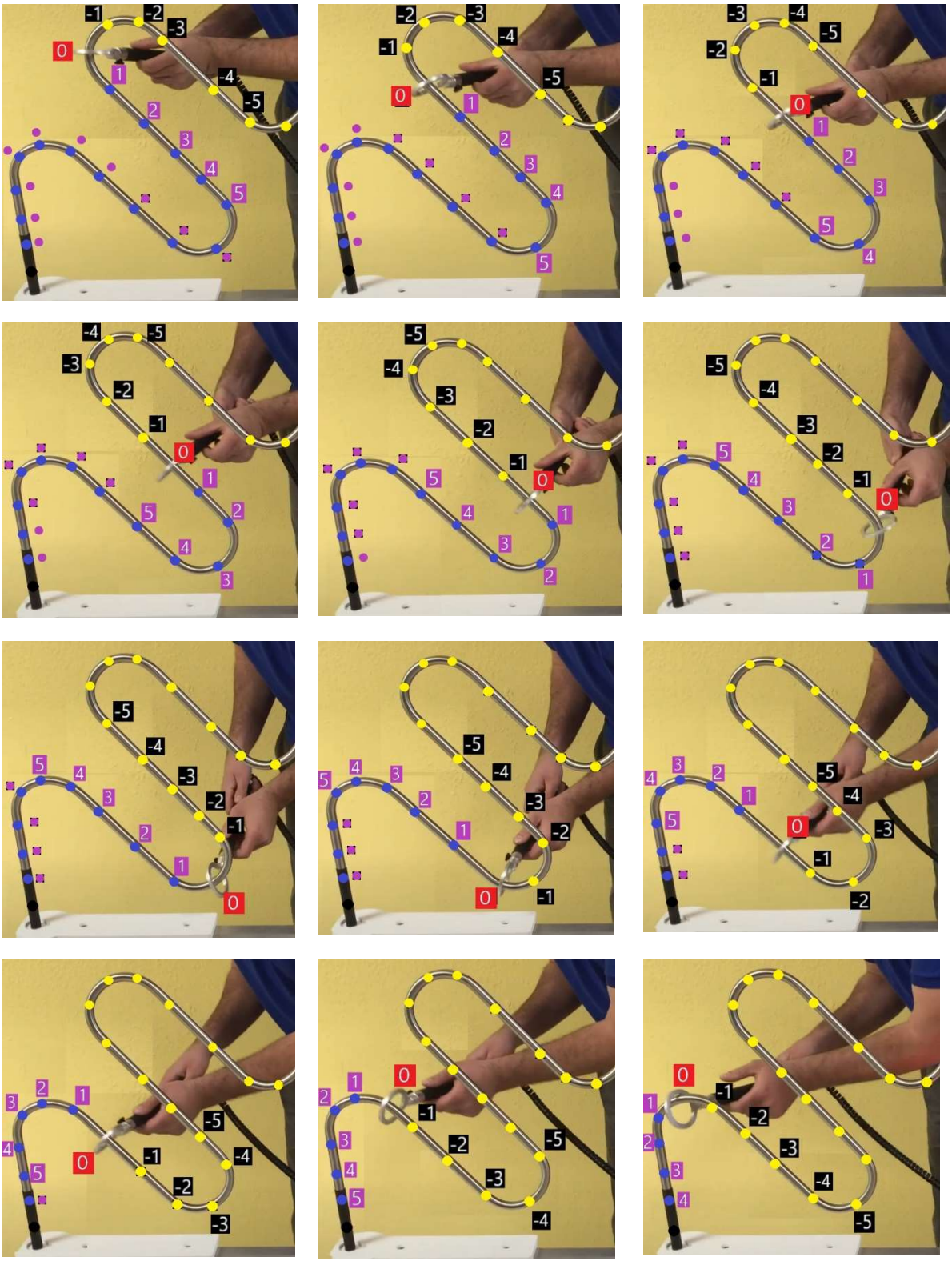

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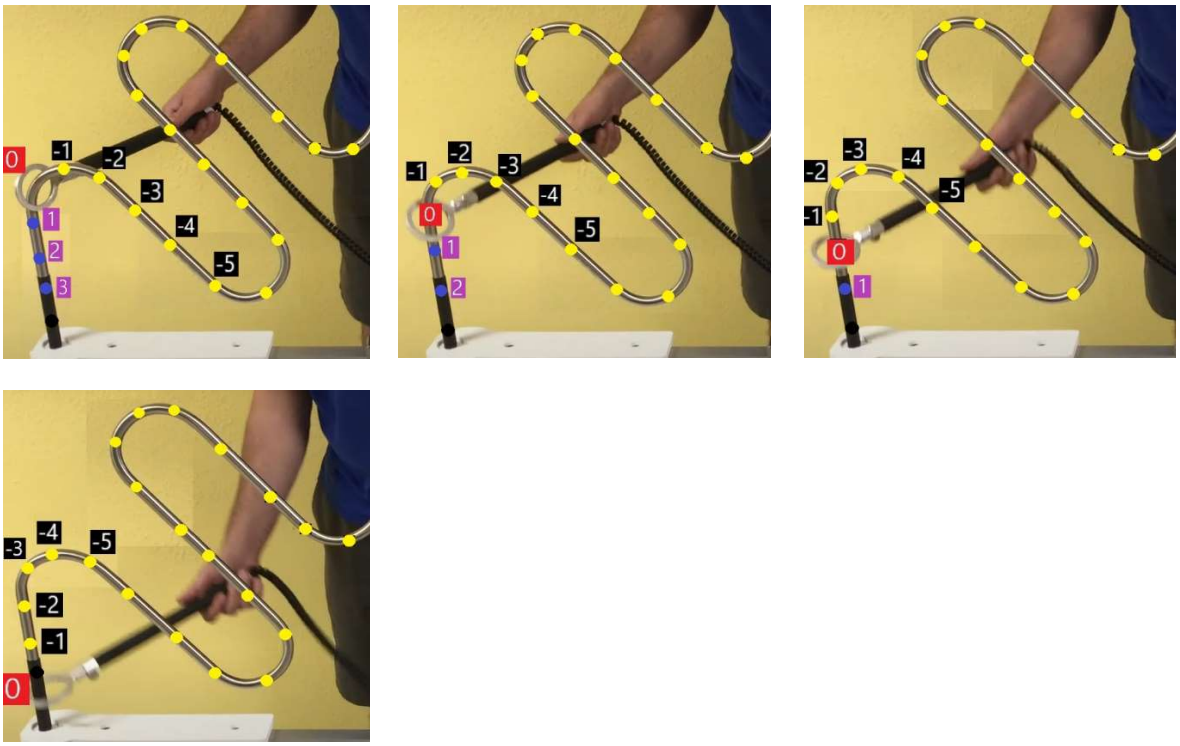


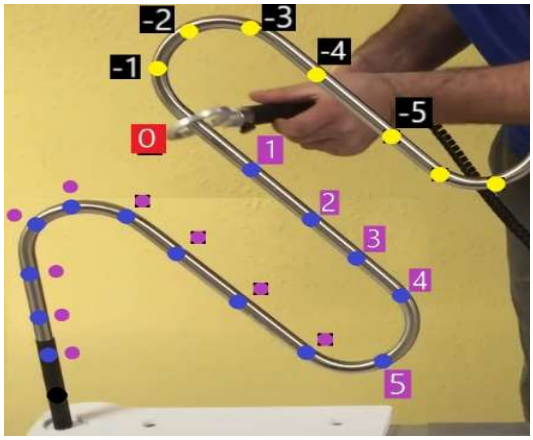
Images: In an animation, the progression of an action trajectory shape can be depicted as follows: Within any conceivable action, the action object can only successfully execute the action by first entering the next position P(+1) within the action trajectory shape. The current position P(0) then shifts one place forward, and a manifest position P(-1) is added. This process continues with each new position P(0) until the end of the action trajectory shape is reached.

The perception-action coupling in relationship to the movement of a ring along a nerve spiral

With the preceding argumentation, the explanatory model of the motoric movement action now provides a comprehensive and universal explanation of how perception is linked to action within any conceivable task. The animations in the previous section illustrate that the action object maintains a fixed relationship with the perceptual image of the action trajectory shape. This becomes easier to comprehend when envisioning a marble in a marble run. In this analogy, you will become much more aware that the perception-action coupling is a unified phenomenon where only a single change occurs every ongoing time span. Within the marble run it becomes quite visible that during the actual execution, each position P(0) serves as the precise separation between all already manifested positions P(-x) and the latent positions P(+x) yet to be traversed.
Through this explanation of the perception-action coupling, the explanatory model can precisely demonstrate how organisms must have evolved within an ecological framework. However, delving into this subject exceeds the scope of this publication. Instead, several crucial points will be highlighted concerning the functional perceptual processes within this motor action.
It's imperative to recognize that while the ultimate goal is to guide the ring to the end of the spiral, during the execution of the action, we are solely engaged in bridging (lots of) space between A and B. It can be observed within any conceivable action that we spend relatively more time bridging this gap than with the end goal itself. The explanatory model, however, unequivocally shows that not only the end goal matters, but all positions P between the beginning and the end of the spiral are equally significant.
Additionally, it must be remarked that the action of the ring at P(0) can be perceived distinctly, yet no fixed unit of time can be attributed to it. Each unit of time can be divided into a thousand smaller units,

Contact: kwillinq@gmail.com Website: https://www.explanatorymodel.nl/ – N.J. Mol

and these units can be further subdivided, leading the explanatory model to argue that the action at P(0) fundamentally takes such a brief time span that it only gains significance in relationship to perceptions of the adjacent time frames. In other words, perceiving the current ring position solely gains meaning through the adjacent future "current" positions P(+x) and the adjacent manifest "current" positions P(-x) of the ring. Within which the overarching idea is to emphasize that perceptions within any conceivable action mainly pertain to one single phenomenon wherein the perception of the action also compels a perceptual image, but primarily that they are absolutely interdependent.



Images: Within many motoric actions the action trajectory shape will not become visible, making it challenging to depict with animations. Conversely, the marble within the marble run, is capable to vividly illustrate this concept. It clearly showcases one single phenomenon wherein the marble, at each position P, delineates the precise separation between all already manifested positions P(-x) and all latent positions P(+x). Additionally, it exemplifies one of the essences of the coupling. If we couldn't see the marble run, the movements of the marble would lack essential context, and conversely, without the marble, we would be completely unable to perceive any coupling as well[14].

In many motor actions, the action trajectory shape remains invisible, making it challenging to conceptualize the perception-action coupling. However, with the nerve spiral and the marble run, this becomes more accessible because both present a compelling action trajectory shape. They both illustrate a phenomenon in which the action object (marble/ring) marks the precise boundary at each position P between all the already manifest positions P(-x) and all the latent positions P(+x). Furthermore, they reveal one of the essentials of the (perception-action) coupling. If there were no marble run or nerve spiral to observe, the movements of the action object would lack a framework. Similarly, if there were no action object to observe, we couldn't perceive a coupling either. Thus, without each other, they hold no significance at all.

The *tau*-value in relationship to the movement of a ring along a nerve spiral

The explanatory model of the motor action demonstrates through the perception-action coupling that the perception of each position of the ring c.q. the action object within the action trajectory shape is equally important. This is vividly illustrated in the nerve spiral.
In most motor actions, the primary objective is mainly to reach the end of the action trajectory. Upon achieving this, the task is completed, and the egocentrically formulated intention is concluded. At this

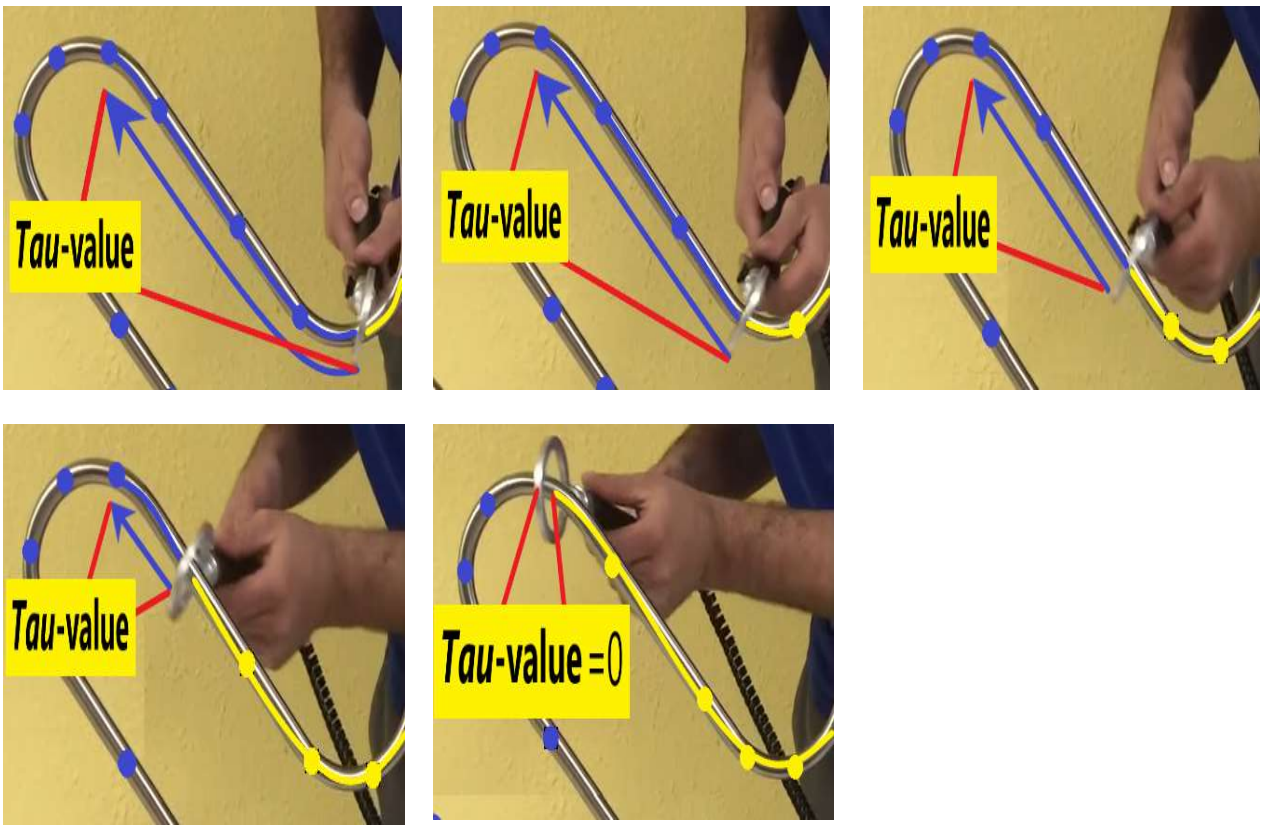
[14] The marble run provides a significant clarification of the perception-action coupling. However, what it suggests must be adjusted, as the reality is slightly different. Due to the inherent and rigid structure of both the marble run and the nerve spiral, the perceptual image of the latent action trajectory that we construct won't differ much from the actual form we see in front of us. However, in reality, factually no manifest positions of the ring or the marble will remain visible. Which conversely is the case within motoric actions like writing or pouring.

