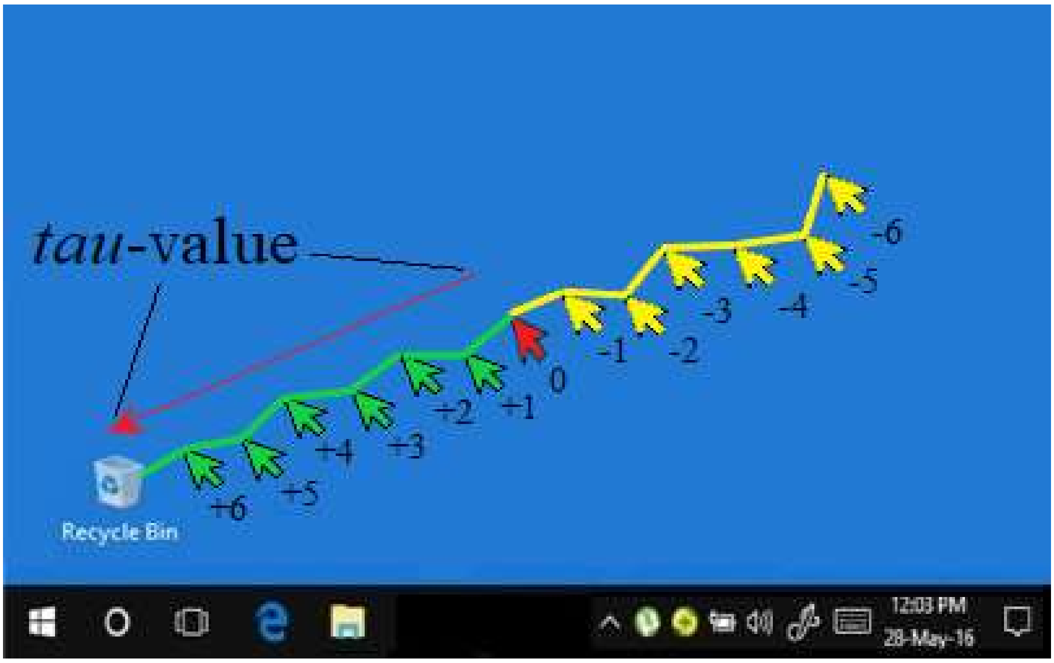
Within a computer task the cortical streams will have to mediate the egocentric zigzag movement of the pointer toward an icon



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

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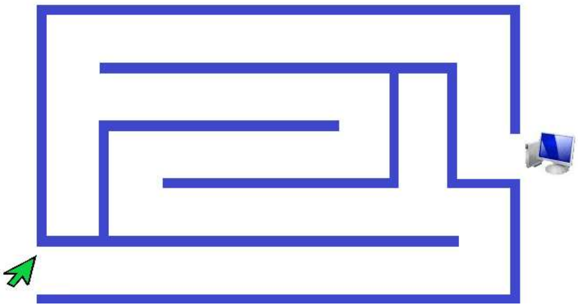
Introduction

