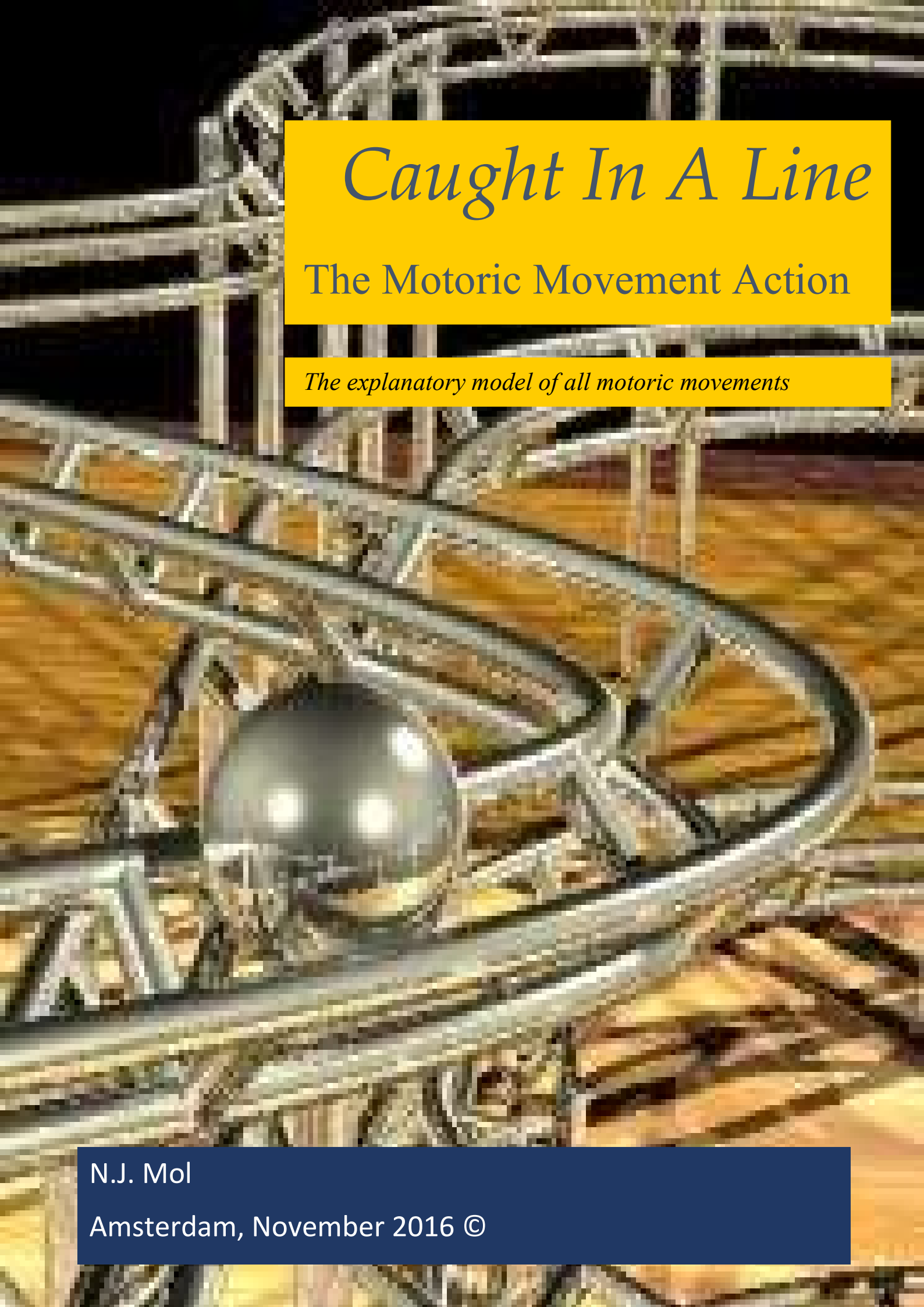

Caught In A Line

The Motoric Movement Action

The explanatory model of all motoric movements

N.J. Mol

Cover: *The marble run*

What is so fascinating about a marble run? You release the marble at the top and you know that a round object will roll down influenced by gravity. Is it because we let something move what can't move by itself? Is it because something is still moving while our effort stopped a long time ago? Or is it the fact that we impose our will to the marble to follow a defined path? Whatever the answer might be it will remain fascinating to stand in a mountain stream in summer and influence the water stream by just changing a few rocks. We are not able to control matter but we are able to control the direction of the matter.

“I am feeling like a million, though I haven’t got a dollar, shilling or sue, still I am feeling like a million and I want to get it over to you”

“I am feeling like a million though I couldn’t buy a collar, a necktie or glove still I am feeling like a million; Is it you? Is it me? Is it love?”

Dick Jurgens and his Orchestra – Singer: Ronnie Kemper

For Anja

Caught In A Line

The Motoric Movement Action
The explanatory model of all motoric movements

Author: N.J. Mol

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Preface

"CANCER IS CURED!" That exact headline will one day cover the front sheets of journals this century. Maybe even this coming decade. Cancer research has been confronted with the same problems like every other big research topic. A naïve first phase in which cancer was looked upon as being one manifestation and where the phase of defining the first research question was one of the most difficult phases. But finally it will lead up to that day. The next century cancer will be described in history books as a disease that once was and was as deadly as measles, small pocks and flu. Than we talk about cancer in the past tense. Everything will be clear then. How it appears, how we can prevent it and how we can get rid of it. Then the research topic is closed.

How will a researcher in the field of cancer know that he explained it all? I think we then have to look how mathematical proof is gained. At the moment mathematicians are solving important mathematical topics. A mathematician involves in his research all necessary variables which the topic imposes. All ideas for solutions are constantly compared to these requirements. When there is a full evidence everything will fall into its place. Then it doesn't matter anymore how you shoot at the evidence it answers all previous developed research questions. The evidence can be considered as one whole and proven unit, and is never to be touched again. It will feel like that too. Of course colleagues will have to test it but the mathematician is already convinced. Within his code of ethics he himself was the biggest critic of his own findings during the evolution of his research. A researcher must shoot at his own work with such an intensity that the test of colleagues will only be a formality. Only then a researcher will reveal his findings.

By the way I am now outlining an image that finding a full prove is common among researchers. The opposite is true. Most researchers will never experience that brilliant moment. A few will experience it once in their lives and very few two times or more. To definitely solve research questions in an unambiguous way takes a long journey where the journey itself maybe is more important than the final solution. Researchers work hard to fill the blanks which will occur along the way. And like I said earlier the hardest part might be the beginning. Unfortunately one mainly looks at the person who fits in the last piece of the puzzle. In science it is all about the process of increasing insights. In science that is the way. Somebody will once cure cancer. But only as a part of a process of increasing insights and as a consequence of thousands of hours of effort by many.

I solved the research topic of the Motoric Movement Action. I found the model which explains how every motoric movement is working at the primary, the functional, level. The primary level describes the processes which are linked to the obvious visual actions. So I don't describe for example cellular processes or which parts of the brains are involved. These are layers further away from the primary

level. To put it in other words, a mere mortal is able to understand it. My explanatory model explains all conscious motoric movements which people make with a purpose. There is a wide range of motoric movements involved. Amongst other actions it ranges from wandering around bored, driving a car to talking and blowing out candles and it is even possible to range the phenomenon of facial expressions under the explanatory model of the Motoric Movement Action.

The proof is complete. The perspective from where the Motoric Movement Action is explained is the final perspective. One cannot find other perspectives. The explanatory model gives a uniform answer to all questions raised by the Motoric Movement Action. It doesn't matter how you shoot at it, there will be no holes.

The book in front of you now has been written shortly after I finished my first book with the title "Watch The Ball Trajectory!". The writing of that book was my primary goal. However I noticed, during the development of that book, that the explanatory model of the Motoric Movement Actions in tennis contained an universal truth. I was able to come to that conclusion because the Motoric Movement Actions in tennis can be considered as one of the most complex actions we execute. Simpler Motoric Movement Actions could easily be fit in the line of thought and it that way were easy to assess. The explanatory model didn't budge as well and was confirmed continuously. The same happened when I compared the explanatory model with research results of affiliated scientific research. No harm was done. In fact the opposite happened. It explained all phenomena and it opened closed doors continuously. Even while writing the book I kept making discoveries.

Besides that I saw that affiliated scientific research struggled to appoint all relevant parts. I noticed a confusing usage of parts in several scientific disciplines. One clear model could definitely make an end to this. The explanatory model of the Motoric Movement Action is able to provide a uniform use of language and a uniform approach. The Motoric Movement Action is part of a wide range of disciplines. The explanatory model can be used in the research field of perception processes, motoric learning, rehabilitation therapies, neuron mirror imaging, flow, focus, robotics etc.. It will largely increase the chance of interdisciplinary exchanges.