Contact: kwillinq@gmail.com Website: https://www.explanatorymodel.nl/ – N.J. Mol

point, the entire latent action trajectory is populated with manifest positions P, leaving no latent positions. Within his *tau*-coupling theory, D.N. Lee referred to this phenomenon as the closing of the gap c.q. as the *tau*-value approaching to zero.
However within the nerve spiral game, due to the extremely small ring-to-spiral ratio, the natural mediation process of the cortical streams, which must process the double and mutual observations of the ring in relation to the spiral, falls short. Consequently, the entire execution of the nerve spiral encompasses, in principle, one ongoing *tau*-coupling. A detailed explanation of this process is omitted here, and we will suffice with mentioning four notable *tau*-values that arise within alone a part of the nerve spiral.

Tau-value 1

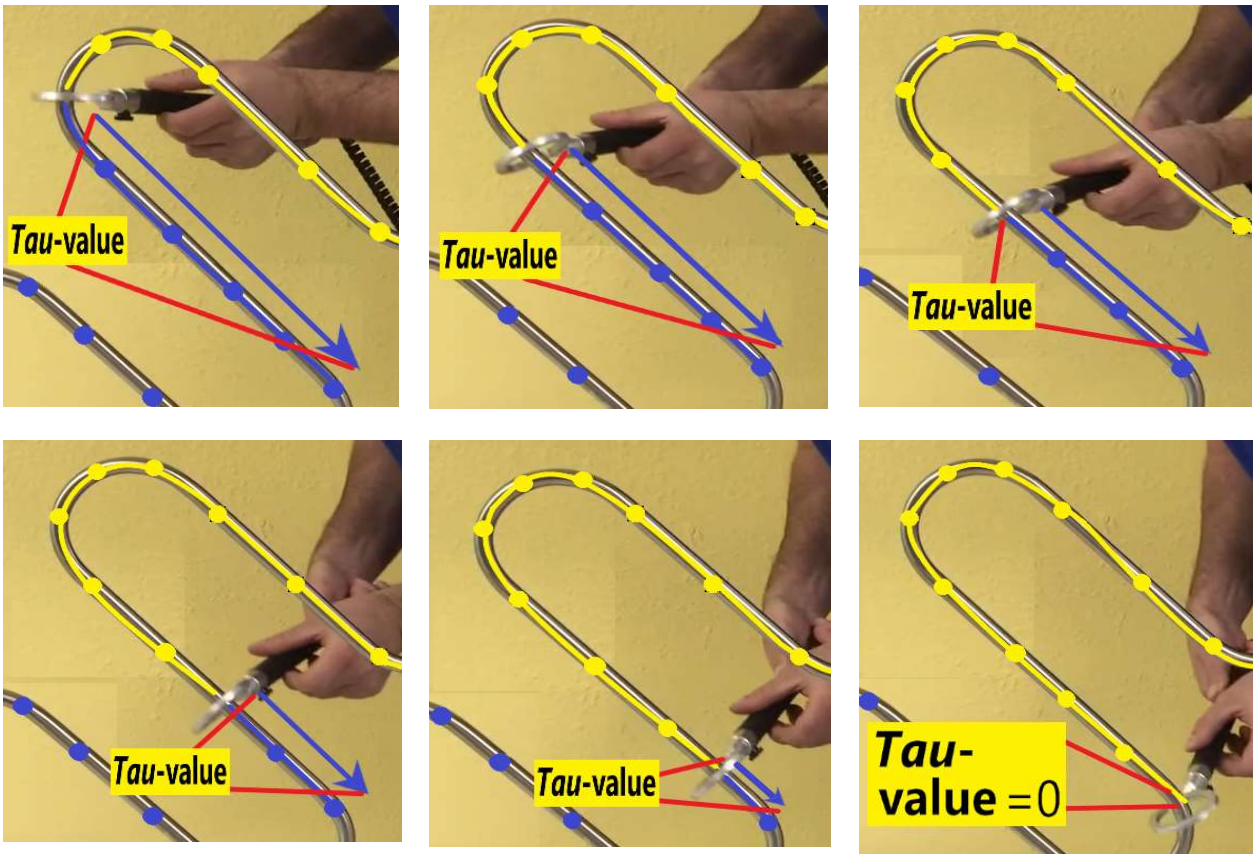
Within the perception-action coupling, the ring will traverse all latent positions P that have been strategically determined within a perceptual representation of an action trajectory. With each successive position P of the ring, the *tau*-value will decrease.



Images: From the moment we begin the execution of the nerve spiral, the ring first traverses a straight part of the action trajectory shape upward until a bend occurs. At that point, it becomes crucial to observe the *tau*-value for the first time as it approaches zero. The first straight portion is relatively easy to navigate with a not-changing shape of the ring. However, when the curve is reached, the shape of the ring must be adjusted very precisely to match each subsequent position within the spiral. The *tau*-value can be observed in two autonomous ways. You can observe how the manifest (yellow) positions P of the ring take over the latent (blue) action trajectory or, at an even more fundamental level, you can observe the speed at which the latent part of the action trajectory disappears. In essence, then you are only perceiving how the latent (blue) "gap" closes.

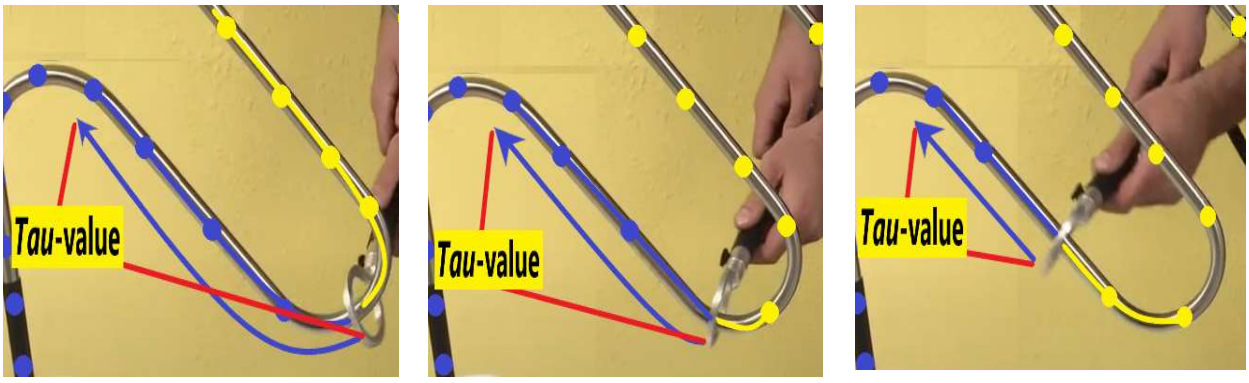
Contact: kwillinq@gmail.com Website: https://www.explanatorymodel.nl/ – N.J. Mol

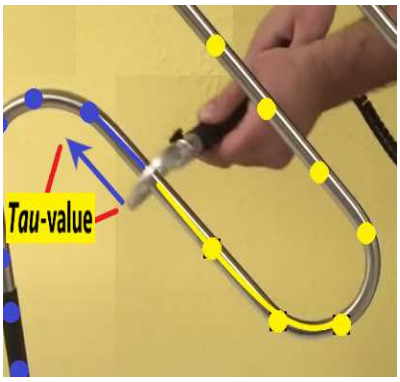
Tau-value 2

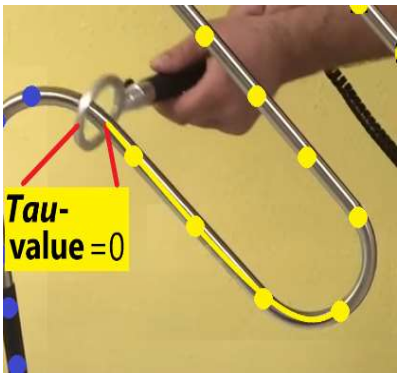


Images: Each position P of the first bend must be traversed very carefully because during the movement, the ring must also be rotated accordingly. However, after the bend, there is another straight section, and the movement of the ring can be accelerated. Until the next bend, it becomes important for the second time that we perceive a *tau*-value and see it approaching zero because after that, the whole challenging process in the next bend repeats itself. The *tau*-value can be observed in two autonomous ways. You can observe how the manifest (yellow) positions P of the ring take over the latent (blue) action trajectory or, at an even more fundamental level, you can observe the speed at which the latent part of the action trajectory disappears. In essence, then you are only perceiving how the latent (blue) "gap" closes.

Tau-value 3

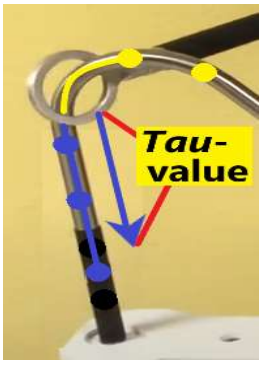


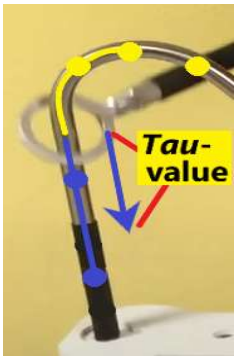


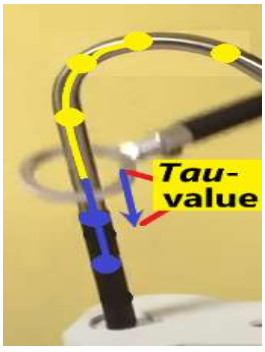


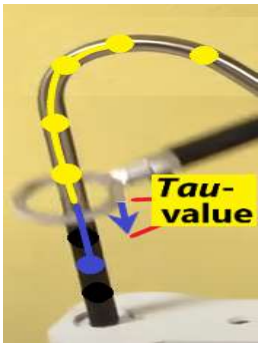
Images: The second bend must also be traversed very carefully because during the movement, the ring must also be rotated. However, after the bend, there is another straight section, and the movement of the ring can be accelerated again. Until the next bend, it becomes important for the third time that we perceive a *tau*-value and see it approaching zero because after that, the whole challenging process in the bend repeats itself. The *tau*-value can be observed in two autonomous ways. You can observe how the manifest (yellow) positions P of the ring take over the latent (blue) action trajectory or, at an even more fundamental level, you can observe the speed at which the latent part of the action trajectory disappears. In essence, then you are only perceiving how the latent (blue) "gap" closes.

Tau-value 4





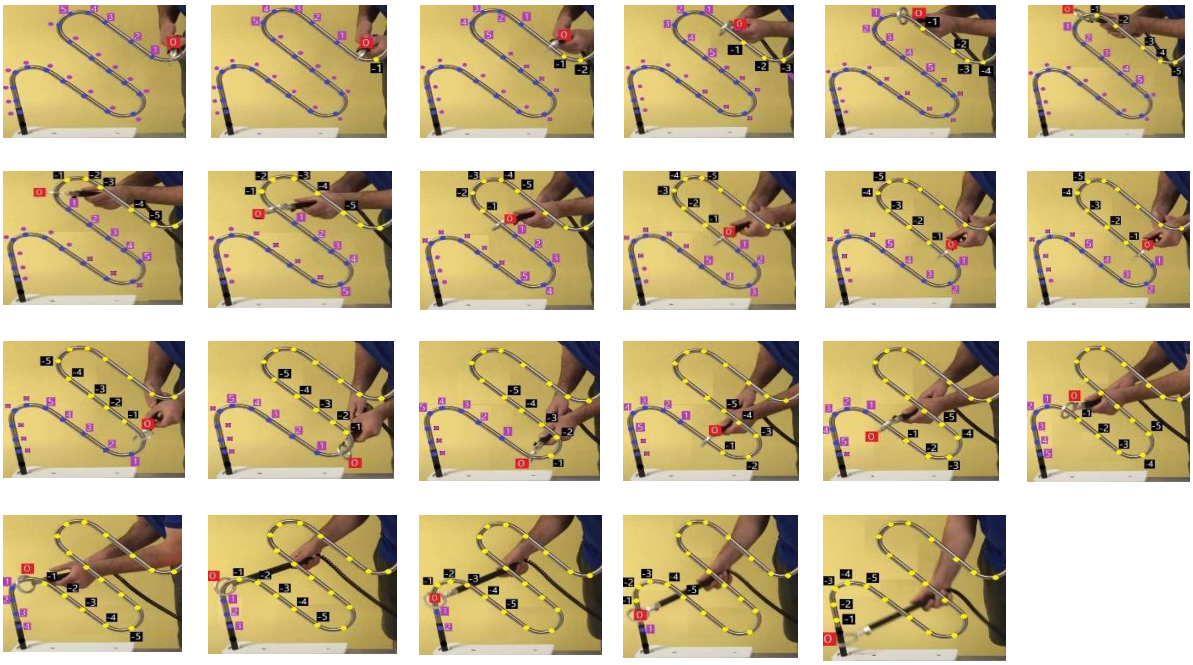




Images: After the third bend, the final part is a straight section, and the movement of the ring can be accelerated again until the end of the spiral. At that point, the entire action is completed, and the ring will no longer be able to touch the spiral. The *tau*-value can be observed in two autonomous ways. You can observe how the manifest (yellow) positions P of the ring take over the latent (blue) action trajectory or, at an even more fundamental level, you can observe the speed at which the latent part of the action trajectory disappears. In essence, then you are only perceiving how the latent (blue) "gap" closes.