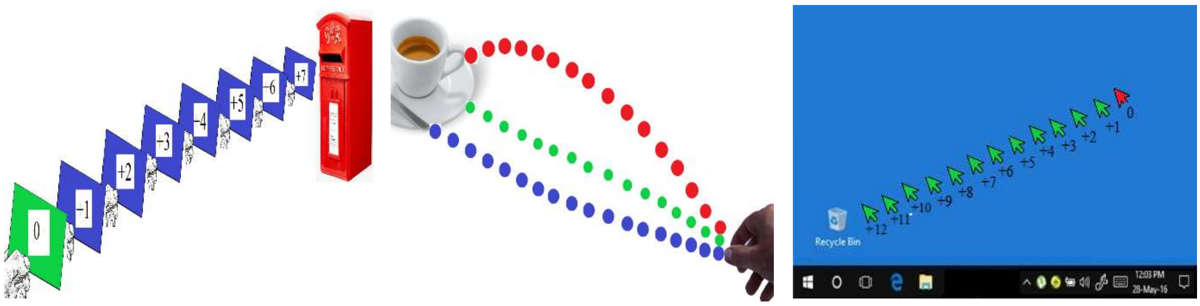
The current scientific perspective views the execution of motor actions as a single, indivisible process because it assumes only one focus in relation to the execution of a single action. It is assumed that in catching a ball or grasping a coffee cup, the perception processes are mainly concerned with these objects, upon which a motor plan (movement plan) is then formulated to get them in hand. This explanation presupposes a significant degree of automation of the movement of the hand (the fingertips) due to the dominant or leading perception of the ball or coffee cup. After all, there is only one focus to be divided. Consequently, in scientific research, the (perception of the) movement of the hand has so far taken a subordinate place.
According to this explanation, in computer tasks, such as moving a pointer towards an icon, it is assumed that the perception processes continually remain focused on the icon. Here too, due to this leading focus, a significant degree of automation of the pointer's movement is assumed, and little further attention is given to the perception processes in relation to the movement of the pointer.
Since 2016, however, a new explanatory model has been developed that sheds a completely different light on the execution of motor actions. It encompasses a universal explanation that shows that the execution of any conceivable action always requires the simultaneous perception of three autonomous foci, in accordance with J.J. Gibson's theory, which compels both the movement of the animal/organism as well as the movement of the environment. In catching a ball or grasping a coffee cup, one autonomous focus remains concerned with (the movement of) the ball and/or the cup as an environmental object, which universally represents a catching action. The other two autonomous foci are concerned with the perception of the movement within the egocentrically executed action, i.e., with the movement of the hand (the fingertips) along an action trajectory shape (towards the ball and/or the coffee cup), which universally represents a throwing action. Thus, the explanatory model confirms the autonomy of perceiving (the movement of) the ball and/or the coffee cup, but also reveals the novel insight that the throwing action of the hand (fingertips) is also a completely autonomously perceived part of the action. The same clarification leads to the confirmation of the autonomous perception of the

icon within computer tasks, but conversely, it is also formulated that two foci are engaged in autonomously perceiving the movement of the pointer.
Precisely because the scientific relevance of this aspect has never been recognized, this article specifically focuses on the two foci that belong to the throwing action of a pointer within an egocentrically executed action trajectory shape in relation to, for example, moving a pointer towards an icon on a computer screen. It convincingly demonstrates that the pointer can solely be autonomously moved in a zigzag manner within an action trajectory shape. The cortical streams, entirely in accordance with the current scientific literature, must mandatorily mediate this process, and the explanation can only be understood if one realizes that our perception processes must be egocentrically focused on the autonomous guidance of the pointer along an action trajectory shape toward the icon.

1. <u>The main goal of the tactical movement action (TMA) encompasses the construction of a perceptual image of a latent action trajectory shape between the current position of the pointer and the intended icon</u>



Supported by scientific evidence[1], 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 a computer task is to create a perceptual image of a latent action trajectory shape between the current position of the pointer (position A) and the desired icon (position B). The explanatory model demonstrates that during this phase, we are indeed largely focused on all physical dimensions of the icon 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 formation of a perceptual image of a latent action trajectory shape between the current position of the pointer and the icon also indicates that we strategically determine beforehand whether the space between the pointer and the icon (in the very near future) can be filled or bridged by a continuous trajectory shape of all dimensions of the pointer. The explanatory model provides irrefutable scientific evidence, and you can quickly conclude from your own empirical experiences that one creates a completely different action trajectory shape when you first have to navigate through a labyrinth on a screen before reaching the icon.



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

[1] 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

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 pointer, one must perceive the movement of the action object during the bridging process, as only the pointer, 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 pointer, 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 pointer towards the icon. This contrasts with the traditional perspective of science, which remains constantly focused on the icon itself. During the actual movement action (AMA), our main concern is the egocentric bridging process of the pointer, 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 icon itself is not any longer the focal point, but rather the movement of the pointer towards it c.q. the bridging of the void (!) between the current location of the pointer and the icon 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 pointer and the icon can be filled by a continuous line of all dimensions of the pointer. This means that all positions P between the current location of the pointer and the icon 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 action trajectory, we are mainly focused on the perception of three positions: position P(x-1), where we just came from, position P(x), where the pointer is now, and position P(x+1), the perception of the next position where we need to move the pointer. In this phase, we are primarily engaged in the aforementioned bridging process and only monitor whether the gap between the pointer and the icon is closing. This also reveals another essential ecological novelty, showing that during the actual movement action, we are indeed not concerned with the icon itself, but only with reducing the number of latent positions P between the pointer and the icon.