So, however my first book "Watch The Ball Trajectory!" explains the whole model, I believed it is a good thing to also explain the explanatory model to all motoric movements in general and to centre it from that angle. This book shines a different and more light to the Motoric Movement Action. It approaches the Motoric Movement Action in general and not specific out of the perspective of tennis. Many things I couldn't mention in a *tennis book* could be mentioned in here.

In "Watch The Ball Trajectory!" the explanatory model towards tennis is fully explained and elaborated. Besides the explanation of the game I also dare to state here that I fully comprehend the technique models of the elite players in tennis. I understand them and are able to execute them. This makes that tennis is fully explained ….. till now. Till now because, as I explain in "Watch The Ball Trajectory!", technique models will probably never stop to develop.
I can't go that far in other Motoric Movement Actions. Although the explanatory model remains unharmed, I leave the full appointing of specific Motoric Movement Actions to the specialists in these fields. So the full appointing in tennis can be regarded as an intent to come that stage in other disciplines.

I also think that the importance of this book is not solely depending on the contents. With the maybe more subjective indications I bring forward in this book it is not only about the content but also about the way of reasoning and the way in which solutions are found. I have a strong feeling that these non-conventional angles can contribute a lot to further research.

Freek de Jonge – De Mars (1981); "De steen waar de een over struikelt is vaak voor de ander de muur waartegen hij aanloopt"[1].

This is an independent and autonomous book. Still I hope you will read "Watch The Ball Trajectory!" as well. For tennis players it is a must of course. For others who have more interest in a general explanation of the Motoric Movement Action an insight in one of the most complex motoric movements, like tennis, shows very well the borders of the Motoric Movement Action.
In my opinion the books form very good illustrations for each other. Because I wanted to publish them at the same time I consider them both as additional evidence. While I write this nobody ever read one syllable and I mainly sit here feeling that I have to come up with prove. By illuminating one of the most complex Motoric Movement Actions in all its facets and by illuminating the Motoric Movement Action as broad as possible I hope you will discover that the explanatory model can be applied to all motoric movements and never gets a scratch.

I have chosen a book form. That has several reasons. I introduce a completely new insight. With a wide variety of consequences and applications. So there is not for example a narrow formulated goal out of a specific scientific discipline. This form gives me the freedom to share with you all my findings and will not limit me like a more scientific approach would. Of course I want to reveal the explanatory model but that doesn't deny the fact that I also want to brainstorm to create a circle of increasing insights. Development will only flourish if people dare to offer lose fragments of thoughts. Still I tried to record everything in an objective way and to follow the code of ethics in science.

The book in front of you explains the Motoric Movement Action out of a complex system. Books are very well suited for linear approaches but not for complex ones. A complex system is complex because all the parts have complex relations with all other parts. The disadvantage of a book might be that a reader is able to get a linear idea of it all. Please keep in mind that a complex system is involved.

Although this book is about all Motoric Movement Actions, you will find many sports illustrations. Images can help a lot in making things clear rapidly. However, it doesn't matter where you look, but illustrations of action trajectories or movement trajectories are hard to find. Even in sports the supply is limited. The explanatory model is new and never translated into images. I hope that skilful people are able to add appropriate illustrations to the explanatory model in the near future. The DemoClip[2], the basic proposition of "Watch The Ball Trajectory!", was a lucky find and completely fulfils the demands. Till now it is the only moving footage with which I can clarify the explanatory model. I actually used almost all the illustrations I could find. So the supply was mainly leading the choices. Fortunate enough there is a vast supply of traffic situation images used in traffic exams.

In general I want to thank all the people who gave me the ideas to do things in a certain way or to not do things in a certain way. I respect all the people who put in an effort to do a kind of research and then make it available to third parties.
I want to thank Anatoly Antipin for all the pictures with racket animations and ball trajectory animations.

[1] Translation: "The stone which causes one man to stumble might be a wall for others blocking the road".
[2] See "Watch The Ball Trajectory!" – Introduction; https://www.youtube.com/watch?v=JuD4cLlt5ik

Introduction

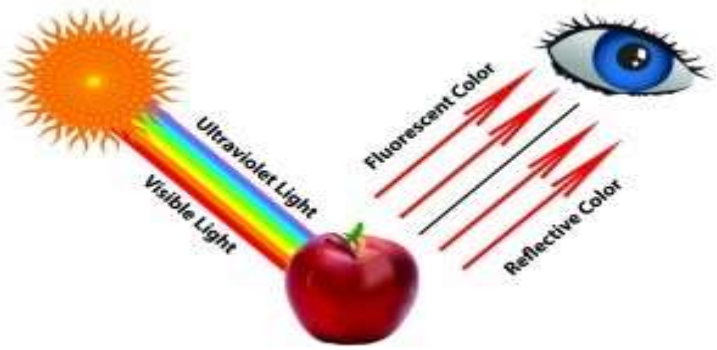
If I look at my red wall, I see the colour red. And red is red. As a child you are certain about that fact. Later scientific and philosophic explanations are still hard to comprehend.

"Newton observed that color is not inherent in objects. Rather, the surface of an object reflects some colors and absorbs all the others. We perceive only the reflected colors.

Thus, red is not "in" an apple. The surface of the apple is reflecting the wavelengths we see as red and absorbing all the rest. An object appears white when it reflects all wavelengths and black when it absorbs them all.

Red, green and blue are the additive primary colors of the color spectrum. Combining balanced amounts of red, green and blue lights also produces pure white. By varying the amount of red, green and blue light, all of the colors in the visible spectrum can be produced.

Considered to be part of the brain itself, the retina is covered by millions of light-sensitive cells, some shaped like rods and some like cones. These receptors process the light into nerve impulses and pass them along to the cortex of the brain via the optic nerve."[3]

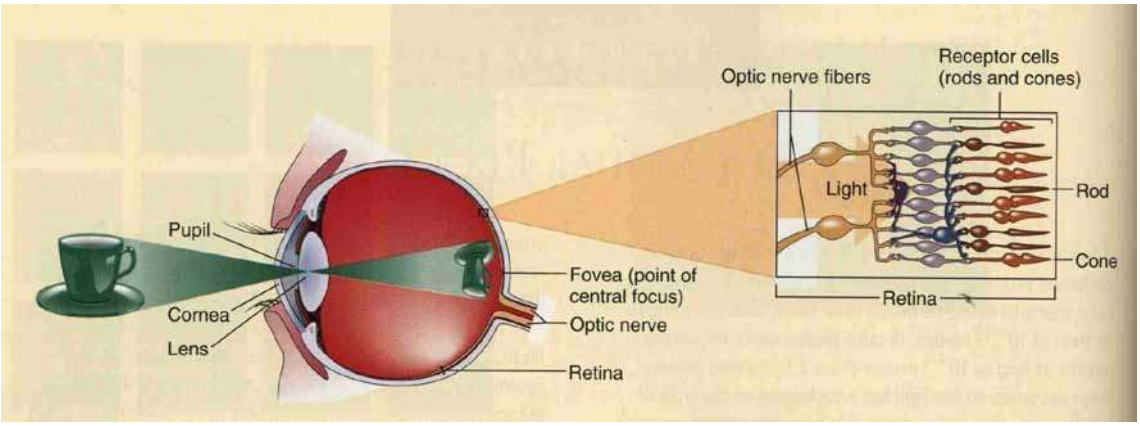


Because I don't see a red wall over there. My eyes receive specific wavelengths which make an appeal in me to experience the colour red. Every visible surface of the wall or apple makes lines to receptor cells of my eyes. So there are, invisible, wavelength lines from the object to me which give the impression that the object *there* is red. But it isn't red *there*. The end of the wavelength trajectories make the colour red in my receptor cells. So the wall *there* becomes red *here*. In my eyes.

[3] http://www.pantone.com/how-do-we-see-color

Also every pixel of a movie screen at a premiere makes contact with your eyes. By beams of light. We can imagine these wavelengths making lines. Thousands maybe million lines run from the screen to the receptor cells of your eyes. So every pixel of the screen makes let's say a hundred lines to one eye. And you probably have two eyes and there are a thousand visitors in the cinema. That is an awful lot of lines. A mishmash of lines. A *matrix* of lines. Of visual lines.