Contact: kwillinq@gmail.com Website: https://www.explanatorymodel.nl/ – N.J. Mol

Part 4 - The execution of an external action trajectory shape over which the ring moves dictates all internal sensorimotor perception processes within the nerve spiral; The *tau*-coupling process shows that we do not need a motor plan



Caught In A Line
The explanatory model of all motoric movement actions

N.J. Mol
November 2023

Contact: kwillinq@gmail.com
https://www.researchgate.net/profile/Nj-Mol/research
https://www.explanatorymodel.nl/

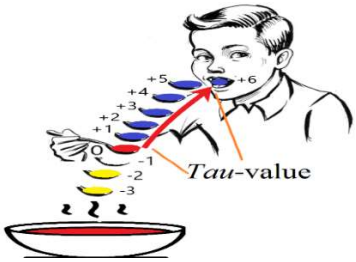
Introduction

If, within the game of nerve spiral, we want to move a ring attached to a stalk over a spiral, the explanatory model of the motoric movement action has demonstrated that solely the movement of the ring embodies the core of the task and of our egocentric intention. Within there scientific evidence has been provided that, prior to the actual execution of any conceivable action, we first create a perceptual image of an entire latent action trajectory shape over which we can successfully move (all the dimensions of) the action object[15], in this case, the ring, from the beginning to the end of the spiral[16]. Although it may seem that this doesn't happen in this game due to the already physical presence of a spiral, that is incorrect. Creating a perceptual image of a latent action trajectory shape is an implicit part of our perception processes because without such an image, you simply wouldn't be able to begin the actual execution.
However, science has so far completely missed all the essentials in regard to the action trajectory shape and only indirectly noticed that (action) paths are formed between the end effectors c.q. the action object, and the goal of the action. While it can be quickly established that all positions P of an action object are invariably constrained within one single line segment shape within any conceivable motor action. This should have led to several revolutionary insights:
1. Factually, the action object invariably fills an action trajectory shape in the same way as a marble moves within a marble run, in which the perception of the marble's current location always marks the exact boundary between the manifest and latent parts of the perceptual image of the action trajectory shape.
2. All latent positions P of the action object effectively always have to sprout from the manifest positions P, or effectively always have to originate from the manifest part of the action trajectory shape.
3. Within the action trajectory shape, it factually always becomes apparent when the action is coming to its end due to the perception of the disappearing of the complete latent action trajectory shape c.q. the *tau*-value approaching to zero[17].
So, although the explanatory model demonstrates that the perception of the movement of the action object within the perceptual image of a latent action trajectory shape encompasses an autonomous phenomenon and thus exclusively is going to perform the essence of the task, the explanatory model also clearly shows that the action object itself absolutely isn't capable to move. Even when grasping with the fingertips, the explanatory model shows that the movement of the fingertips along an external action trajectory shape on the outside of the body can't be moved by the outside of the fingertips themselves. So even within grasping, the movement within the external (primary) focus can only be executed with movements that must always be perceived within the body, within the internal (secondary) focus. In the present action, where a ring moves at an obvious distance from the body, which shows obvious commonalities with the spoonbowl during eating, this insight will be easily recognized, and it

[15] Science and the explanatory model of the motoric movement action use the terms 1. end effector and 2. action object for the same phenomenon. For example, in eating with a spoon, science refers to the spoon bowl as the end effector, whereas the explanatory model designates the spoon bowl as the action object.
[16] https://www.researchgate.net/publication/372290282_Grasping_encompasses_two_consecutive_autonomous_phases_-_The_scientific_proof_that_we_tactically_construct_an_action_trajectory_shape_prior_to_the_factual_execution_of_that_exact_same_action_trajector
[17] https://www.researchgate.net/publication/374288678_Within_the_nerve_spiral_the_essence_of_the_task_is_solely_executed_by_the_movements_of_the_ring_Within_the_primary_focus_the_ring_moves_like_a_marble_in_a_marble_run_producing_the_tau-value

Contact: kwillinq@gmail.com Website: https://www.explanatorymodel.nl/ – N.J. Mol

will also be easy to determine that the ring can solely be moved along an external action trajectory shape with movements within the body that solely reach up to the ring's handle[18,19].



Images: The explanatory model of the motoric movement action shows, beyond any reasonable doubt, that there is no need for a motor plan to initiate an action. It demonstrates that all sensorimotor perception processes within the internal (secondary) focus simply need to follow the lead of the external (primary) focus. This clarification, which does not require any hierarchy, underscores our freedom from being tied to specific sensorimotor movements and this perspective is in perfect alignment with an ecological approach to motor actions.

In summary, this leads to the conclusion that the phenomenon of the perception-action coupling is solely related to the perception of movement within the external (primary) focus. Only within this focus, a perceptual image, consisting of the future positions P of the action object, is filled by the future actual positions of that exact same action object. Also, only within this focus, the *tau*-value can be perceived. This publication now explains how the perception of the *tau*-value should be linked to the internal (secondary) focus and extensively discusses the consequences this has for the perception processes within the internal (secondary) focus c.q. for all sensorimotor actions.

A universal *tau*-coupling is present within every conceivable motoric action

The explanatory model, in conjunction with previous publications, demonstrates that the *tau*-value can be universally observed within any conceivable action. This aligns with the findings of D.N. Lee, who showed that in many actions, a gap c.q. a line segment shape between the action object and the end goal[20] gradually approached zero and eventually completely disappeared. While Lee's discovery generated significant interest in the scientific community, a major breakthrough remained elusive. Lee connected this crucial *tau*-value to various irrelevant other possible *tau*-values without realizing that multiple foci could be distinguished and linked within a single motoric action.
However, this insight proved to be highly relevant for the explanatory model of the motoric movement action. By understanding that the movement of an action object along an action trajectory shape outside the body is a completely autonomously observable phenomenon, and can only be executed by a completely different autonomously observable phenomenon within the body, it is now possible to explain precisely which phenomena should be connected and how the *tau*-coupling is established. The

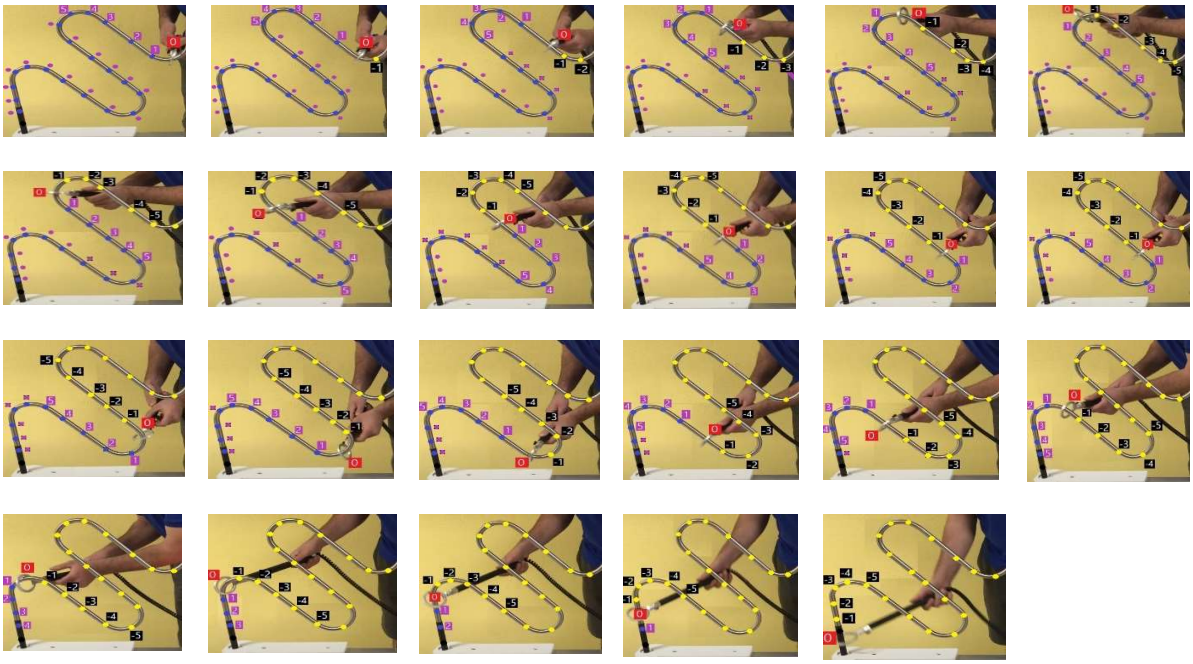
[18] https://www.researchgate.net/publication/373195543_The_execution_of_a_nerve_spiral_requires_the_compelling_cooperation_between_an_internal_secondary_and_an_external_primary_focus_-_The_clarification_of_all_grasping_actions

[19] This intriguing dualism demands our utmost attention as it presents the essence of our perception processes. The internal (secondary) focus not only meticulously tracks the movement of the action object within the action trajectory shape but is also the instigator of this movement. It might sound paradoxical that the very action you initiate creates your own reliance. However, this is precisely what occurs because it is an implicit fact that when you move something inside your body, an external part of your body will inevitably move within an action trajectory shape on the outside of your body.

[20] In the original work, examples include a long jumper leaping towards the take-off bar, a Northern Gannet diving toward the water surface, and a bee heading towards a flower.

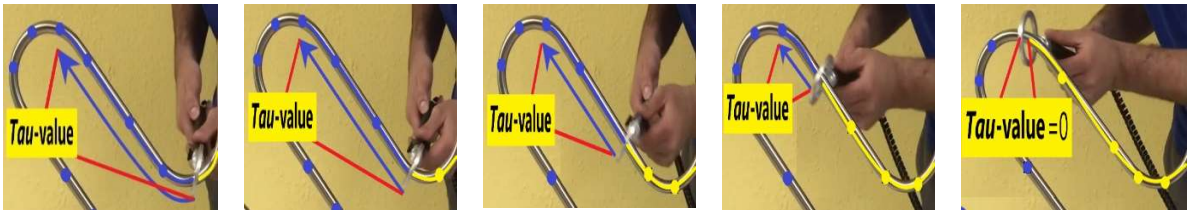
perception of the *tau*-value approaching zero within the external (primary) focus should ultimately guide the observations within the internal (secondary) focus.

The *tau*-coupling when moving a ring over a nerve spiral



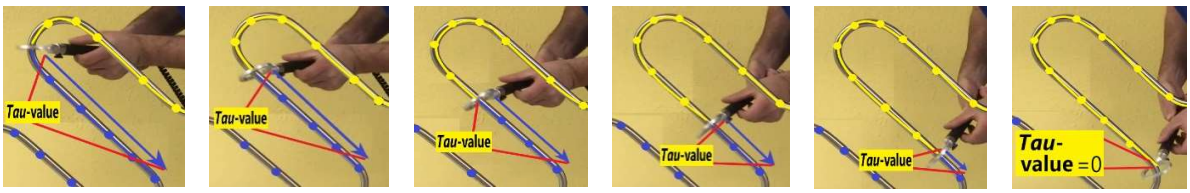
The explanatory model of the motoric movement action encompasses a universal explanation of any conceivable motor action and knows no exceptions. So, also within the nerve spiral, we first construct a perceptual image of an entire latent action trajectory shape over which the action object, in this case, the ring, will have to move, and only then do we actually execute it. The ring will then, carefully traverse all planned latent positions P, similar to a marble moving within a marble run, in which the current position P(0) of the ring will always mark the precise separation between the manifest part and the latent part of the action trajectory shape.
So, in the same universal way, the traversing of the spiral will cause the perception-action coupling and the approaching of the *tau*-value to zero at the end of the spiral will ensure that the ring comes to a halt in time. However, there is a significant difference compared to other motor actions. The task within the nerve spiral involves the unique aspect that all positions P between the starting point A and the endpoint B of the action trajectory shape are very compellingly present in the nerve spiral. The crucial point of the game is that the ring is not allowed to touch the spiral. If it does, a bell or buzzer goes off, and you are disqualified. So in this action, much more attention must be paid to all positions between A and B, making this game actually host a continuous *tau*-coupling process. The complete designation of this process is not relevant in this explanation and has been omitted for the sake of brevity. Solely the *tau*-coupling process of the most noticeable *tau*-values that clearly arise in this demonstrated game will be clarified.

a. Tau-coupling process 1



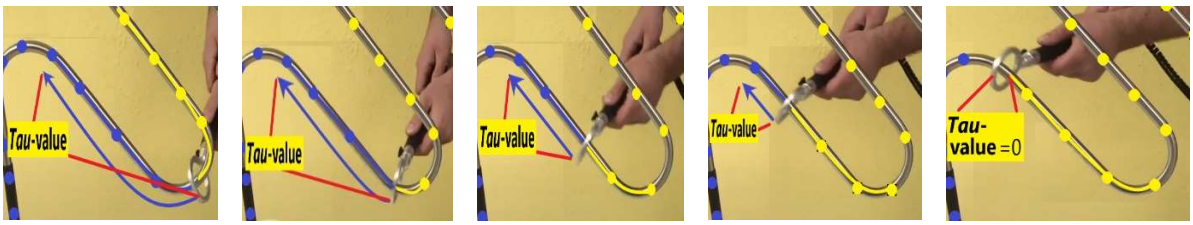
From the moment we commence the execution of the nerve spiral, as shown in the images, the ring first ascends a portion of the action trajectory shape until a bending point occurs in the spiral. At this point, it is crucial for the first time to observe a *tau*-value and see it approach zero. The straight path is relatively easy to traverse with a constant shape of the ring. However, as we reach the curve, the autonomous components of the line and shape of the ring's action trajectory shape, at each progressing position P, must be precisely adjusted to the spiral. This means that the entire first curve must be navigated very carefully because, during the movement, the ring also needs to be rotated. Within the internal (secondary) focus, adjustments to the handle, where the ring is attached, must be conveyed so that the ring can smoothly and evenly approach that challenging curve. In many motor actions, it can be concluded that, after a phase of relative acceleration during the bridging phase, there is a relative deceleration of the action object being manipulated as a *tau*-coupling process within an action is finalized[21].