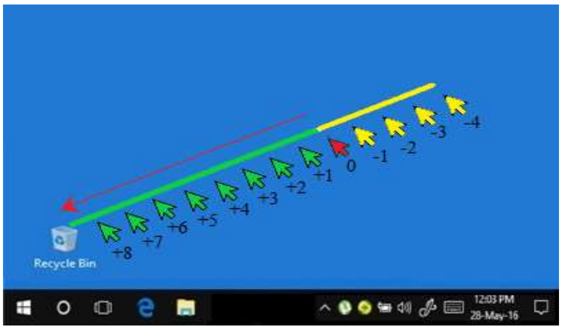
2. <u>The reciprocal dependency between the internal and external focus results in absolute deviations of the pointer within the perceptual image of the latent action trajectory shape</u>

The explanatory model of the motoric movement action unequivocally illustrates within the context of moving a pointer towards an icon on a computer screen that two foci always arise. We can only guide the pointer along an external action trajectory (from A to B) 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. In this motor action, it is immediately apparent that the perception of mouse movements has absolutely nothing to do with the perception of pointer movements.
However, as the explanatory model now demonstrates that the movement of the pointer within the external action trajectory shape is going to fulfil the essence of the task, an intriguing phenomenon of reciprocal dependency emerges. Only internal motor movements towards the computer mouse can lead the pointer externally along an action trajectory shape, yet the progression of the pointer within that trajectory will, as the primary focus, dictate those internal motor movements. The inevitable consequence of this observation encompasses that it is not a matter of whether the pointer will deviate

within the perceptual image of the latent action trajectory shape, but rather that this is an absolute certainty. In which this absoluteness logically stems from the factual nature of the autonomous perception of both foci.

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 move the pointer from a random position A to an icon, our main endeavour will primarily become to initiate the bridging process of the pointer in which the perceptual image of the latent action trajectory shape serves as an open yet compelling guiding[2] phenomenon. This means that we aim to *step by step* (!) reduce the distance between the current position of the pointer and the icon, starting with the first step of moving the pointer from position P(0) to position P(+1).



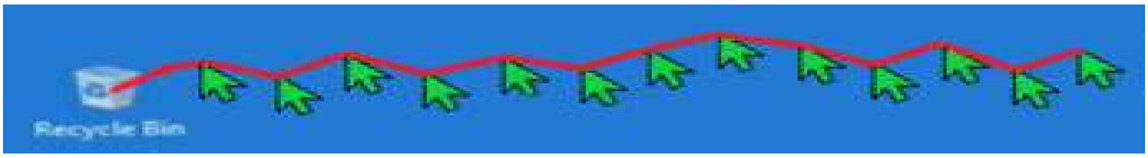
Images: The explanatory model of the motoric movement action provides a tangible example with the marble in the marble run, illustrating the continuous reciprocal perception-action coupling within any conceivable motoric action. From the perspective of the marble's current position, one can perceive 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. Although all this remains invisible when moving a pointer, it is present in an equivalent manner. Because in our worldly dimensions, it is just a mere fact that all positions P of any moving object, including a pointer, must emerge from each other, meaning that the perception of the pointer's movement is always captured in one single line segment shape within computer tasks. In which the current position P(0) of the pointer 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 pointer positions prior to the current position P(0).

The perceptual image of the entire latent 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 pointer 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 pointer will inevitably deviate[3] from the

[2] Upon perusing the explanatory model, one will start to realize that the construction of a perceptual image of a latent action trajectory shape is necessary to initiate any motor action, but it doesn't need to be followed precisely. That's the essence of a highly economical system. In the initial stages of an action trajectory shape, it's not a problem at all if the pointer deviates, as long as the pointer comes closer to the endpoint. However, without a (precisely global) perceptual image of a latent action trajectory shape, motor actions cannot commence and the explanatory model introduces the term "precise global" in this context. The perceptual image of the latent action trajectory shape must precisely indicate the global (fluctuation boarders of the) direction it should take.