Except to the eyes of the older man sitting in row three. The grandpa of the leading actor in the movie. He had to rise early and because of all the consternation he failed to have his afternoon nap. However his eyes make latent visual lines to the screen. They are obvious latent because you can see the colours pass his closed eyelids with bright flashes. The moment he will open his eyes the visual lines become manifest in a blink. Just like with the other members of the public.



But in spite of this well accepted scientific explanation I think that you also experience that a red wall is red and that you don't experience the scientific model consciously. However in this book I will also try to engage you in a similar kind of explanatory model. A model which we also don't experience consciously but is the scientific explanation of all Motoric Movement Actions. All our Motoric Movement Actions are caught in lines. And not because I want it but it is the way how our perception processes work.

Like we experience colours, so we experience movements as well. Our visual perception continuously makes images of an apple in a fruit basket. Static, still images. These static images are compared with each other every moment of time. But because the apple is lying still in the basket the consecutive images will not show any movement and will reveal the same latent matrix lines to a static observer. Of course that is different with that cyclist over there. Our visual perception also make static, still images of him every new time frame. All consecutive images of the cyclist will show a linear progression.

In that way all moving things in a surroundings form dynamic latent action trajectories in the matrix and all static things form static latent action trajectories towards an observer. The matrix will evolve from complex to very complex if the observer also starts to move. Besides this fact it is important to notice that if something moves or not moves our perception makes images in the same active way. For the visual perception the world always stands still in one image. The consecutive images create the illusion of movement. I am sure you are familiar with those *flip books*[4] with consecutive drawings. That is the way our perception functions as well. Essential for a flip book to work is that places P(0) of one drawing must have a connection with the places P(+1) and P(-1) of the bordering pictures. Then we experience objects *caught in lines* like we are used to see. When you flip the images randomly the perception can't distinguish any line. Our cognition is not able to do anything with that.

[4] https://www.youtube.com/watch?v=oAS6Oyy2XXk

Analogous to our vision this can be applied to our hearing. Sound comes to us in a matrix of sound-wave lines. Our hearing also creates a static, still *sound* image every moment of time. The connection of these separate images suggests, when they differ in tone, movement in those sounds.

Although we are able to find the source of the sound with our ears it is remarkable that we much more hear the sounds *here* and that we think we see *there*. Especially at concerts where they turned the sound volume to the maximum level you really hear the sound *in your ears*. But you will continue to see the DJ at the stage *there*. In this case the ears are correct and that conclusion should be copied by the eyes. The vile thing however is that we make a picture *here* that it looks *there*. So the moving cyclist over *there* is only becoming an image *here* and the suggestion of movement only arises because the consecutive images suggest a line *here* in your eyes.

So in every surroundings we relate to all things present. Either moving or static. In the matrix of that surroundings there are uncountable latent action trajectories. Those action trajectories connect an object we are holding, our body or a part of our body to all those objects and subjects which can be used for a Motoric Movement Action. So I can close the door of the fridge with my hand, my foot, a pan I am holding, a cool move with my bum etc.. There are many ways to close that door. And besides that there are many possibilities within each of those options. For example I can close that door with my bum in many ways. All the possible action trajectories stay latent till the moment I actually will close the door. Than one action trajectory becomes manifest. Only one action trajectory will and must be created for one Motoric Movement Action to succeed.

In one surroundings matrix also all other objects and subjects create uncountable latent action trajectories with each other. Luckily the matrix stays invisible. Otherwise you could go crazy.

> *In posting a letter the movement action (MA) shows that you have to imagine an action trajectory out of the perspective of the letter to the slit of the mail box. Only the movement of the letter will fulfil the posting task. Just like a ball in a ball trajectory only the letter will occupy all separate places P of all still standing letter images. We will never be able to control that line and we never did. The motoric movement (MM) can only execute the posting task. By making movement trajectories we can actually take care of the fact that the action trajectory of the letter will be created. Within sports the movement action (MA) forms the explanation of the game. The motoric movement (MM) is only about the playing of the game. Analogous to the letter only the ball in tennis determines the game. The Game Idea or Movement Action Idea in tennis provides the sole assignment to connect ball trajectories to chains and to make that impossible for the opponent.*

The action trajectories are always there. A car makes latent action trajectories with all locations where the car can go. A just finished letter makes latent action trajectories with all mail boxes in the world. Because a letter only carries the task to be posted (first).
It is important to realise that action trajectories are not made once we decide to post a letter but that the action trajectory is already there. It is also important to see that the action trajectory must be observed out of the perspective of the letter and that we as mail men have no control over that line. At least that is the way how our perception processes work. They perceive the action trajectory out of the perspective of the action object and not for example out of an egocentric will to post that letter. According to these perception processes a letter posts itself.

I already demonstrated this fact thoroughly in “Watch The Ball Trajectory!”. Only the ball is fulfilling the Game Idea or Action Idea of the Game Action. We only can play the game of tennis. It would be

nice if you would look at the DemoClip[5] now. The DemoClip contains the essence of my book about the Game Action in tennis. If the screen turns black it shows a few matrix lines in tennis.

"I want to take you to the DemoClip. First look at it as a spectator from the stands. At first the clip shows a rally between Nadal and Federer. We can see the characteristic gameplay. Suddenly after a few strokes the screen turns black and the only things remaining are the court and the ball trajectories. You can see the creation of a chain of ball trajectories. The end of one ball trajectory is the beginning of the next ball trajectory. It stops when one player, in this case Roger Federer, cannot continue to add another ball trajectory to the chain.
Then I want to ask you to join one of the players at the tennis court and to start the DemoClip once more. First you see one of the players around you but soon you only see ball trajectories going back and forth. Do you see the connecting ball trajectories? Do you see the chain? Now you see the Game Idea in its purest form. Not from the perspective of the spectator, not from the perspective of the player but from the perspective of the ball. The Game Idea from the perspective of the ball is to form chains of ball trajectories and to prevent the opponent doing so.
We do say: "the game is played". That indicates that the game is a separate phenomenon. Nadal and Federer play the game. They play the game with their strokes, their bodies, their appearances etc..
That has always distracted us from seeing the pure game. At the end of the DemoClip you are not distracted anymore. The game has become an abstraction and can be witnessed without interferences.

Please stay a little while more at the court. Now pause the DemoClip at the end and look at one ball trajectory. If they had played with a rugby ball little could be said about the ball trajectory after the bounce. But tennis is played with a smooth round ball. One can very well predict the ball trajectory after the bounce. But not only after the bounce. The end of each ball trajectory can very well be traced back to the beginning of that ball trajectory. And from only the beginning you can make a precise prediction about the global outcome at the end of that ball trajectory. The only source of every complete ball trajectory is situated in the beginning of a ball trajectory. The only part a player can influence is the first initial little piece of the ball trajectory. It is not like in curling that you can influence the ball trajectory along the way. I call that the Initial Phase (IP)[6] of a ball trajectory. A player needs to put all the requirements for the whole ball trajectory in the Initial Phase. So the Initial Phase is also responsible for the shape of a ball trajectory after the bounce.
I will prove that elite players form perceptions out of the Initial Phase for both incoming and outgoing ball trajectories because they need information about the global latent outcome of the ball trajectory to help them with the actual game play. Global because it can't be precise and is not necessary to be precise at that moment. The global visualization of the latent part of the ball trajectory however is essential for playing the game. It gives compelling direction to the possible continuation. So don't watch the ball but watch the ball trajectory and try to make global conclusions about the latent parts as precise as possible.

The Game Idea leads to two tennis actions. The Actual Tennis Action is solely occupied with the prolonging of the chain. It has the main task to connect one specific incoming ball trajectory to one specific outgoing ball trajectory. The Tactical Tennis Action is solely occupied with trying to prevent this prolonging process from the opponent. This is the whole description of the Game Idea from the perspective of the ball. There is nothing more. I had to find a name for the combined tennis actions. I call it the Game Action.

By appointing the Game Action I was able to draw a few very important conclusions. A moving ball is inseparable from its trajectory. Its ball trajectory. The ball is leading and determines with its place in the ball trajectory the spatio-temporal actions which have to take place from the player. But the ball trajectory is also leading. The shape of the ball trajectory will tell where the ball will be in the near future. A sound visualization of the shape of the ball trajectory out of the Initial Phase forces a ball to

[5] https://www.youtube.com/watch?v=JuD4cLlt5ik
[6] Chapter 1.4

follow that visualization. That is a new and a little bit odd perspective. This book will clarify this completely. It has to do with the multiple possibilities of vision and perception. In retrospect we can conclude that the position of the perception (P) in the old tennis action was far too limited. I will prove that the perception is controlling or better predominating the whole process."[7]

I will now translate the DemoClip to a posting task. Imagine the letter on my bureau. You see it take off from the desk without a person present. The letter flies through the air. The front door opens and closes. It flies to the elevator. It remains still for a while going to the ground floor. The elevator doors open and then you see a letter bouncing a little and moving until it reaches the mail box. It is important that you now see one long line of places P of the letter from my bureau to the slit of the mail box. The Motoric Movement Action posting is not only the standing in front of the mailbox.