b. Tau-coupling process 2



However, after this first curve, there is another straight section, and the movement of the ring can be accelerated again. Until the next curve, it becomes crucial for the second time to observe a *tau*-value and see it approach zero, as the challenging process in the next curve repeats itself afterward. Within the internal (secondary) focus, adjustments to the handle, where the ring is attached, must be conveyed so that the ring can once again smoothly and evenly approach that challenging curve. In many motor actions, it can be concluded that, after a phase of relative acceleration during the bridging phase, there is a relative deceleration of the action object being manipulated as a *tau*-coupling process within an action is finalized[22].

c. Tau-coupling process 3

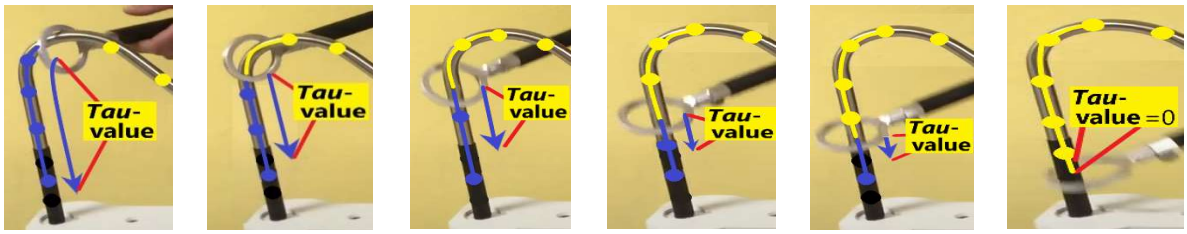


[21] As explained in this section, the explanatory model underpins the notion that within many motoric actions a bell-shaped profile is capable to occur when plotting the execution speed of an action against time in a graph. In many actions, it is indeed typical that after a short initiation phase, a smooth and faster bridging phase occurs, followed by a more precise phase towards the end. Although the model generally supports these principles, it doubts the emergence of a highly proportional bell shape in all cases. Additionally, the explanatory model illustrates that this is certainly not the case for all actions. In situations where you need to create a crescendo at the end of the action, such as clapping your hands or defending against an attacker with a punch or a kick, you must accelerate the relevant body parts in the final phase. Similarly, in many ball sports, achieving a necessary "crescendo" can only be accomplished if, after an initial relatively slower catching phase, you maximize acceleration of the ball towards the end of the action trajectory shape.

[22] See note 7.

The second curve must also be navigated very carefully because, during (!) the movement, the ring must be rotated. However, after the curve, there is another straight section, and the movement of the ring can be accelerated again. Until the next curve, it becomes crucial for the third time to observe a *tau*-value and see it approach to zero because afterward, the challenging process repeats itself in the next curve. Then, within the internal (secondary) focus, adjustments to the handle, where the ring is attached, must be conveyed so that the ring can once again smoothly and evenly approach that challenging last curve. In many motor actions, it can be concluded that, after a phase of relative acceleration during the bridging phase, there is a relative deceleration of the action object being manipulated as a *tau*-coupling process within an action is finalized[23].

d. Tau-coupling process 4



After the third curve, the final part is a straight section, and the movement of the ring can be accelerated again until the end of the spiral. When the ring reaches the isolated (black) section of the spiral, it can no longer touch the spiral, and the entire action is completed. Then, there is no need to slow down the ring anymore, and in that regard, there are no more observations required within the internal (secondary) focus towards the handle.

The perception processes within the internal (secondary) focus in regard to the sensorimotoric movements towards the outer surface of the handle attached to the ring

The explanatory model of the motoric movement action presents a completely new paradigm. It's built on the factual observation that an autonomous internal movement of any organism will implicitly lead to an autonomous external movement of the outside of that organism. In which it is also a fundamental fact that the movement of any given position P on the outside of that organism will need to sprout from each other c.q. that all those positions P will always be interconnected. Which factually means that they will always create a line segment shape. So the most important conclusion reveals that these two movements are implicitly connected, but that the perception processes mediating these movements are completely autonomous and independent of each other[24].
This aforementioned clarification doesn't pertain to the paradigm itself but to its foundation. In regard to which the explanatory model notes that these phenomena occur regardless of which focus you centralize. However, the new paradigm lies in the novelty that you can fully execute a motor action by focusing solely on creating and completing an external action trajectory shape. In contrast to the idea that early organisms primarily started by emphasizing arbitrary motor movements within the body and then observing the external result, the explanatory model states that these roles have now been completely reversed after millions of years of evolution. So within the nerve spiral, we primarily perceive

[23] See note 7.
[24] While the explanatory model of the motoric movement action has a strong suspicion that the earliest organisms initially engaged in random motor movements, it demonstrates that after millions of years of evolution, the roles of internal and external have reversed. It's much more efficient for organisms to work from an action trajectory shape rather than relying on random motor movements. Creating an action trajectory shape, for instance, from fingertips to a coffee cup or from a spoon to a soup bowl, is by far more effective and efficient than repeatedly generating random internal movements with the hope that the fingertips will reach the coffee cup or the spoon will reach the soup.

Contact: kwillinq@gmail.com Website: https://www.explanatorymodel.nl/ – N.J. Mol

the dominant movement of the ring within the external (primary) focus and guide its progress with motoric movements within the internal (secondary) focus, which only reach the outer parts of the handle attached to the ring.
Thanks to this new paradigm, the explanatory model of the motoric movement action is now capable of identifying all functional perception processes within any conceivable motoric action, thus enabling it to describe all sensorimotor perception processes within any conceivable motoric action. In this section, a list of the most crucial insights will be outlined, with a focus on challenging many prevailing assumptions within the scientific community.

a. Visuomotoric perception processes

Of course, science views both visual perception and motor action as essential in executing actions, assuming they share a close relationship. Which, out of a single-focus perspective, led to the rather artificial birth of the term *visuomotoric* perception processes. While one might argue that the term provided some direction in scientific thinking, its content remained vague and never led to any significant consensus.
The explanatory model now emphatically reveals that this term represents an erroneous way of thinking within the scientific community and that it must be expunged from the realm of scientific discourse. The explanatory model effectively illustrates that, in practice, when visual perception comes into play, its exclusive role is to contribute to the perception-action coupling taking place within the external (primary) focus, and has no bearing whatsoever within the internal (secondary) focus. In plain terms, visual perception, by itself, will never induce any movement.

b. Sensorimotoric perception processes

Just like the concept of visuomotoric perception processes, science introduced the term *sensorimotoric* perception processes. In contrast to the previous paragraph, the explanatory model provides a significantly broader description in regard to those sensorimotoric processes than previously presumed in the scientific community and shows unequivocally that we even can execute motoric actions solely through proprioceptive perception, expanding our capabilities beyond what science has traditionally acknowledged. Many actions can be executed with ease, albeit less efficiently, in complete darkness or without any visual input[25,26]. Consider activities like clapping your hands behind your back, unlocking a door with a key at night, or swatting an annoying mosquito behind your ear. In all these actions, the *tau*-value within the external (primary) focus can be entirely perceived proprioceptively[27].
Additionally, the explanatory model unmistakably reveals that within any conceivable action, an external (primary) focus, operating within a strict *tau*-coupling process, can only be executed by an internal (secondary) focus. It highlights that this secondary focus is exclusively perceived within the body, and therefore, all perceptions within this focus are inherently of a sensorimotoric nature.

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[25] Motoric displacement actions from point A to point B, such as walking, cycling, rowing or car driving, can hardly be executed without visual input. However, a person with 100% visual impairment is perfectly capable to navigate through their home freely and by foot travel significant distances outside using a cane. This cane vividly demonstrates that our perception processes are not solely focused on reaching point B but are also deeply engaged in the bridging process. With the cane, the individual is essentially "observing" (feeling) whether the next position P (+1) within the perceptual image of the latent action trajectory shape, is accessible and can be occupied by their body. This observation mirrors what was mentioned earlier regarding the spoon's journey towards the mouth or towards the plate of soup.
[26] Think also of inserting a car key into the ignition. In an unfamiliar car, we need visual perception several times initially to create an action trajectory shape, but after a few repetitions, we do it entirely blindly.
[27] https://www.researchgate.net/publication/342715828_The_complete_functional_explanation_of_limb_position_and_movement_in_relationship_to_the_proprioceptive_perception_-_The_behavioural_perception_processes_within_clapping_behind_your_back

c. The internal (secondary) focus has an indispensable interdependent relationship with the external (primary) focus.

So, the explanatory model revolves around an entirely new paradigm, which reveals that within the execution of a single action, implicitly two autonomous foci arise in relation to two autonomous movements. These two autonomous foci must enter into a mandatory collaboration to accomplish the action successfully. The collaboration involves the motor processes within the internal (secondary) focus, which alone can enable the action object to move, compellingly following the movement within the external (primary) focus. When one is first confronted with this concept, it may evoke an extremely paradoxical feeling. How can a phenomenon that is inherently essential to the action and only solely can ensure the action's success be so dependent on another autonomous phenomenon that it itself brings to life? However, with further contemplation, one will come to realize that it is a remarkable evolutionary discovery and that it provides an explanation for all functional perception processes within any conceivable motor action. Moreover, the explanatory model clearly elucidates how this phenomenon must have developed from the earliest stages of evolution, but further details are omitted here for the sake of brevity[28]. It is emphasized that these two phenomena are entirely interdependent, and without either one, no motor action can be successfully executed.

d. No motor plan and no hierarchy

If the scientific community were to acknowledge that the perception of the movement of an action object within an action trajectory shape, within the external (primary) focus, has the capability to guide the entire execution of any conceivable motoric action, several challenges within science would be resolved immediately. If it were accepted that, prior to the execution of a motor action, we create an all-encompassing and directing perceptual image of an external latent action trajectory shape, the need for a motor plan would instantly disappear. Which would lead to the understanding that all sensorimotor movements simply serve the external (primary) focus, and as a result, there would be no need to recognize hierarchy within the sensorimotor structure. Then all sensorimotor activity can hierarchically be regarded at the exact same level which just obediently have to carry out the task within the external (primary) focus.

e. The explanatory model reflects an optimal ecological approach

In the current scientific paradigm, there is a consensus that motor planning exists, but there is absolutely no agreement on how such a motor plan is developed. While it's acknowledged that creating a motor plan demands more cognitive capacity from an organism, it essentially reveals that, even after many decades, there is no clear answer to this question. An important, unanswered scientific question is how a motor plan adapts when a sudden change occurs during an action. Which also leads to the pressing follow-up question of how more primitive organisms can cope with such situations.
The explanatory model of the motoric movement action demonstrates that perceiving the *tau*-value, despite its inherent complexity, can be distilled into a very simple universal phenomenon. Which is

[28] In future publications, where the precise role of the cortical streams in regard to this phenomenon will be explained, this evolutionary development will be further elucidated. In brief, the explanation will demonstrate that organisms initially started with just random (!) movements within their bodies to move a part of the external body somewhere. After millions of years, we 1. realized that this specific external body part, like a marble in a marble run, fills an external action trajectory shape, and 2. gained a solid understanding of the involved motoric movements. This understanding allowed us to reverse the roles, shifting from initiating movements from inside the body to initiating them from the outside. This line of thinking even goes so far as to suggest that the cortical streams within an organism have evolved evolutionarily to precisely mediate this relationship of a marble-marble run in a double and reciprocal process.

also explained in the context of moving a ring along a spiral[29]. To perceive the *tau*-value, all you need to do is register the speed at which the latent part of the perceptual image of the entire action trajectory shape disappears. Essentially, this amounts to a straightforward observation of the disappearance of a two-dimensional line segment.
Subsequently the explanatory model reveals that the internal (secondary) focus can align itself with the external (primary) focus as a whole, without any rigid hierarchy. This simplifies the observation of the *tau*-coupling process to such an extent that, within an ecological framework, it's hard to surpass and which concept can also be applied to the earliest organisms.

f. The sensorimotoric movements when manoeuvring the outside of the handle connected to the ring within the internal (secondary) focus are proprioceptively perceived

The explanatory model clearly demonstrates that the internal (secondary) focus is perceived exclusively within the body, thereby showing that visual perception is never involved in this process. The internal (secondary) focus can only be perceived proprioceptively. You can practically confirm this within the nerve spiral by covering everything except the ring and the spiral. As long as these remain visible, there will be no impact on this nervous action.

g. Hybrid (proprioceptive) perception processes

A significant shortcoming in scientific research pertains to the notion that motor actions are always executed with roughly the same sensorimotor perception processes. The explanatory model reveals a universal framework, but it clearly demonstrates as a novelty that often multiple constellations of perception processes are involved within the execution of the same motoric action and that we are capable to endlessly, *ecologically* (!), vary within this realm.
For example, when in pitch black darkness, we bring our (non-key-holding) hand to a lock, we can successfully move the key to the lock using solely proprioceptive perception within the external (primary) focus c.q. we can successfully move the key along a perceptual image of a latent action trajectory shape using solely proprioceptive perception processes. So even if it then appears that we perform this motoric action with only visual perception in broad daylight, that's factually incorrect. In broad daylight visual perception processes may dominate, but proprioceptive perception processes will never disappear and so will always be present in some hybrid form. So actions we perform during the day with relatively many visual perception processes are always executed proprioceptively as well.
Within the internal (secondary) focus, the situation is no different. You can quickly ascertain for yourself that, in the case of a nerve spiral, you can move the ring solely with torso action or even with just a walking action if you hold the handle rigidly. In this way, you could even move it with just upper arm and/or forearm action. However, even when you consider more common motor actions used to move the ring, you can quickly observe for yourself that you could use relatively more hand or relatively more finger action.
Which, in short, indicates that you might have developed your own preferred motor skills within the nerve spiral, but they will always consist of an ever-evolving combination of hybrid sensorimotor perceptions. Due to the fact that such a complex phenomenon is involved will never allow an identical configuration of perception processes to arise. Upon which the explanatory model of all motoric movement actions again hastily wants to add that these hybrid possibilities in the utmost harmony align within an ecological approach and that a parsimonious organism would never have strived to achieve identical executions.