[3] As stated in footnote 4, this precisely illustrates an optimal parsimonious model, where nothing needs to be executed very precisely, but only gives a general (albeit compelling) direction. If you were only able to move a pointer in an identical manner each time, moving a pointer toward an icon would become an impossible task.

perceptual image. It is an absolute factual given that cannot be avoided, and it would quickly lead to chaotic action trajectories[4] if there were not a system capable of mediating these deviations.



Images: The perceptual image of a latent action trajectory shape, constructed within the tactical movement action (TMA), depicts a smooth line segment shape from the pointer toward the icon. However, during the actual execution, the pointer, akin to a ring in relationship to a nerve spiral[5], 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 pointer 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[6]. Similar to a marble in a marble run, the pointer in relationship to the whole 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 pointer towards the action trajectory shape, and vice versa the ventral stream primarily monitors the action trajectory shape towards the actual position of the pointer. The nerve spiral clearly demonstrates that this double reciprocal coupling inevitably leads to deviations or touches of the ring with the spiral, causing the pointer to follow the action trajectory shape in a zigzag movement. However, the ingenious mediation of the cortical streams ensures that the action trajectory shapes appear 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[7]. Therefore, it ideally presupposes a mutually reinforcing system that continuously monitors the relationship with the

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.

[4] 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.

[5] 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

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

[7] One must be able to stop at the right distance behind the waiting car and not bump into it, one must be able to push away an opponent in a precise *tau*-coupling process at just the right moment, and not a moment earlier or later; one must bring food precisely to the mouth, and the fingertips must also stop precisely at the coffee cup without knocking it over repeatedly.

action trajectory shape from the current position of the pointer, and conversely, constantly monitors the actual position of the pointer from the perceptual image of the action trajectory.
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 pointer, while the dorsal stream does so vice versa, primarily from the actual position of the pointer 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[8], 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.


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)

[8] 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.

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[9] 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 when moving a pointer towards an icon in a computer task

The explanatory model of motoric movement action reveals that the zigzag process and the accordion process are inherent in every conceivable action[10]. However, in other actions, demonstrating this is much more challenging than in 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.

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 letter, the pointer, and the spoon bowl) will definitely deviate from the perceptual image of the latent action trajectory shape in width.

The accordion process (the pedal process) when moving a pointer to an icon is difficult to depict in an animation because it involves compressions and elongations of time[11]. Nonetheless, similar to driving a car, you must realize that you can never move the pointer identically in time along an action trajectory shape. You can quickly observe empirically that they will vary infinitely within certain fluctuation boundaries.

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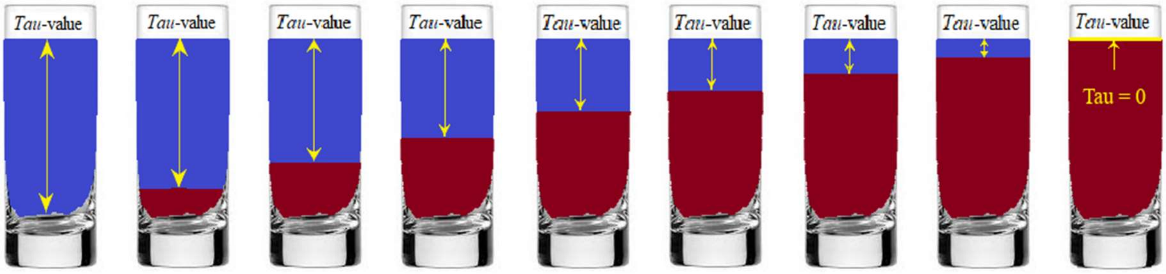
[9] https://www.researchgate.net/publication/375121264_The_tau-coupling_process_when_clicking_an_icon_shows_that_we_absolutely_do_not_need_a_motor_plan_Executing_an_external_action_trajectory_shape_within_the_external_primary_focus_dictates_all_internal_s

[10] 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.

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



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.