Now please make a video clip of all the consecutive places P of the letter. Just like the ball trajectories in the DemoClip. And play it a few times. You see one line, one trajectory. A *letter* trajectory with no person in sight. That is the action trajectory of the Motoric Movement Action *posting*. That is the line which fulfils the essence of the task and we have nothing to do with that line. That line only has to do with the letter. And this is the way our visual perception processes witness this action. That is the premise of this book.
That is a new and a bit odd fact because we never experienced it that way consciously. We have to get used to that. Red is not red and the essence of the task of a Motoric Movement Action must be viewed out of the perspective of the action object.

For now I focus on an object. Not a part of the body. It is relative easy to convince you with that perspective. Later on the whole process must also be applied to the (outside) of body parts or the (outside) of the body. When we press a light switch the line between the little area on the outside of the index finger forms the action trajectory with the little area on the outside of the light switch that will be touched. Like the letter we don't control that line in a direct way. We can control that line on the outside of the body with movement trajectories on the inside of the body indirectly. Of course we witness movements of our body on the outside but we also know they don't arise there. What we see on the outside of the body are only the outer characteristics of inner body movements. Movement trajectories find their roots always on the inside of the body. Out of a complex system thinking approach there are always more movement trajectories. Like in the posting task the line of the action trajectory and the lines of movement trajectories are part of two different worlds. The motoric movement (MM) or technique must be observed out of the perspective of the person who wants to carry out a Motoric Movement Action. With the motoric movement (MM) belong the movement trajectories. The movement action (MA) must be observed out of the (movement) action object that fulfils the action trajectory. The different trajectories don't share anything.

[7] "Watch The Ball Trajectory!" p.20

So the task of the Motoric Movement Action can only be executed by the ball and the letter and by nothing else. And why is that conclusion important? Because our perception processes function in that way. The visual perception processes mainly assess the Motoric Movement Action out of the perspective of the (movement) action object. So in tennis from the perspective of the ball, in a posting task out of the perspective of the letter, in rowing out of the boat and in blowing out candles out of the airstream which leaves our mouth aimed at the candles.
So the primary focus within the perception processes is not aiming at the movement trajectories within the motoric movement (MM) but they look at the line which fulfils the task. The action trajectory.
That is the essence of mankind. To cognitively recognize and see the tiger is important but it is also important to know which relation it has with the line it is moving in. To achieve that we continuously make static images of all manifest places P of the tiger and draw a line through them. We combine the manifest part of that line with stored cognitive knowledge we have of this animal and so we can make a perceptual image of the latent part of the action trajectory of the tiger.

Image: The Motoric Movement Action *eating*; We have a huge amount of experience concerning the action trajectory. From a young age we learn to create action trajectories. At that age we follow a strict trainings program to get the timing and the direction right. For eating in *flow* the primary focus must be based upon the action trajectory. The action trajectory is the line from the food (!), in the bowl of the spoon, to the mouth. The movement trajectories must be automatized out of the proprioception. In this phase there is still no automatization. As you can see that disturbs the action trajectories. The movement trajectories of the motoric movement (MM) are still demanding to much attention. And that is not strange. This is the first time in life that we have to fulfil a Motoric Movement Action with an extra flexible movement trajectory (spoon). That (motoric) movement object increases the complexity of the motoric movement (MM) with a factor.

Like we execute the Motoric Movement Action *not-catching/avoiding/fleeing* with the tiger so in actual catch actions we make the same action trajectory of a movement action object that we indeed want to catch. And that is what we do in each Motoric Movement Action. From ancient times we are only interested if the food is going to the pan, if the food is going to our plate and if the food is going to our mouth. In case of this last event the visual perception of the action trajectory determines when we have to open our mouth. Out of the beginning of that action trajectory and our vast knowledge about this action trajectory we can very precisely predict in which time the latent part of the action trajectory will

have reached our mouth. That is why we don't make a saccade in the Motoric Movement Action eating. We execute the last part of that Motoric Movement Action blind.
We are not interested in visual processing our body movements in this eating task. We mainly do that in a proprioceptive way.

In this book I will start by clarifying some definitions and theories. After that I compare the perception processes of the explanatory model with current scientific research. Then I will deepen the Motoric Movement Action. I will try to illuminate the Motoric Movement Action in such a way that you get a good picture of the range of it. Subsequent the only two autonomous parts, the movement action (MA) and the motoric movement (MM), of the Motoric Movement Action are discussed separately. The last chapter is about motoric learning. It doesn't really belong to the book. I added it because in a motoric learning process the essences of the Motoric Movement Action come together and because it is an essential part of our lives. Besides that it gave me the opportunity to review all previous information in a slightly different way. In appendix A I will appoint the Motoric Movement Action *walking/running.* As an autonomous Motoric Movement Action or as a part of other Motoric Movement Actions it probably is the most performed Motoric Movement Action.

Chapter 1 - Definitions and Theories

1. The explanatory model of the Motoric Movement Action
2. The components of the Motoric Movement Action
3. Trajectories and the Motoric Movement Action
4. Perceptual organisation
5. The matrix
6. Focus
7. Complex system versus linear system

1. The explanatory model of the Motoric Movement Action

The explanatory model of the Motoric Movement Action explains the processes which the body fulfils during the execution of one Motoric Movement Action. All Motoric Movement Actions follow the explanatory model in a uniform way. The model explains that the body executes a Motoric Movement Action with the use of two autonomous parts. One can compare the two parts with for example the heart and the lungs. Two autonomous organs with obvious different functions which together provide the body with oxygen. The only two autonomous organs of the Motoric Movement Action are the movement action (MA) and the motoric movement (MM).
The essence of the movement action (MA) is situated in the fact that our perception processes perceive the Motoric Movement Action only out of the perspective of the (movement) action *object*. And not out of the perspective of the action *subject*. One is able to visualize a trajectory which fulfils the task out of the perspective of the (movement) action object. The (movement) action object will actually make that trajectory but by means of a cognitive basis, containing knowledge about the specific action trajectory, we are also able to construct the latent part of the action trajectory. In that way we are able to precisely predict what the global shape of that action trajectory in the near future will be. An accurate perceptual image of the global shape of a latent action trajectory imposes the obligation to a (movement) action object to actually follow that trajectory. That allows us to monitor and adjust this process maximally. So an (movement) action object constructs the action trajectory actively but is also caught in that line.
However this essence only explains something about the specific perception processes which accompany the task of the movement action (MA). It doesn't say anything about the execution of the task. The movement action (MA) is executed with the motoric movement (MM). With this *organ* the body took care of the fact that a completely different system, a generic motoric system, is able to execute a wide range of action trajectories. This motoric system is regarded out of the perspective of the action subject. It will take care of the fact that the (movement) action object will be transported over the action trajectory with the use of movement trajectories.
The different perspectives take care of the fact that the two organs of the Motoric Movement Action, just like the heart and the lungs, belong to two different worlds where nothing coincides with the other world. So therefor the two parts involve essentially different perception processes.
These observations might be able to construct a linear thought concerning the Motoric Movement Action. That needs to be prevented as much as possible. The Motoric Movement Action indeed contains two complex subsystems which can be appointed separately but during the execution they are part of one Motoric Movement Action. One whole complex system. The motoric movement (MM) and the

movement action (MA) happen at the same time and have a complex relationship. Not a linear relationship. What part will do what is dependent on which Motoric Movement Action is involved and under what circumstances. When you for example want to switch on the light, in a safe surroundings, then you make an initial motoric movement (MM) with your hand before you construct a definite action trajectory. Under normal circumstances you will make eye contact with the light switch when your hand is just on its way. The eye contact is needed to (re-)confirm the actual action trajectory and to observe if the action trajectory is not occupied. When the surroundings are not safe you probably will not make that *unseen* initial movement.
So the perception processes within the two organs are also working at the same time. Therefor each Motoric Movement Action demands attention for two different foci at the same time. Even in the simplest Motoric Movement Action the primary focus must be pointed at the action trajectory and the secondary focus must be pointed at the biomechanical main action within the motoric movement (MM) towards the transition point of the action trajectory.