[29] https://www.researchgate.net/publication/374288678_Within_the_nerve_spiral_the_essence_of_the_task_is_solely_executed_by_the_movements_of_the_ring_Within_the_primary_focus_the_ring_moves_like_a_marble_in_a_marble_run_producing_the_tau-value

h. Optimization process

The explanatory model of the motoric movement action demonstrates that a motor action can only be executed by the stacking of two autonomous foci and shows within the previous paragraph that the perception of movement within the internal (secondary) focus is inherently of such a high complex nature that it will definitely prevent the occurrence of an identical internal configuration to occur. Consequently this will cause that the action object is capable to and definitely shall deviate from the perceptual image of the latent action trajectory shape at each progressing point P and even though the cortical streams ingeniously mediate this process, it's empirically evident that an identical execution of any action trajectory shape is unattainable. This unequivocally portrays that performing any conceivable action can only be viewed as an optimization process. Hence, you will never be able to make a ring move identically. Instead, you solely can optimize the perceptions within both foci, which also allows you to perform actions in a very successful manner but in ever-varying ways.

i. Within the internal (secondary) focus the line and shape within the line segment shape of the action trajectory demand autonomous perception processes; Solely the line generates the *tau*-value

The explanatory model of the motoric movement action demonstrates, beyond any reasonable doubt, that we do not (need to) create motor plans and that all sensorimotor processes can be compellingly guided by the external (primary) focus. But if a motor plan would have been necessary, science would still have remained remote from a breakthrough, as sensorimotor processes must accompany two autonomous phenomena within the action trajectory shape that have never been recognized in science. The frequently used compound term "action trajectory shape" is in fact a line segment shape and encompasses two autonomous components: the line and the shape. The explanatory model illustrates that they are perceived entirely separately but simultaneously. For experts, this is clearly recognizable within any conceivable action. However to make it comprehensible for everyone, these phenomena are explained within the context of the motoric movement action *car driving* (or riding a bicycle) since this action inherently contains the scientific evidence of these two autonomous perceptions.

Images: In the case of a car and a bicycle without hand brakes, only the steering wheel can compensate for deviations in the width of the action trajectory shape, and the pedals can only compensate for deviations in the length of the action trajectory shape.

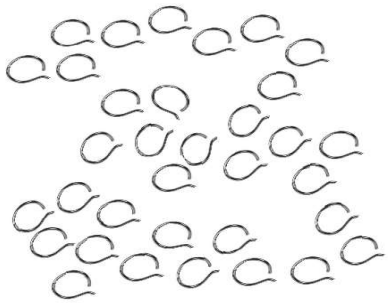
When driving a car, it becomes immediately evident that one can exclusively influence the movement within the shape (!) of the action trajectory with the steering wheel. This defines the explanatory model as mediating the deviations in the y-axis. Additionally, it should also become immediately clear that with the pedals, one can exclusively influence the movement within the line (!) of the action trajectory. This defines the explanatory model as mediating the deviations in the x-axis[30].

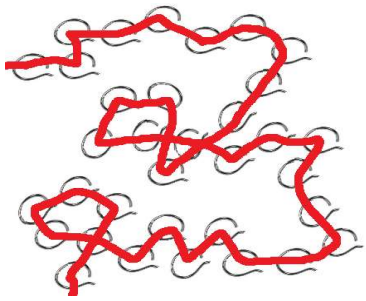
[30] The same explanation naturally applies when considering a bicycle with coaster brakes.

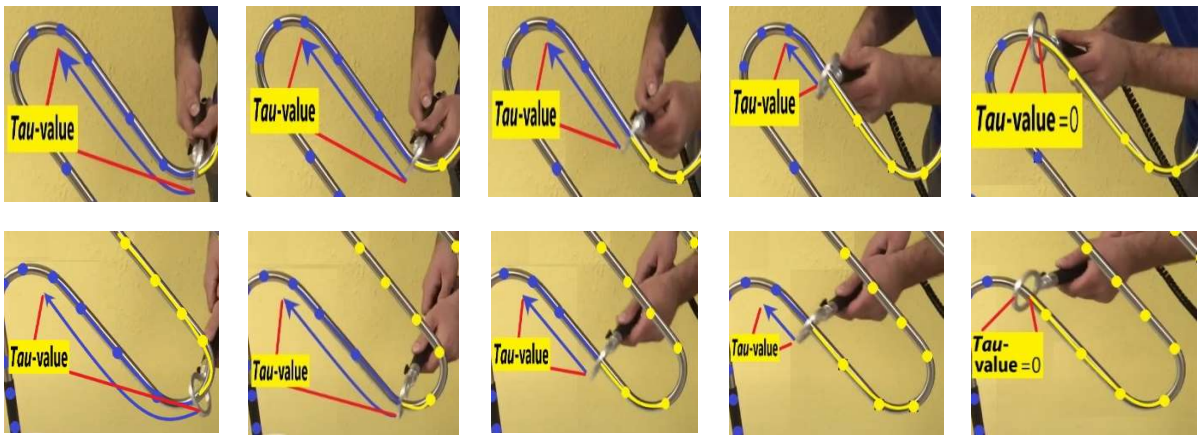
So, when driving a car, it becomes crystal clear that perceiving (and controlling) the shape has absolutely nothing to do with perceiving (and controlling) the line. In which it is essential to mention that perceiving the filling of the latent line (within the x-axis) by the manifest places P of the action object within the external (primary) focus solely involves the *tau*-value which within car driving is solely executed by the pedals. Solely the speed with which the line is filled determines the duration of the action c.q. determines the finalization of the action.
The explanatory model of the motoric movement action demonstrates that the perception of movement within the internal (secondary) focus in any conceivable action, including the execution of the nerve spiral, contains the same x- and y-axis components. Although it places greater demands on the development of an organism, conversely, it can be shown to fit perfectly within an ecological approach. The dichotomy, where a separate x- and y-axis component is distinguished, can actually deliver the final breakthrough in the understanding of why we are capable to reduce very complex perception processes to the perception of such trivial and simple phenomena. The mere perception of the x-axis can be traced back to simply perceiving how the latent part of the perceptual image of the latent action trajectory disappears.

Contact: kwillinq@gmail.com Website: https://www.explanatorymodel.nl/ – N.J. Mol

Part 5 - The nerve spiral demonstrates that random motor activity implicitly generates an internal and external focus and provides scientific evidence that the external focus can guide the action due to the ingenious evolutionary development of the cortical streams







Caught In A Line
The explanatory model of all motoric movement actions

N.J. Mol
December 2023

Introduction

The explanatory model of the motoric movement action is capable of delineating all functional perception processes within any conceivable action. Nevertheless, challenges are encountered in its implementation within the scientific community due to the intrinsic nature of a new paradigm within a complex dynamic system. The explanatory model demands the simultaneous integration of multiple innovative mind steps.
In order to facilitate those necessary subsequent steps in science, a series of new articles is introduced, each time focusing on a different motoric action which will be assessed within the complete spectrum of (general) motor activity. The aim is to provide a broader perspective on specific motor activity required for goal-directed actions. Additionally, they universally demonstrate that motor activity always leads to the simultaneous autonomous perception of both internal and external movements, which can be appointed as primary or secondary, and finally, they elucidate all elements underlying the explanatory model of the motoric movement action.
This article centers around the game of the nerve spiral[31]. The explanation consists of three parts. The first part exclusively focuses on general motor activity and not on specific actions. Here, an action is defined as deliberate motor activity aimed at performing a specific task as a result of an egocentrically formulated intention. At the end of this part, the nerve spiral task is fully explained in relation to general motor activity. In contrast to the first part, the second part addresses deliberate c.q. specific actions where an egocentrically intention is formulated to actually move a ring along an electric loaded spiral. Two action strategies are highlighted in this part, logically stemming from the general motor activity mentioned in the first part. The concluding part emphasizes the relationship between the discussed motor activities and the explanatory model of the motoric movement action.

Part 1 - Internal motor (movement) activity when no deliberate goal-directed action is involved

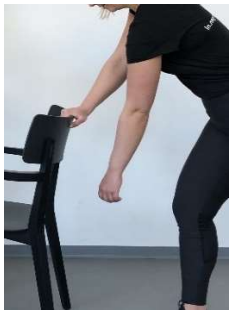
The explanatory model of the motoric movement action identifies all functional perception processes within any conceivable action. In which the fundamental assumption encompasses that the action arises from explicitly formulating a particular egocentric will. However, in this paragraph, we do not assess a specific motor action with an egocentric intention yet. In here we solely focus on general motor activity. The distinction between mere motor activity and conscious actions provides valuable insight into the broad spectrum of motor (movement) activity.

[31] A.k.a. *The buzz wire game*, *The nerve tester game* etc..

Contact: kwillinq@gmail.com Website: https://www.explanatorymodel.nl/ – N.J. Mol

a. Basic exercise (passive arm without a spoon)

The entire explanation is built upon a basic exercise, involving a forward-leaning posture with one arm hanging passively downward. This posture is often used in physiotherapy exercises to allow isolated movement of the arm. That is strenuously not the intention of this exercise. It is essential to keep the arm entirely passive during the execution of the basic exercise.



Images: The basic exercise illustrates a forward-leaning position with a passive arm. Despite the apparent action in the images, the primary goal is to develop and observe other body actions and notice how they laterally influence the movement of the passive arm.

Although the hanging arm is prominently present, you are now asked not to focus on it specifically. Conversely, the emphasis must be put on developing other than arm activities (knee, torso, head, foot action, etc.) and observing whether the passive arm is going to move.

Conclusion of the basic exercise (passive arm without a spoon)

It can be conclusively observed that you are capable to (secondarily) perceive movement of all separate positions P of the outside of a passive arm by directing (primary) attention to an entirely different internal motor activity. This observation carries the following factual conclusions:

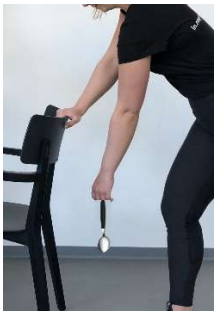
1) While there is nothing predictable about where the passive arm will move, as random internal motor activity will always result in random or chance movements of the passive arm, there is, on the other hand, a very essential fact to note. All individual external points/positions P of the arm will always have to be connected c.q. will always have to emerge from each other. If we, for example, were to focus on three points of the arm, such as the fingertips, knuckles of the fist, and the elbow[32], you cannot escape the factual conclusion that all those points always move in a line segment shape and that it always involves only one (!) line segment shape[33]. So, this applies to all places on the arm, and within there it can also factually be established that each position P of the arm will move like a marble in a marble run[34]. The current position P (0) of each piece of the arm will always mark the separation between the manifest positions P (-x) and the future positions P (+x).
2) The second very essential conclusion encompasses the fact that the two movements have a causal connection, but the perception of the movement of internal motor activity (knee, torso, head, foot

[32] Hence, you must also realize that when grasping a coffee cup, where we typically focus on the movement of the fingertips, all other mentioned body parts also move in linear forms. This demonstrates that the related perception processes are entirely subjective and depend on the chosen focus.
[33] Indeed, you can factually ascertain that your own body, from birth to the end of life, is also confined within one extensive line segment shape. Your body at every position P(0) is, in fact, bound to the penultimate position P(-1) and the subsequent position P(+1). There is simply no escaping it. You are factually "*Caught In A Line*".
[34] https://www.researchgate.net/publication/336880958_The_explanatory_model_of_all_motoric_movement_actions_-_The_Marble_Run

action, etc.) has absolutely nothing to do with the perception of the movement within the linear form where all separate parts of the arm become a part of[35].

b. Basic exercise (passive arm with a spoon)

A crucial aspect of the preceding conclusion involves the fact that internal sensorimotoric movements implicitly lead to a movement of, for example, the fingertips over an external line segment shape outside the body. There is, therefore, a direct causal relationship between these two movements, with the remarkable phenomenon that, without internal motor activity, an action trajectory shape of the fingertips is just not capable to occur. However, it is essential to establish that the perception of the movement of the fingertips over an action trajectory shape outside the body, in spite of this crucial causal relationship, has no connection with the perception of internal sensorimotoric movements. To further clarify this intriguing duality, the basic exercise is repeated, with the sole difference that the hand of the passive arm is holding a spoon. The entire exercise proceeds identically to the description above.



Images: In the repetition of the basic exercise, only a spoon is added, while the exercise remains unchanged. It is crucial, once again, not to develop conscious arm action but merely to observe how other bodily actions influence the entirely passive arm with the spoon. Now you can factually establish that all separate positions P of the arm but also all separate positions of the spoon will start to move in line segment shapes. Due to the fact that all those separate positions can only emerge from each other c.q. they will always be interconnected.