2. The components of the Motoric Movement Action

Motoric Movement Actions can be defined as being those motoric actions in which we consciously want to complete a task with an object or a body part or the whole body and in which there is a movement involved of that object, body part or body. Motoric actions, like standing still, can only be transferred to a Motoric Movement Action if one considers the 0-movement over a timeline as a movement.

The Motoric Movement Action contains two parts. The motoric movement (MM) and the movement action (MA). The movement action (MA) is leading the motoric movement (MM). The motoric movement (MM) is necessary for the actual execution of a Motoric Movement Action. The formula MMA = MM x (MA) shows that relation in the right way.
The motoric movement (MM) and the movement action (MA) contain different lines of the movements involved. Respectively the movement trajectories and the action trajectory. They belong to two different autonomous worlds. They are not able to have any overlap. The action trajectory is shaped out of the *object* that fulfils the task. The movement trajectories are shaped out of the *subject* that executes the action trajectory. However the motoric movement (MM) is glued to the movement action (MA) on the outside. If one Motoric Movement Action wants to succeed they both have to be executed. Optimisation of efficiency and/or effectiveness of the Motoric Movement Action can only occur by optimising the product of both parts.

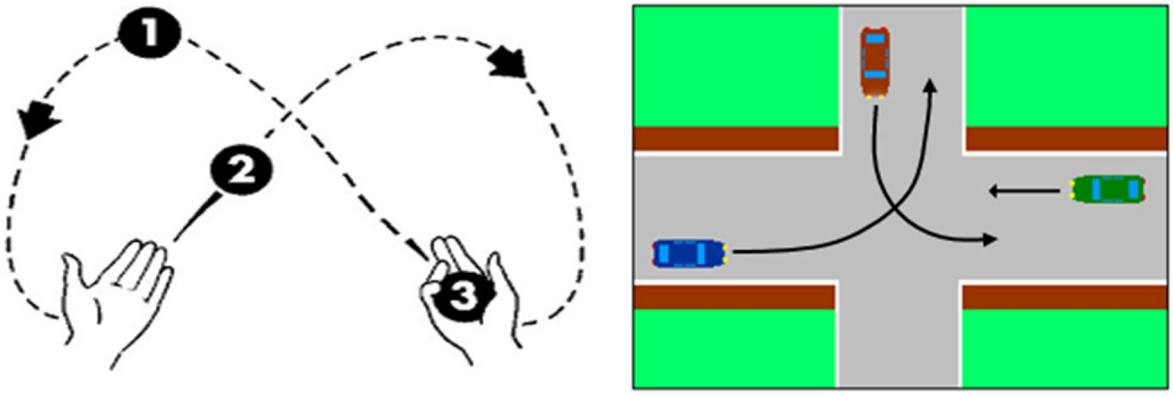


Image: In everyday activities the action idea is most of the time very simple. In juggling a cascade with three balls that idea is more complex. Three actual action trajectories are involved which must be executed and caught at the same time. One ball (ball 2) just has to be thrown in the Initial Phase of its

ball trajectory. The hand which threw that ball now mainly has to receive another ball (ball 1) which is halfway its trajectory. The catching will happen a little later. The other hand just caught a ball (ball 3) and is now preparing the Initial Phase of a new mirror ball trajectory. The action idea in the traffic situation follows the juggling cascade. The big difference however is that the cars don't want to be caught in the last phase of their action trajectories. In this they follow the Motoric Movement Action not catching/avoiding/fleeing.

Within the movement action (MA) there is always a task. The task idea or the (movement) action idea describes the progression of the (movement) action object over the action trajectory. The action idea is the line of thought in how the task will be completed over the action trajectory. The action idea is the same as the Game Idea in sports. It only has a linguistic twist.

The execution of the task belongs to the motoric movement (MM). It is executed with movement trajectories or motoric movement trajectories. The (motoric) movement idea or the execution idea contains the line of thought in how the movement trajectories will execute the action trajectory. The movement idea is, even for the simplest Motoric Movement Actions, always appointed out of a complex system. The whole body has to become one unity in every Motoric Movement Action. The execution of one Motoric Movement Action needs all body parts, either static or dynamic, to create the necessary movement trajectories. The complex technique model or movement model that is formed that way has this unity approach as its basic idea. That is why it is called the unity model.

The (motoric) movement idea of pressing a light switch is to make the body rigid in such a way that the arm will be able to push of (abduction) from the torso in such a way that the movement trajectories of the body are capable of pushing the outside of the top of the index finger against the outside of the light switch. The area of the index finger which will press against the switch is also the transition point from the movement trajectories on the inside of the body to the action trajectory on the outside of the body. The transition point can also be called the contact point.

The name Motoric Movement Action has been linguistically chosen in such a way that it would show the importance of the complete title but that it would be possible to very well divide it into two autonomous parts. Those parts had to show that two movements were involved because that is the essence of the Motoric Movement Action. It had to express that the task is fulfilled by a movement we can't control and is executed by movements we can control.
The choice for Motoric Movement Action makes it possible to appoint every action to its specific task. So we are able to appoint the motoric *juggling* action, the motoric *golf* action, the motoric *post* action, the motoric *traffic* action etc.. The movement action (MA) contains three parts. Besides the cognitive basis that is the tactical movement action and the actual movement action. So within the *post* action (MA) we can specify the tactical *post* action and the actual *post* action. So that is why I appoint in the *tennis* action the Actual Tennis Action and the Tactical Tennis Action.

3. Trajectories and the Motoric Movement Action

Every object, body part or body that is involved in a Motoric Movement Action makes a linear movement. Every place P(0) of an object, body part or whole body in a movement is always connected to the places P(+1) and P(-1) and not for example to the places Q(-1), R(+1) of S(+14). So P(0) always has a relationship with P(+4) and P(+10). But also with the places P(-4) and P(-16). That connection and for example the inertia of an object, body part or body makes it possible to create sound images of how most objects, body parts or bodies will behave in trajectories out of cognitive knowledge. An object, body part or body will shape the action trajectory actively. However a sound visualisation of a latent action trajectory will also force the action object to actually follow that line. So an (movement) action object not only creates a trajectory but is also stuck to it. It is *caught in a line*. In daily traffic we use that constantly.

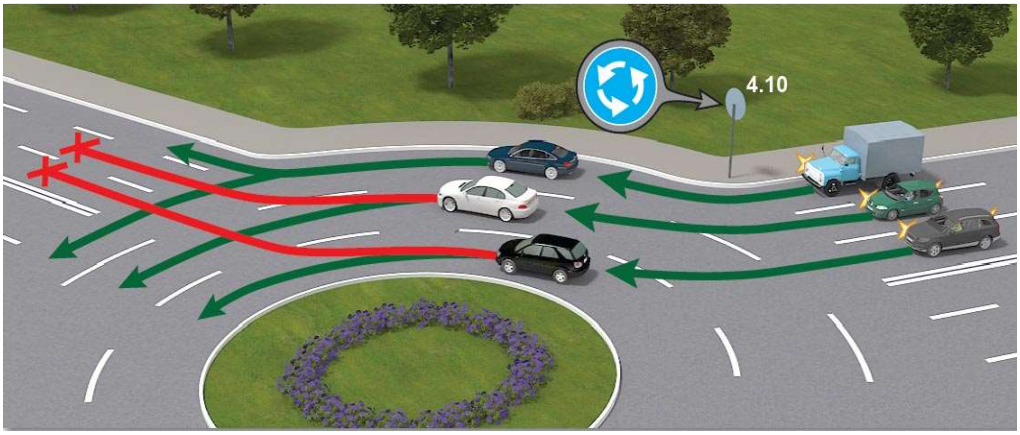
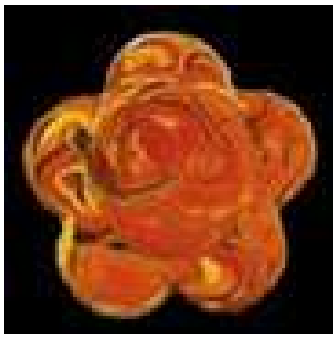
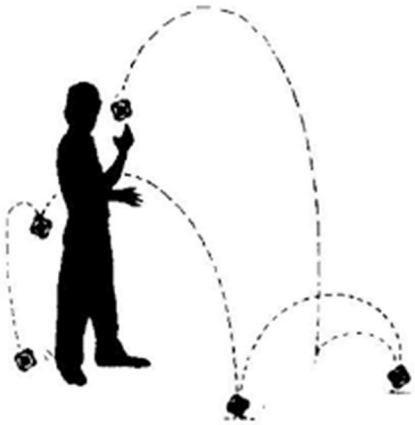


Image: In daily traffic we continuously make use of the fact that the other participants are caught in lines. Our perception processes mainly look at the latent parts of the action trajectories out of the manifest parts of those trajectories and general cognitive knowledge. We use the latent parts of the action trajectories with *nothing* to manoeuvre with our own action trajectory. This looking at nothing is an important part of our perception processes.

"Every moving ball leaves a trail. A Z-ball will show a strange and irregular pattern. But this ball also created a ball trajectory. If one could throw a Z-ball at the exact same place the ball trajectory would show big differences with the former one. No pattern will occur in the innumerous possibilities this ball has.
Moving tennis balls however do show regular patterns. A tennis ball is a smooth round ball. A tennis ball has a set relationship for every time (t) with a certain place (P). For t(0) →P(0); for t(1) →P(1); for t(2) →P(2) etc.. Ball trajectories are projections of all the points P the ball will encounter in time. They show a recurring steady pattern. A reproduction of a ball trajectory will globally show the same characteristics. If that wasn't the case tennis couldn't be played. When a ball trajectory is actually produced the ball is in front of the ball trajectory. The ball has relations with all times $t \geq 0$ and all places P. But a ball has also relations for every time $t < 0$. So for t(-1) →P(-1); for t(-2) →P(-2) etc.. After the Initial Phase a ball trajectory cannot be adjusted like in curling.



Z-ball



Z-ball bounce behaviour

So it is very well possible to make statements about the shape of a ball trajectory even if one only knows the beginning of a ball trajectory. One can predict precisely the global shape of the ball trajectory after the bounce. And vice versa from the end of a ball trajectory one can precisely predict the global shape of the beginning of that ball trajectory.

So perception mechanisms will be able to precisely predict the global shape of the latent end of a ball trajectory when a ball trajectory is just produced. That is the premise underlying this book. The ball is going to make its ball trajectory but also casts its shadow forward. The Initial Phase is determining which shape the ball must follow. There is continuous mutual relationship. The ball shapes the ball trajectory but has to follow the shape as well."[8]

What goes for the movement action (MA) also goes for the motoric movement (MM). Every motoric movement (MM) follows the same linear behavior. Every moving body part also moves over a line. A movement trajectory.

3. Perceptual organisation

"*4.2 From the retina to the brains: bottom-up processes*

The cones and rods send electric signals to the brains. On the basis of this input the brains calculate which objects caused the received stimulation pattern. The structuring of the receptor signals to meaningful objects has three main stages: 1. a primary sketch, 2. perceptual organisation and 3. pattern and object recognition.

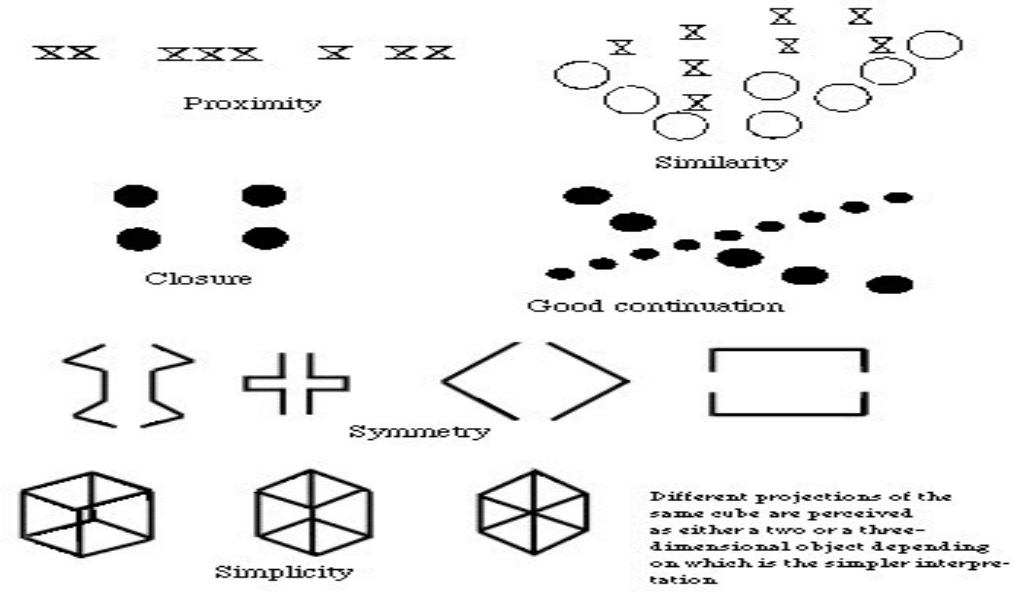
1. The primary sketch

According to David Marr especially the edges of shapes are important. He assumed that the visual system in an early stage is going to look for those places which show abrupt transitions in clarity. Mathematical algorithms which are capable to do this must fulfil 3 conditions: 1 must be able to determine which transitions of clarity are abrupt enough to form a border, 2 not only the edges but also are able to detect the orientation of the edges and 3 must be able to make a distinction between important clarity changes and clarity changes which just happen by coincidence. The end result is called the primary sketch. The signal is simplified enormously.

[8] "Watch The Ball Trajectory!" p.26

2. Perceptual organisation

The visual system then has the task to determine which edges belong to each other as being a part of the same object. The gestalt psychologists were the first ones to point to the significance of the perceptual organisation, the process in which the different edges from the retinal image are structured to bigger pieces of the puzzle with certain relationships. Two important principles in the perceptual organisation are perceptual grouping and figure-background distinction. Perceptual grouping refers to the processes which take care that elements out of the primary sketch are being seen as belonging together, as part of the same perceptual experience. Some principles of grouping are the principles of proximity, similarity, closure and good continuation. Wertheimer found that past experiences also belong to a groupings principle. Grouping principles help us to understand daily visual perceptions of the world. Besides that there is a need to make a distinction between a figure or a background. This is called figure-background distinction. Just like in the perceptual grouping there are all kind of principles which increases the chance that a certain part of the stimulus is perceived as a figure. Examples of these principles are familiarity, texture, location, form, symmetry and encirclement.



Image[9]: Grouping principles of the perceptual organisation

3. Pattern and object recognition

One suspects that the perceptual organisation leads to a representation of the input which is not completely 3D yet. This representation contains especially that information of the surfaces directly visible to the observer, in which we can call this a viewer based (viewer-centred) reference frame. The coordinate system of the visual stimulus is set by the direction and distance in relation to the eyes of the observer. Not visible parts of an object must be completed with a representation which is object oriented. That representation must be defined in object coordinates independent to the specific viewing angle of the object. To recognize an object and to activate the coupled knowledge, the viewer-centred image must be linked to a memory representation. This process is called pattern recognition."[10]

So in general visual perception is perceived according the three above mentioned phases. This is correct if we want to cognitively recognize elements of the static, still, images we are making every time

[9] https://www.siggraph.org/education/materials/HyperVis/vision/percorg.htm
[10] Psychologie; Marc Brysbaert; Chapter 4 https://syneratio.com/sites/default/files/samenvatting_hoofdstuk_3_4_5_psychologie.pdf

frame of the surroundings matrix we are in. Although for movement we actually don't need stage 3. Within stage 2, the perceptual organisation, objects are mainly recognized in interrelated lines (see image). If an unknown moving object (UFO) shows a linear relationship with all following places P of its action trajectory than the visual perception will at least register movement of all surfaces belonging to that object. For the perception it is also very important to know if something is moving. Then it becomes important what is moving.

"Many objects that move, don't move towards us, but execute movements independently. This kind of biological movements, especially human movement, we can recognize with a minimum of information. Elements from one scene which move together are prone to a strong grouping principle. When a part of the visual field moves in a certain direction irrespective of the rest of the field we have a strong tendency to observe this part as a separate group. Wertheimer calls this the grouping principle of the common fate.
In some cases we perceive movement when it is not there. If a line of light bulbs are switched on and off in a sequence from left to right we see a light moving from left to right. This illusion is called the apparent movement."[11]

So one could say that our perception wants to cognitively recognize all objects in every surroundings. The perceptual organisation is supporting this ultimate goal and offers the ability to address still unidentified objects once they start moving. This signalling function is from the beginning of time a very important part of our strategy to survive. Our perception therefore wants to see lines/trajectories and especially action trajectories that could threaten us.
One could even say that all our perception processes are focused on lines/trajectories if one considers standing still as a 0-movement according to the theory of relativity. From this angle one could state that for the perception everything moves. The observation is then cognitively judged to be standing still if the consecutive images of the observer don't show a linear difference. Think in this case about a cyclist. For the cyclist the only thing standing still is his bike.