Conclusion of the basic exercise (passive arm with a spoon)

Like in the first version of the basic exercise it can be factually established that you are capable to (secondarily) perceive movement of all separate positions P of the outside of a passive arm, now holding a spoon, by directing (primary) attention to an entirely different internal motor activity. This observation carries the following factual conclusions:

1) While there is nothing predictable about where the passive arm with the spoon will move, as random internal motor activity will always result in random or chance movements of the passive arm with the spoon, there is, on the other hand, a very essential fact to note. All separate points/positions P of the arm and all separate points/positions P of the spoon will always have to be connected c.q. will always have to emerge from each other. Once again, the three previously mentioned arm positions (the fingertips, the knuckles of the fist, and the elbow) will create a line segment shape, but also all the separate positions of the spoon also form separate lines. If you focus, for example, on the handle or the bowl of the spoon, you cannot escape the factual conclusion that all those points always move in a linear form, and that, too, always involves exact one (!) entire line segment shape[36]. So, all separate positions of the arm and of the spoon are going to traverse a

[35] The explanatory model of the motoric movement action demonstrates in numerous articles that the two perceptions of two types of movements are autonomous because they belong to the incompatible worlds of inside and outside the body. Therefore, there can never be a blending of the two.

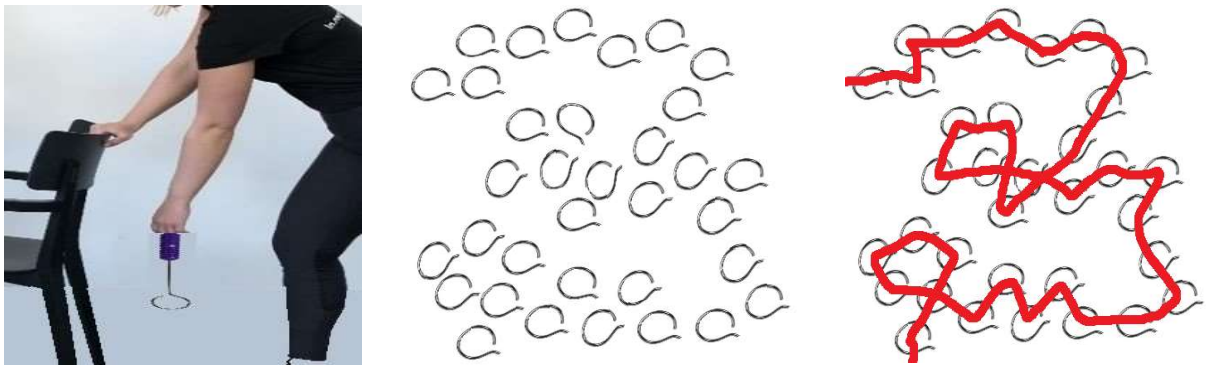
[36] Hence, you must also realize that when eating soup, where we typically focus on the movement of the spoon-bowl, all other mentioned body and spoon parts also move in line segment shapes. This demonstrates that the related perception processes are entirely subjective and depend on the chosen focus.

linear form and within there it can also factually be established that each position P of the arm and of the spoon will move like a marble in a marble run. The current position P (0) of each piece of the arm and spoon will always mark the separation between the manifest positions P (-x) and the future positions P (+x).

2) The second highly essential conclusion, as mentioned in the first version of the basic exercise, remains fully intact here as well. The perception of the movement of internal motor activity (knee, torso, head, foot action, etc.) has absolutely nothing to do with the observation of the line segment shape that all parts of the arm and now the spoon become a part of. However, the new aspect introduced by the spoon concerns the fact that a spoon is an inanimate object. What leads to the astonishing factual conclusion that, for instance, we can observe the movement of the spoon's bowl over a line, but we can only generate motor activity up to the outer surface of the handle of the spoon. The perplexing aspect of this realization may be the fact that the movement of the spoon's bowl over a line segment shape is entirely dependent on a completely different internal motoric movement. Without this source of action, the spoon's bowl will never move. Additionally, the confirming aspect of this realization may concern the conviction that the perception of the movement of the spoon's bowl over a line has absolutely no connection with the perception of internal motor movement activity.

c. <u>The basic exercise in relation to motoric arm activity when moving a ring attached to a handle</u>

If we define an action as a conscious motor activity in which a specific goal is pursued from an egocentrically formulated will, then the explanation in the entire first part of this article falls outside the framework of actions. In this paragraph, we still do not assume a conscious goal-directed action, but rather build upon what the basic exercise regarding the movement of a spoon demonstrates.



Images: The basic exercise can be universally translated into moving a ring attached to a handle. Which in all aspects resembles moving a spoon(-bowl). You should mainly focus on touching the handle c.q. you should primarily direct your attention proprioceptively towards the outer part of the handle you are holding and only secondarily notice how the ring moves through the air. Even if you engage only in upper arm, forearm, hand, or even just finger action, the consequences remain the same[37].

As the previous paragraph illustrates, the basic exercise can easily be translated into an action involving an external (lifeless) object, such as a ring attached to a handle. To maximize the distinction between the (perception of) the movement of the spoon bowl/ring and the (perception of) the movement of internal motor activity, and thus make the principles easily accessible, you were specifically asked not to perform any arm activity. However, the distance between the spoon bowl/ring and internal

[37] Two essential omissions should be noted in the animations: 1. Only a limited number of ring positions are represented. If you engage in a few minutes of random motor activity, the entire environment should be filled with rings. 2. The connection of successive positions P of the ring cannot be captured in an animation. The perception of the ring's movement involves a continuous (smooth) line of rings. The red line represents this continuous connection but does not actually show rings. Therefore, you need to create a hybrid perceptual representation, which you can only really perceive by actually moving a ring in the air.

motor activity doesn't matter at all. Even if you focus primarily on (internal) motor arm activity, you can secondarily observe that the spoon bowl or the ring moves randomly through the air. You can develop only upper or lower arm activity, but even if you develop only hand or even solely finger action, the same principles will still apply. It should be reiterated that you can only empirically determine that the position P(0) of the ring, in the present action, must always result from the preceding positions, and that all positions P of the ring are always confined to one line segment shape.

Conclusion basic exercise in relation to motoric arm activity when moving a ring attached to a handle

In actions involving lifeless objects, such as a ring belonging to a nerve spiral game, it becomes immediately clear that you (secondarily) can make the ring move by focusing entirely on a different (primary) motor activity, which can only reach up to the outer surface of the handle of the ring. This is the only thing necessary to draw the following factual conclusions:

1) Although there is nothing predictable about where the ring will move, as random internal motor activity will always result in random or chance movements of the ring, there is, on the other hand, a very essential fact to note. All separate points/positions P of the ring will always have to be connected c.q. will always have to emerge from each other. Due to which one can conclude that all those points always construct a linear form, and that, too, always involves exact one (!) entire line segment shape. The ring will move in that linear form in the same universal manner as a marble moves within a marble run. In which the current position P (0) of the ring will always serve as the precise separation between all manifest positions P (-x) and all future positions P (+x).
2) Once again, the second highly essential conclusion follows the explanation as in the case of the other basic exercises. The perception of the movement of internal motor activity has absolutely nothing to do with the perception of the external movement of the ring within the line segment shape that all positions of the ring become a part of.

   The perplexing aspect of this realization may be the fact that the movement of the ring over a line segment shape is entirely dependent on a completely different internal motoric movement solely reaching the outer surface of the handle of the ring. Without this source of action, the ring will never move. Additionally, the confirming aspect of this realization may concern the conviction that the perception of the movement of the ring over a linear form has absolutely no connection with the perception of internal motor movement activity.

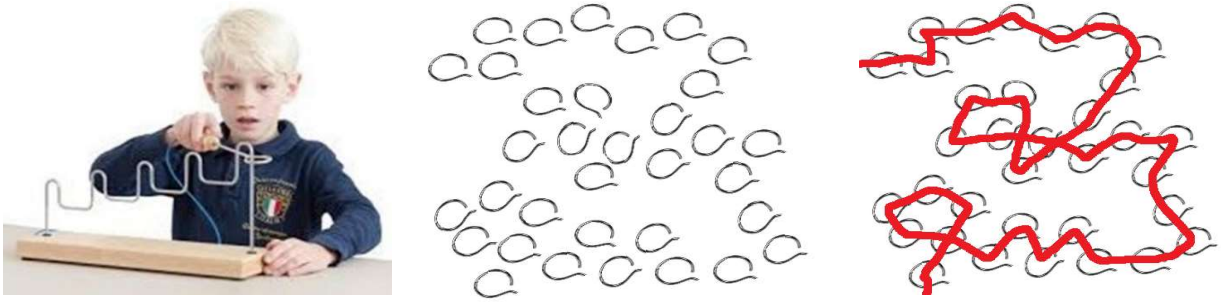
Part 2 - Internal motor (movement) activity when a deliberate goal-directed action is involved

The explanatory model of the motoric movement action encompasses the clarification of all functional perception processes within any conceivable action, assuming that these are conscious actions driven by an egocentrically formulated will, with a clearly defined specific goal. So, the motor movements in the first part specifically did not involve actions aimed at placing motor activity in a larger context. Conversely within the second part, general motor activity will now be translated towards specific motoric actions. Although the explanatory model of the motoric movement action is emphasized more in this part, the explanation within this section still aims to clarify the entire spectrum of motor (movement) activity.
So, within the second part we do assume deliberate goal-directed actions where an egocentric will is formulated to achieve a specific goal and in this chapter the movement of a ring along an electric loaded spiral encompasses the main issue. The basic exercise clearly shows that two possible action strategies c.q. execution perspectives can be pursued in this regard.

a. Execution perspective 1 – Primary focus on the internal movements towards the outer surface of the handle and secondary focus on the external movement of the ring

The basic exercise from the first part clearly demonstrates that with primary attention on internal motor activity, focused on the exterior of the handle of the ring, we can randomly move a ring through the air. However, this random movement becomes problematic when formulating the egocentric intention to precisely manoeuvre a ring along a fixed spiral, without touching it. Even with primary attention on

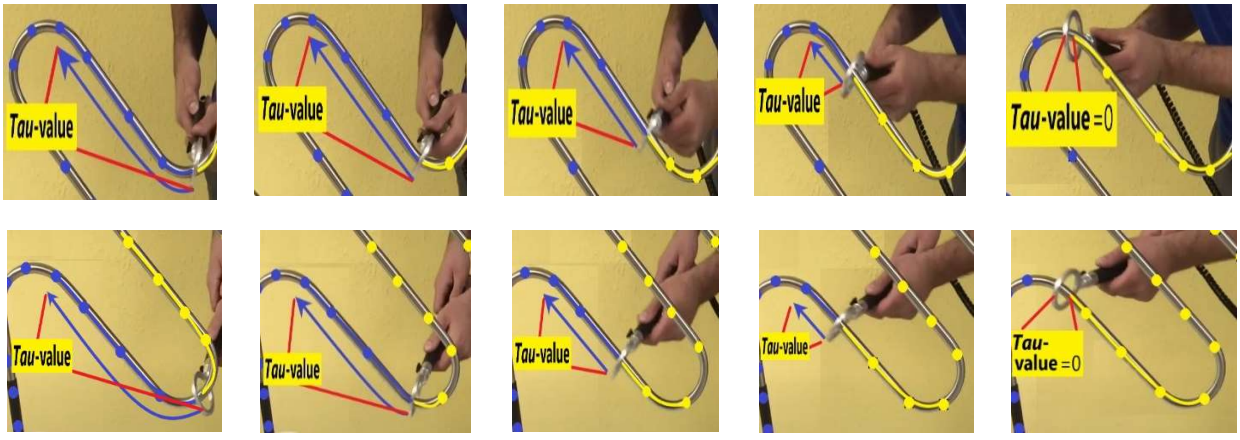
internal motor activity, we can make the ring cover a considerable amount of positions in the air in a few minutes, but it is far from economical (efficient and effective).



Images: Even if one wants to consciously move a ring over a spiral within a deliberate action, it remains a strategy at all times to focus primarily on the handle of the ring while secondarily observing whether the ring will ever reach the end of the spiral without touching it. Although it is a possible strategy, it requires a considerable amount of luck and/or patience. However, it is not an economical strategy, and one can quickly conclude that successful execution is only feasible if the nerve spiral involves a very short distance[38].

b. <u>Execution perspective 2 – Primary focus on the external movement of the ring and secondary focus towards the outer surface of the handle</u>

Contrary to the description of random motor activity within the basic exercises within the first part of this article and also in contrast to the previous action strategy, when it comes to the emergence of a deliberate action, one can adopt a completely different execution perspective. It would indeed be by far the most parsimonious (ecological) solution to first conceptualize an action trajectory shape and then proceed to execute it.



Images: Within the nerve spiral the most economical approach is to first create a perceptual image of an efficient and effective latent action trajectory shape over which the ring will successfully transverse a spiral and then proceed to factually fill it in.

In the second execution strategy, the roles of attention are reversed. The primary focus now has the goal to track the external progress of the ring within the action trajectory shape, and this must be followed secondarily by motor activity. In which you now have to observe, similar to the basic exercise in the first part, that motor activity passively follows the primary focus.

38 Each additional position P to be bridged will result in an exponential increase in deviation possibilities.

It would, of course, be by far the most parsimonious execution strategy, but the reversal of roles requires significantly more cognitive capacity. While the first execution perspective allows for a straightforward initiation of the action, the second one demands the following essential cognitive skills:

a. It demands that first a perceptual image of a latent action trajectory shape is constructed over which the ring can be successfully moved along a spiral.
b. There needs a significant complex system to be present which must be capable of mediating the (perception of) the movement of the ring within the action trajectory shape. While the roles of attention can be reversed, will not change the fact that the ring can only be moved by (the perception of) a completely different autonomous (internal) phenomenon. Even if we try to enforce that the ring actually fills in the perceptual image of the latent action trajectory shape, the autonomy of the motor activity will cause the ring to deviate from that perceptual image of the latent action trajectory shape at every position P.

Part 3 – General conclusion

The explanatory model of the motoric movement action is capable of appointing all functional perception processes within any conceivable action. However, its implementation in the scientific world encounters several challenges. It represents an entirely new paradigm and involves an explanation within a complex dynamic system where multiple new conceptual mind steps must be combined simultaneously. Therefor the goal is to try to enhance the insights around the explanatory model, and for that purpose, the preceding paragraphs zoomed in on the entire spectrum of motor activity. From a generally recognizable image, a translation was made to the core concepts and thought processes demanded by the explanatory model of the motoric movement action.
In the end, within this article, two possible action perspectives were identified based on general motor activity. Without any reasonable doubt it becomes clear that the second perspective, where the primary focus is pointed at the construction and execution of a perceptual image of a latent (external) action trajectory shape, will be far more superior to the first mentioned action strategy. However, this ultimate parsimonious solution also reveals which additional conditions the most superior action strategy should meet:

a. Firstly, an organism must have the cognitive ability to create a perceptual image of a latent action trajectory, over which, in the present action, the ring will be successfully moved along a nerve spiral. Regarding this first condition, the explanatory model of the motoric movement action has provided universal scientific evidence that we create such a perceptual image within every conceivable action. This has been specifically addressed within computer[39], grasping[40] and throwing[41] tasks, but it can easily be adapted to any conceivable action.
b. Secondly, an organism must have the cognitive ability to mediate the movement of the ring within that perceptual image of a latent action trajectory. The mere quintessence of this article encompasses namely that motor activity is a completely autonomous phenomenon and although it has a direct causal relationship with the movement of the ring within an action trajectory shape, the ring will never be able to move by itself. So, we might be intensely motivated to reverse the roles of

[39] https://www.researchgate.net/publication/372719694_When_moving_a_pointer_on_a_computer_screen_you_are_mainly_attentive_to_where_'nothing'_is_-_The_scientific_evidence_regarding_visual_perception_within_each_motor_action
[40] https://www.researchgate.net/publication/372290282_Grasping_encompasses_two_consecutive_autonomous_phases_-_The_scientific_proof_that_we_tactically_construct_an_action_trajectory_shape_prior_to_the_factual_execution_of_that_exact_same_action_trajector?_sg%5B0%5D=cjBGD1Dj5IxR2T4se38lo9o1z_MKwSU49eb_oQsTOUjibSgy5M67E9dyDJ2vYL6jmizwVBbPYrgk9NU6pmmALDQpNZJERFlrXLCWSXY.BBjj_0oQKGMN_JQZfSCEjGE1eN9IjRkkPyAjEjWIaxLJGM1U2MeX-LYMQPb3Fz_XmE18jNVnKKf8WfOSPcG4l1w&_tp=eyJjb250ZXh0Ijp7ImZpcnN0UGFnZSI6ImhvbWUiLCJwYWdlIjoicHJvZmlsZSIsInBvc2l0aW9uIjoicGFnZUNvbnRlbnQifX0
[41] https://www.researchgate.net/publication/371912704_The_scientific_proof_that_we_primarily_start_with_the_construction_of_a_perceptual_image_of_an_outgoing_ball_trajectory_shape_prior_to_the_factual_execution_-_The_complete_explanation_of_the_free_thro

Contact: kwillinq@gmail.com Website: https://www.explanatorymodel.nl/ – N.J. Mol

the primary and secondary focus and envision very neat and straight (optimally economical) action trajectory shapes but due to the autonomy of the perception of both movements, we simply cannot execute them in that way. The autonomous (mainly visual) perception of the movement of the ring will eagerly try to follow the perceptual image of the latent action trajectory shape, but the autonomous proprioceptive perception towards the outer surface of the handle of the ring will actually cause the ring to deviate at every position P within the perceptual image of a latent action trajectory shape.
The explanatory model of the motoric movement action thus concludes that there must be a very heavy significant system to mediate the ever-deviating movements of the ring within an ever-deviating action trajectory shape each consecutive time frame. Regarding this second condition the explanatory model finds that this very heavy system is present within the processing processes of the perception c.q. is present within the functioning of the cortical streams and, based upon current scientific literature, it asserts that there is a double and mutual relationship between the dorsal and ventral stream. In the present game task, the dorsal stream is mainly related to the processing of perceptions concerning the specific position of the ring, and the ventral stream is mainly related to the processing of perceptions concerning the perceptual image of the whole action trajectory shape. However, this must be seen as mutual. At any time frame *t* or at any point P (0) of the action, one perceives the ring relative to the action trajectory shape and vice versa. So, the dorsal stream mainly processes the position of the ring, but this is always related to the action trajectory shape, and conversely, the ventral stream mainly processes the progression within the action trajectory shape, but this is always related to the specific position of the ring.
This dual and reciprocal collaboration leads to random deviations of the ring from the perceptual image of the latent action trajectory shape at every position P(0). As a result, the ventral stream promptly needs to renew/update the perceptual image of the latent action trajectory shape, which immediately becomes the compelling new output situation in relation to the dorsal stream. This process repeats with each new deviation. This inevitable consequence causes the ring to move involuntarily in a zigzag or jerky manner within the perceptual image of the action trajectory shape due to the (very small) reaction time inherent in this dual and reciprocal collaboration.
The zigzag collaboration is vividly illustrated in the execution of the nerve spiral, which legitimacy is solely based on this jerky phenomenon. While you may successfully traverse a spiral, you can quickly empirically determine that you will never be able to construct straight action trajectory shapes because the ring will always deviate randomly, and the reactions of the cortical streams demand essential reaction time. Additionally, you will soon conclude that you simply cannot create an identical action trajectory shape for any conceivable action.

Contact: kwillinq@gmail.com Website: https://www.explanatorymodel.nl/ – N.J. Mol

Part 6 - The explanation of the emergence of the cortical streams - We can only guide a ring along a nerve spiral with a zigzag movement, yet the ingenious mediation by the cortical streams creates the delusion of a straight action trajectory shape

Caught In A Line
The explanatory model of all motoric movement actions

N.J. Mol
May 2024

Contact: kwillinq@gmail.com
https://www.researchgate.net/profile/Nj-Mol/research
https://www.explanatorymodel.nl/

Introduction

The explanatory model of the motoric movement action provides a profound understanding of all functional c.q. behavioural perception processes occurring within any conceivable goal-directed motoric action. Nonetheless, challenges arise in its implementation within the scientific community, given the intrinsic nature of a new paradigm within a complex dynamic system. It necessitates the simultaneous integration of several innovative mind steps, including:

1. The scientific evidence showing that, as part of a tactical (ecological) consideration, we always first create a perceptual image of a latent action trajectory shape before we actually start to transport a ring from A to B along a spiral.
2. The understanding of the necessity of a compelling collaboration between an internal and an external focus in every motor action. The movement of the ring, within the game of the nerve spiral, in relationship to the external action trajectory shape can solely be perceived outside the body and is only caused by perception of movements within the body, reaching only to the outer surface of the handle belonging to the ring. Due to their exclusive domains these perceptions are incompatible.
3. The assumption of the crucial role of the movement of the ring over the action trajectory shape as the essence of this task, wherein the external focus must be hierarchically considered primary. This assigns a secondary status to the internal focus and demonstrates that no motor plan is ever conducted.
4. The explanation of how the primary focus generates the *tau*-value and how the secondary focus needs to obediently follow the development of that *tau*-value within a strict *tau*-coupling process, providing the first ecological explanation for anticipating all unexpected events during an action.
5. The insight that when we move the ring within an action trajectory shape from the beginning to the end of the spiral, it is a subjective choice from the perspective of the ring. With the same arm action, all other parts of the arm (elbow, hand, upper arm, etc.) and all parts of the handle with the ring move in a unique action trajectory shape. This demonstrates that when moving an arm holding an action object, there is a causal relationship between the perception of internal and external movements, but an explicit relationship only emerges when we subjectively "choose" the ring as the action object[42].

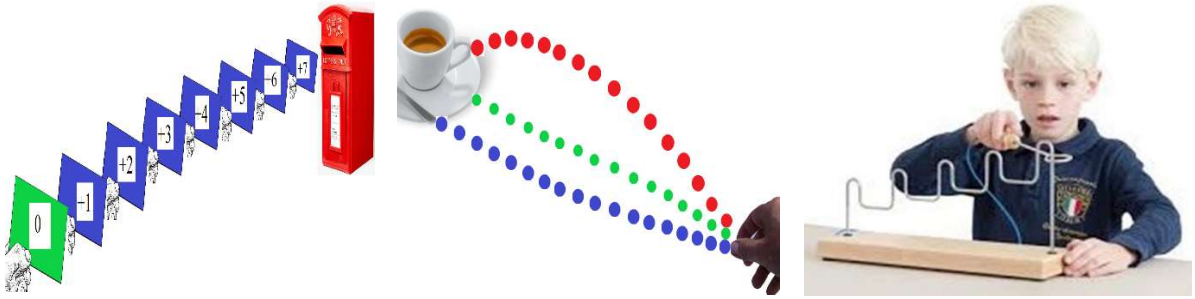
As a concluding step in this chapter, we delve into the functioning of the cortical streams when playing the "nerve spiral" game in which the entire idea of the game is exactly based on how the cortical

[42] https://www.researchgate.net/publication/376888581_The_nerve_spiral_demonstrates_that_random_motor_activity_implicitly_generates_an_internal_and_external_focus_and_provides_scientific_evidence_that_the_external_focus_can_guide_the_action_due_to_the_in

streams operate. It provides a comprehensive understanding of why they must play such a significant role and why they have evolved ecologically and evolutionarily. Additionally, it precisely explains how they mediate two autonomous deviation processes within every motor action: the zigzag process and the accordion process[43].

1. The tactical movement action (TMA) in relationship to the nerve spiral encompasses the construction of a perceptual image of a latent action trajectory shape between the beginning and the end of the spiral

Supported by scientific evidence[44], the explanatory model delineates that the execution of any motor action involves two distinct sequential phases: the tactical movement action (TMA) and the actual movement action (AMA). The tactical movement action is focused solely on planning the upcoming action and must be finalized before any actual execution occurs. An essential aspect of the tactical movement action within the nerve spiral game is to create a perceptual image of a latent action trajectory shape between the beginning and the end of the spiral over which the empty space within the ring needs to travel and will prevent the touching of the edge of the ring with the spiral.
The explanatory model demonstrates that during this phase, we are indeed largely focused on all physical dimensions of the end of the spiral, implicitly leading to the completion of the motoric action, aligning with much scientific research. However, with the recognition that a perceptual image of a latent action trajectory shape is being created, the explanatory model also arrives at a conclusion that is not yet recognized within the scientific community. The construction of this perceptual image of a latent action trajectory shape between the beginning and the end of the spiral also reveals that we strategically determine beforehand whether the space between these points can be filled or bridged by a contiguous line encompassing all dimensions of the ring.



Images: Within letter posting and grasping we also construct a perceptual image of a latent action trajectory shape during the tactical movement action (TMA) like in any conceivable motoric action, over which *all dimensions* (!) of the action object (i.e., the letter and the fingertips) will enable the action to succeed. During the actual execution within the actual movement action (AMA), akin to the ring in relationship to the nerve spiral, one must perceive the movement of the action object during the bridging process, as only the ring, the letter, and the fingertips are going to move c.q. can be moved egocentrically. Within the images, it is particularly noticeable that we actively perceive whether the entire path through all dimensions of the fingertips, the ring, or the letter can be filled in a continuous action trajectory shape c.q. we mainly perceive the "nothingness" in the vista in front of us. Because only in that void there is (empty) space to successfully execute an action.

In addition to unveiling this novelty, it is also revealed that when the tactical movement action has been finalized, we are primarily going to focus on the movement of the ring from the beginning to the end of the spiral. This contrasts with the traditional perspective of science, which remains constantly focused on the end of the spiral. During the actual movement action (AMA), our main concern is the

[43] In previous publications, this has been referred to as the harmonica process.
[44] https://www.researchgate.net/publication/376051657_The_nerve_spiral_provides_the_scientific_evidence_that_our_primary_attention_is_directed_towards_the_movement_of_the_ring_within_a_perceptual_image_of_a_latent_external_action_trajectory_shape

Contact: kwillinq@gmail.com Website: https://www.explanatorymodel.nl/ – N.J. Mol

egocentric bridging process of the ring, guiding it over the perceptual image of the latent action trajectory shape which is exclusively determined during the tactical movement action. So when the factual execution starts the end of the spiral itself is not any longer the focal point, but rather the movement of the ring towards it c.q. the bridging of the void (!) between the current location of the ring and the end of the spiral forms the essence of the action.
Another revolutionary novelty aligns with the previous thought. Although reaching the end of the action trajectory shape will eventually lead us to the completion of this task, the explanatory model, supported by scientific evidence, demonstrates that we also tactically determine beforehand whether the entire (!) space between the beginning and the end of the spiral can be filled by a continuous line segment shape of all dimensions of the ring. This means that all positions P between the beginning and the end of the spiral are observed as actively and as crucially as the endpoint of the action trajectory shape. This realization provides a solid foundation for the fact that during the actual movement action (AMA), we are solely focused on traversing the latent positions P associated with the action trajectory shape. This implies that upon reaching position P(x), for example, somewhere midway along the spiral, we are mainly focused on the perception of three positions: position P(x-1), where we just came from, position P(x), where the ring is now, and position P(x+1), the perception of the next position where we need to move the ring. In this phase, we are primarily engaged in the aforementioned bridging process and only monitor whether the gap between the beginning and the end of the spiral is closing. This also reveals another essential ecological novelty, showing that during the actual movement action (AMA), we are indeed not concerned with the end of the spiral itself, but only with reducing the number of latent positions P within the action trajectory shape.