4. The matrix

a. Definition

The moment we enter a surroundings uncountable latent action trajectories are being shaped between our body and all objects present in that surroundings. It concerns all the lines which could be involved in a Motoric Movement Action. Even within one Motoric Movement Action all the possible variations of action trajectories are part of the matrix. I am able to close the door of the fridge with my hand (L,R), my foot (L,R), my knee (L,R), my bum (L,R), etc.. And there are several possibilities of action trajectories with only my right hand. In that way I relate to all objects in the kitchen. And if somebody else would join me in that kitchen the same has to be applied to that person. So when you both start to actively make a meal that extra person adds an extra factor to an already very complex matrix in that kitchen.

With the exception of an isolation room this happens everywhere. This chaotic pattern of latent action trajectories I call the matrix. It is based on the movie The Matrix and especially on the images of the never ending sequences of digits 1 and 0. I don't think the matrix is linguistically the exact right word. However it emotionally appeals exactly to a depiction of a chaotic action trajectory pattern. Besides that it is a short word which can be pronounced nicely. *Chaotic action trajectory pattern* is linguistically a better word but doesn't get my preference. For the time being I stick to matrix until a better word is presented.

[11] Psychologie; Marc Brysbaert; Chapter 4.3 https://syneratio.com/sites/default/files/samenvatting_hoofdstuk_3_4_5_psychologie.pdf

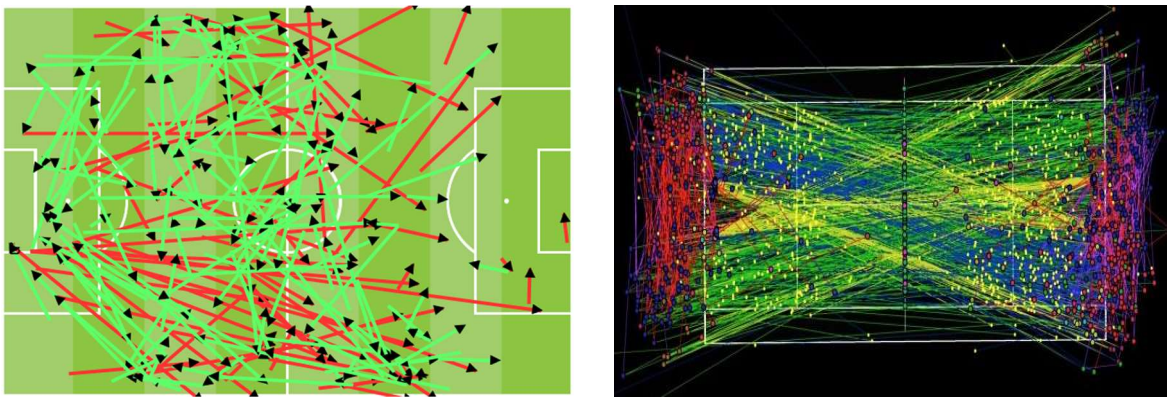


Image: This is an impression of how a matrix could look like in soccer (left) and tennis (right). There are no actual matrix pictures yet.

In a park we also relate to the surroundings in a matrix of latent action trajectories. It doesn't appear like that but our perception processes relate to the complete environment. We see how we relate to the trees, the branches of the tree, the pond, the stray dog, the cyclist, the jogging man etc.. It is all part of our latent reactive Motoric Movement Action *avoiding/fleeing/not-catching*[12]. That becomes obvious if our action trajectory is threatened by action trajectories of third parties. For example in case the storm tears of a branch from the tree right above our head, the jogger suddenly comes around the bench on a narrow road, the dog just exits the pond and starts to shake his body to get rid of the water or a bug is heading exactly in the direction of our mouth.

b. Perception and the matrix

Every time frame the perception creates one static, still image of the whole matrix. Within that one picture our perception wants to recognize all objects/subjects present in that matrix cognitively. At the same time the perception compares every unique picture within one time frame with the consecutive picture of the next time frame. In this comparison it is important to perceive those objects/subjects which show a difference in place. Things that move are able to threaten your action trajectory or your position. The perception is able, out of the perceptual organisation, to lengthen the already manifest places of a motoric action object into a perceptual perception of the latent action trajectory. This bottom-up process is complemented with the top-down process of cognitive knowledge which enriches the situation with all the information we stored concerning that specific action trajectory. From the time we are babies we experience everything in lines/trajectories. At a certain age we own a huge amount of information concerning inertia, ballistics, inflexion points, timing etc. concerning those lines. It enables us to make a precise prediction of the global progression of an action trajectory in most daily activities. The top-down process only has to give a global insight because we fill in the margins of the global image during the actual bottom-up processes of the perceptual organisation.

The awareness (or sensation) is the intake of stimuli out of the environment and the translation of the stimuli in electrochemical neuronal signals which are able to be sent to the brains where they will be transferred. The perception is the organising, interpreting and understanding of sensations. Every sense has to fulfil a set list of internal neuronal events which range from the registration of the stimulus to the final interpretation of the stimulus by the brains.

[12] See chapter 4.6

The crucial question within every subject in every environment is whether other subjects/objects are able to influence their action trajectory. Survival is the origin of species. For animals it is important to cognitively recognize the standing still lion as soon as possible. If it has the colour, the smell and the shape of a lion then it's probably a lion. When they can't do that in time they are able to react to a big subject which shows significant differences in places P of the consecutive matrix images. So this *re-active* process functions as a safety net in case the *active* cognitive process failed. This signal function will still take care of the fact that the lion will be recognized in the end because of his movements.

It should be noted in here that most animals cognitively know that they are in danger only when the lion enters a certain zone. They will not react to a lion far away. If they would do that they would have to flee all day and besides that it is much more important to perceive if all the consecutive images of the lion are aimed at you. Because if the lion is targeting that zebra *over there* than you are not in danger at all. You only need to flee if the action trajectory of that lion can possibly cross your action trajectory. The motto in nature is to save energy for those moments where it is really needed. So only flee when it is a matter of life and death. And otherwise don't flee. Fleeing also carries a risk. You are not familiar with the matrix of the new surroundings yet. They might try to lure you into a trap?! When in nature you are able to become food for a third party than that is a lifelong threat. You have to cope with that in a *dosed* and a *relaxed* way.

We come from that same historical background. We still scan everything. In a park we scan the surroundings in static images. We want to appoint every single image cognitively and to know which objects/subjects threaten our action trajectory. We want to know which latent relationships they have with our action trajectory. Besides that we check the consecutive still images for those objects/subjects that show changes in place. Moving objects reveal their intentions by the manifest part of the action trajectory. A static lion is still able to move in every direction. A moving lion will show its intentions and will be bound to follow the latent part of its action trajectory which we can lengthen out of the manifest part. So in the park it is still about these things what can influence us directly. The branches move but they return to the same position continuously. The cyclist there uses the lane for bikes and I am at the pathway for pedestrians. You only need to flee when a storm rips off a branch right above your head, a group of joggers comes around the corner or a fly comes straight at you.

Tip: It is always better to re-act to the movements of the lion. When you are the first one to show an active action trajectory you are bound to that trajectory through inertia etc.. The lion knows that too. So let the lion reveal his action trajectory first. It is the same principle when a toreador is confronted with a bull.

The fact that our perception of movement is the consequence of comparing static, still images shows that our perception looks as actively to moving objects as they do at static objects. The perception draws the same active conclusion that one object is standing still and the other one is moving. With static not moving objects we actively observe the pictures that show no changes in places P. Out of the theory of relativity one could look upon this phenomenon as a 0-movement.
In movement there is the same activeness. However movement is based upon static, still images. We only witness movement if the places P of the consecutive images show a linear regularity. What raises the question what was there first. The chicken or the egg? Of course there is movement with the mover and is the red wall red like mentioned in the introduction. Only our perception processes don't see it like that. Our perception processes create a moving object in our minds because we can draw a line through the consecutive still standing images. Otherwise we don't perceive movement. And if we don't see a line we can't perceptually lengthen it.