2. <u>The reciprocal dependency between the internal and external focus results in absolute deviations of the ring within the perceptual image of the latent action trajectory shape</u>

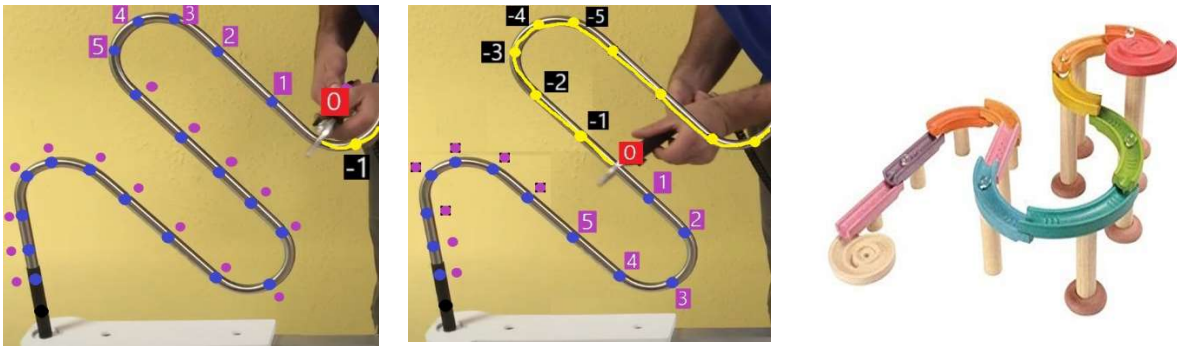
The explanatory model of the motoric movement action unequivocally illustrates within the context of moving a ring along a spiral that two foci always arise[45]. We can only guide the ring along an external action trajectory with a focus on internal movements. These foci are autonomous because the (perception of) movements occur strictly separated inside and outside the body, rendering them incompatible. As the explanatory model now demonstrates that the movement of the ring within the external action trajectory will fulfil the essence of the task, a peculiar phenomenon of reciprocal dependence emerges. Only internal motor movements, reaching only up to the outer surface of the ring's handle, will be able to move the ring externally along an action trajectory. However, the progress of the ring within that action trajectory will, as the primary focus, dictate the secondary focus. The inevitable consequence of this observation is that it is not a question of whether the ring will deviate within the perceptual image of the latent action trajectory, but rather an absolute certainty. This certainty is logically inherent in the autonomous nature of the perception of both foci, which essentially explains the entire essence of this game.

3. <u>Within the actual movement action (AMA) the cortical streams will have to mediate the continuous flow of absolutely emerging deviations</u>

If we now combine the two preceding paragraphs and proceed to actually execute this game, our main endeavour will primarily become to initiate the bridging process of the ring in which the perceptual image of the action trajectory shape serves as an open yet compelling guiding[46] phenomenon. This means that we aim to *step by step* (!) reduce the distance between the beginning and the end of the spiral, starting with the first step of moving the ring from position P(0) to position P(+1).

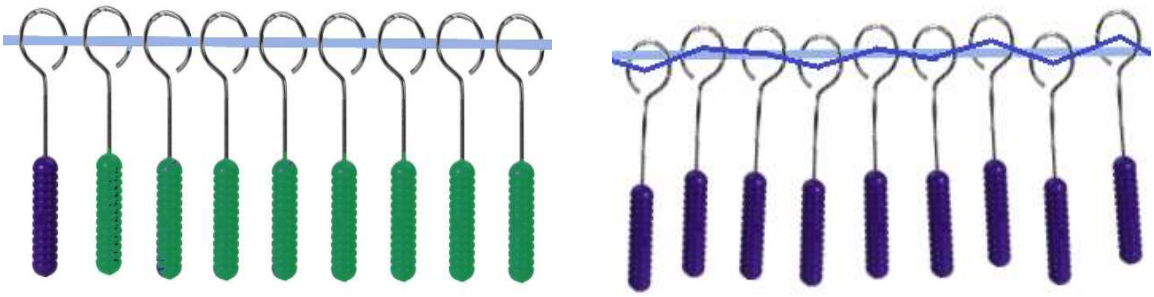
[45] https://www.researchgate.net/publication/373195543_The_execution_of_a_nerve_spiral_requires_the_compelling_cooperation_between_an_internal_secondary_and_an_external_primary_focus_-_The_clarification_of_all_grasping_actions

[46] When one delves into the explanatory model, it becomes apparent that creating an action trajectory shape is necessary to initiate any motor action, but it does not need to be precisely followed. This underscores the essence of a very frugal system. In the early stages of an action trajectory, deviations from the intended path are often acceptable as long as the endpoint is more accurately defined. However, with the nerve spiral, a continuous careful execution is required from the outset, making this task much more complex than most other motor actions.



Images: The explanatory model of the motoric movement action provides a tangible example with the marble in the marble run, illustrating the continuous reciprocal perception-action coupling within any conceivable motoric action. From the perspective of the marble's current position, one can perceive the relationship within the entire marble run, and vice versa, one can perceive the relationship with the marble's current position from the perspective of the entire marble run. In the nerve spiral, this reciprocal phenomenon is also clearly evident and present in a similar manner. Because in our worldly dimensions, it is just a mere fact that all positions P of any moving object, including a ring attached to a handle, must emerge from each other, meaning that the perception of the ring's movement is always captured in one single line segment shape. In which the current position P(0) of the ring will always form the precise separation between the already manifest positions P(-x) and the still latent positions P(+x). In which could be further added that the perceptual image of the still latent action trajectory involves future projections that must arise from the observation of the movement of all subsequential manifest ring positions prior to the current position P(0).

The perceptual image of the entire action trajectory shape thus also represents an image of its very beginning, and at the outset of the action, we will try to guide the ring to follow that beginning. However, even during the bridging to this first position, due to the aforementioned mutual autonomous dependency of the internal and external focus, the ring will inevitably deviate[47] from the perceptual image. It is an absolute factual given that cannot be avoided, and it would quickly lead to chaotic action trajectories[48] if there were not a system capable of mediating these deviations.



[47] As indicated in footnote 5, this precisely exemplifies an optimal parsimonious model, where precision isn't necessary, but merely provides a general (albeit compelling) direction. The nerve spiral deliberately plays with this concept, demonstrating that precision is indeed required to avoid touching the spiral. However, the ratio between the ring and the spiral allows for some deviations, indicating that while you can execute action trajectory shapes very precisely, you can never produce an identical action trajectory shape. If that was required, the execution of this task would become impossible. The task, where you only need to reduce the distance, opens up countless more possibilities and shows that the bridging process is just one part of the task.

[48] The description of the cortical streams within the motoric movement action *car driving* is particularly notable in this regard. If deviations from the driving lane on a highway do not lead to corrections the exponential product will soon lead to accidents. Deviation upon deviation will cause an exponential grow due to the fact that they belong to two complex subsystems.

Contact: kwillinq@gmail.com Website: https://www.explanatorymodel.nl/ – N.J. Mol

Images: The perceptual image of the latent action trajectory shape, constructed within the tactical movement action (TMA), depicts a smooth line segment shape. However, during the actual execution, the ring will definitely deviate at every position P within that perceptual image due to the autonomy of the internal and external focus. This necessitates redirecting the ring back to the original perceptual image to prevent a stacking of deviations. In practice, this means that a corresponding adjustment in the remaining part of the latent action trajectory shape must be made from the micro-deviation[49]. Similar to a marble in a marble run, the ring in relationship to the action trajectory shape will become a part of a continuous mutual perception-action coupling, in which the dorsal stream primarily monitors the actual position of the ring towards the action trajectory shape, and vice versa the ventral stream primarily monitors the complete action trajectory shape towards the actual position of the ring. In the nerve spiral, it is abundantly clear that this dual reciprocal coupling inevitably leads to deviations or touches of the ring with the spiral, and that the ring can only follow the action trajectory shape in a zigzag motion. However, the ingenious mediation of the cortical streams ensures that the action trajectory shape appears deceptively straight.

Within there the explanatory model of the motoric movement action illustrates that the execution of action trajectory shapes indeed encompasses the essence of motor tasks, and that success hinges on the meticulous management of deviations of the action object within the action trajectory shape. Therefore, it ideally presupposes a mutually reinforcing system that continuously monitors the relationship with the action trajectory shape from the current position of the ring, and conversely, constantly monitors the actual position of the ring from the perceptual image of the complete action trajectory shape. The explanatory model thus implies a rather heavy correction system, and based upon current scientific literature, it concludes that the conceptual steps within the explanatory model precisely presuppose what is described (neuro-)scientifically regarding the processing of perceptions: namely, the functionality of the dorsal and ventral stream. At every time *t* or at every position P, all observations are processed by the ventral and dorsal stream in such a way that deviations simply cannot escape attention. The ventral stream primarily processes deviations from the perceptual image of the entire action trajectory to the actual position of the ring, while the dorsal stream does so vice versa, primarily from the actual position of the ring to the perceptual image of the entire action trajectory shape. The mediation of these two processing streams leads to continuous micro-adjustments of the original perceptual image of the latent action trajectory shape, happening so ingeniously and swiftly that the absolute zigzag and accordion-like deviations barely stand out, making the executed action trajectory shapes appear deceptively straight.

4. <u>The cortical streams mediate two autonomous groups of deviations within every conceivable action</u>

The preceding paragraphs extensively delve into the fact that the action object will inevitably deviate from the perceptual image of the latent action trajectory shape, determined within the tactical movement action, when the action is actually performed. The occurring deviations of an action trajectory involve two autonomous phenomena[50], which relate to the words *line* and *shape* in the compound term *line segment shape*. The explanatory model demonstrates that they are observed and processed completely separately, yet simultaneously. Driving and cycling (without hand brakes) show, beyond any reasonable doubt, that the deviations in relationship to the line and shape are autonomously observed and processed.

[49] You can speak of micro-adjustments or of updating c.q. renewing the perceptual image of the remaining latent action trajectory.

[50] In essence, they form two complex subsystems within the larger phenomenon of the whole cortical stream operation, revealing that perceiving deviations c.q. the processing of deviations leads to an unprecedented variety of hybrid perception processes. This article does not delve further into this complexity.

Images: The deviations within each action trajectory shape involve two autonomous phenomena, as indicated by the explanatory model, referred to as the zigzag process and the accordion process. In car driving and cycling (without hand brakes), it becomes immediately apparent that steering exclusively influences the *movement within the shape* (!) of the action trajectory. This defines the explanatory model as mediating deviations along the x-axis and causing the zigzag process. Additionally, it becomes equally evident that using the pedals exclusively influences the movement *within the line* (!) of the action trajectory shape. This defines the explanatory model as mediating deviations along the y-axis and causing the accordion process. Therefore, in driving, it becomes crystal clear that (processing the) perceptions in relationship to the shape have absolutely nothing to do with (processing the) perceptions in relationship to the line. In which it is essential to note that processing observations regarding filling the latent line with the manifest positions P within the external (primary) focus solely involves the perception of the *tau*-value and is thus actually generated solely by the pedals of the car or bicycle. Only the speed within which the line is filled determines the duration of the action, thus finalizing the action.

Deviations along the length axis or y-axis of the action trajectory shape involve deviations of the movement of the action object over time. They are related to determining the *tau*-value[51] within a motor action, and deviations of the action object along the line can be characterized as an accordion process. Deviations along the width axis or x-axis of the action trajectory shape involve deviations of the movement of the action object within the shape and can be characterized as a zigzag process.

5. The zigzag process and the accordion process during the actual movement action (AMA) when executing the nerve spiral game

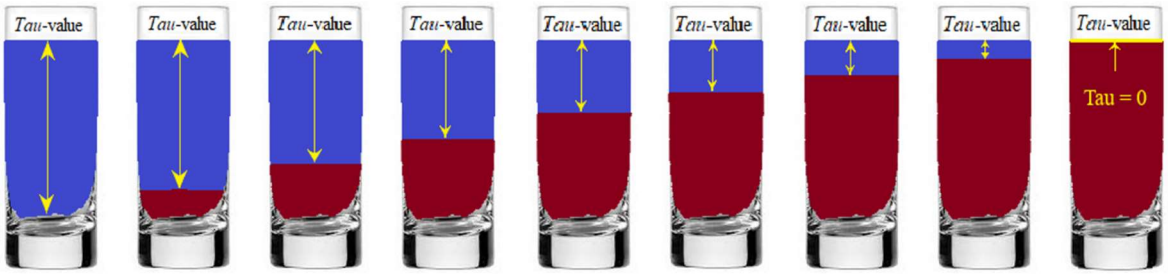
The explanatory model of the motoric movement action reveals that the zigzag process and the accordion process are inherent in every conceivable action[52]. However, in other actions, demonstrating this is much more challenging than within the aforementioned cycling or car driving. Nevertheless, in all actions, one must consider separate pedals and a steering wheel that autonomously influence the construction and mediation of the latent action trajectory shape, which will then be processed through hybrid forms of these phenomena. While the zigzag process (the steering process) can be adequately depicted in animations for most actions, the accordion process cannot.

[51] https://www.researchgate.net/publication/375902347_The_execution_of_an_external_action_trajectory_shape_over_which_the_ring_moves_dictates_all_internal_sensorimotor_perception_processes_within_the_nerve_spiral_The_tau-coupling_process_shows_that_we_do

[52] While this imposes greater demands on organismal development, conversely, it allows for a compelling demonstration of its seamless integration within an ecological framework. The dichotomy that distinguishes a separate x- and y-axis component actually constitutes the breakthrough that allows us to reduce highly complex perception processes to such seemingly simple phenomena.

Images: The zigzag process in any conceivable action can easily be represented in an animation. Due to the fact that the primary focus can only be executed by the autonomous secondary focus, the action object (respectively, the ring, the pointer, and the spoon bowl) will definitely deviate from the perceptual image of the latent action trajectory shape in width. Moreover, the essence of the game in relation to the nerve spiral is precisely the fact that a ring will "zigzag," making the nerve spiral just as convincing as driving a car or riding a bike concerning the explained phenomena.

The accordion process (the pedal process) when executing a nerve spiral is difficult to depict in an animation because it involves compressions and elongations of time[53]. Nonetheless, similar to driving a car, you must realize that you can never move the ring identically in time along a spiral. You can quickly observe empirically that they will vary infinitely within certain fluctuation boundaries.



Images: In the motoric movement action *pouring*, the accordion process is still difficult to capture in an animation. However, it can be factually stated that when filling a glass, as a very rare exception, there are absolutely no deviations within a zigzag process. The cortical streams are fully dedicated to the accordion process during pouring.

[53] Wherein it should be noted for the record that the pointer does not move back within the action trajectory shape.

Contact: kwillinq@gmail.com Website: https://www.explanatorymodel.nl/ – N.J. Mol