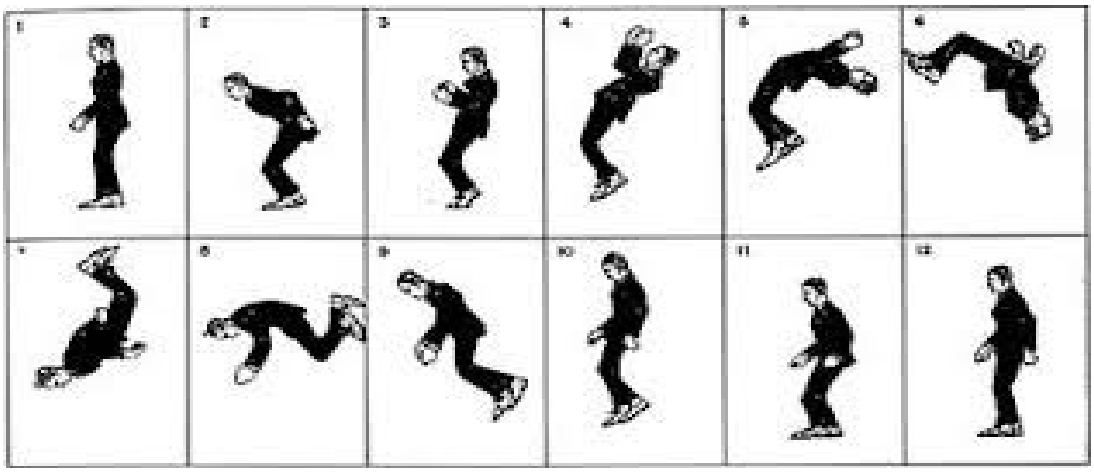


Image: If you scan these pictures chronically you might see movement. But that is an illusion. If you look at them randomly you see what they are. Just static images.

The perception of latent action trajectories in a matrix has to do with the Motoric Movement Action *avoiding/fleeing/not-catching*. This is a reactive Motoric Movement Action which only becomes manifest when an action trajectory is threatening our position or action trajectory. It has the same progression as the specific Motoric Movement Action *catching*. If we actually want to catch an object we select one action trajectory and catch the object with our hand at the end of the object trajectory. In the reactive Motoric Movement Action *avoiding/fleeing/not-catching* we perform the exact same actions like in catching. Only two points are different. First we don't select one action trajectory but we are looking actively at all possible action trajectories that might become a manifest action trajectory. All objects in a matrix are able to become an actual threatening action trajectory.
Besides that the task of the Motoric Movement Action *avoiding* is the *not-catching*. This looks like an inactive action but that is not true. The perception processes are as active as in the Motoric Movement Action *actual-catching*. We only don't actually have to do something with the end of the action trajectory. Or to put it differently in the Motoric Movement Action *avoiding* we have to actively make sure that we don't get contact with the object trajectory[13].
In that way the perception in general is always executing the task to avoid known threatening action trajectories as well as unknown threatening action trajectories. Because the perception doesn't know when something is going to threaten it has to focus on the matrix always. That shows that the perception, the moment we open our eyes, is looking at latent action trajectories in the surroundings and that gave me the entrance to the development of the idea of a matrix.

[13] This is for example the essence of dodgeball; https://en.wikipedia.org/wiki/Dodgeball. You will have to work hard to avoid a ball trajectory.

In specific Motoric Movement Actions this *avoiding* is a returning fact. While executing a specific task we really want the confrontation with the associated action trajectory. Then however we want to avoid all other specific action trajectories present in that matrix. So in daily traffic you indeed want to create your own action trajectory but you want to avoid the action trajectories of the other participants. If we reach for the kettle then we want the hand to go to the handgrip in a undisturbed way and we don't want to hit a hot cup of tea of the table or we want to avoid a running kid in the kitchen. So we want to keep our action trajectory clear from other disturbing actions. Therefor we actively look if nothing will disturb our action trajectory. This looking at nothing is an important part of the perception processes during the Motoric Movement Action. That *nothing* has never been noticed by scientists because indeed *nothing* was to be seen.

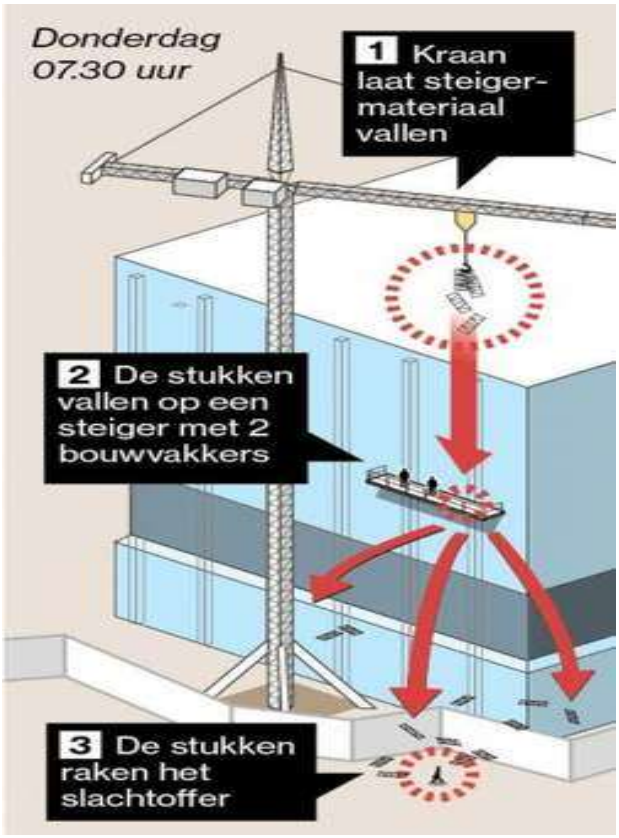


Image: In every matrix and in all our actions the Motoric Movement Action *not-catching/fleeing/avoiding* is always latently present. I don't have to flee anymore because of a lion but if I am going to post a letter I want to avoid the action trajectory of my neighbour miss S. Torytelling for the obvious reason. Besides this personal matter we are avoiding/fleeing in a general way. A fly/bug which is approaching your mouth but also events which we can describe as a plane falling out of the sky and seldom occur. A car can miss a curve, a bucket can fall of the stairs etc.. Still we check the matrix to avoid these as well because when they happen they often have big consequences.

A matrix in an environment can be compared to the matrix lines within the facial recognition and facial expressions. The perception in this phenomenon also makes static, still standing images every moment of time and compares these images. In one image we perceive the status quo of the active positions of all surfaces of the face. Out of the assumption that there is no idle state of a surface of the face, the position of that particular surface is just one possible manifestation which can have many

guises[14]. The cognitive basis comprises a lot of knowledge about the mood of a person of many facial matrix images. That same cognitive basis contains a large library of matrix images which make it possible to easily select your relatives out of a large number of unknown people.

The consecutive images show the changes of all surfaces of the face. When a particular surface changes a new matrix line is created. One could say that the changes are due to the movements of the surfaces of the face at a micro level. Perceiving the transitions of those movements of the face is essential for recognizing mood swings.

Fortunate enough we don't actually experience the matrix. If we really would witness this chaos of lines it would drive us crazy. But even so the Motoric Movement Action assumes that every possible action trajectory is already there latently. On the basis of cognitive knowledge, the tactical movement action and the actual movement action only one line will become manifest within one Motoric Movement Action. Even when I am in a funny mood and make three pirouettes to the light switch than there is still one action trajectory. And it also was there.

[14] Remember the movie screen in the introduction. Every pixel of the screen is being changed every timeframe. Every manifestation of that pixel is followed again and again by new manifestations.

Image: *Guiding lines for the visual disabled.* Sometimes a few action trajectories, out of the many latent matrix possibilities, become suddenly visible.

The fact that action trajectories are not visible within a matrix took care of the fact that the essence in tennis was kept a secret for at least 120 years. “Watch The Ball Trajectory!” marks an end to that era.

5. Focus

The new insight of the explanatory model is situated in the fact that there is not one focus involved but at least two foci during the execution of one Motoric Movement Action. The description of the movement action (MA) shows clearly that the focus of the perception must be pointed to the (movement) action object in its relation to the action trajectory. The description of the motoric movement (MM) clearly shows that another focus of the perception must be pointed to those motoric movement trajectories which contain the biomechanical main action. The formula MMA = MM x (MA) clearly shows that the primary focus always has to contain the action trajectory and that the secondary focus must be pointed from the biomechanical main action toward the action trajectory. So the secondary focus is definitely not only comprising the biomechanical main action. The secondary focus is about the biomechanical main action towards the transition point (TP) in relation to the action trajectory[15].
In sports/games with a direct game dualism a third focus towards the action trajectory of the opponent and a fourth focus towards the biomechanical main action of that action trajectory can be added. It doesn’t matter how many foci will be added the primary focus must be pointed at our own action trajectory.
In daily Motoric Movement Actions we only need the primary focus and the secondary focus. However these foci have to be executed at the same time. For mere mortals it is not possible to execute these foci completely separate. Therefor these two foci should be combined to one complex focus image.

Image: Sometimes a direct (motoric) action dualism[16] occurs in daily Motoric Movement Actions. Besides the combined focus image of our own Motoric Movement Action we then also have to focus to the Motoric Movement Action of others in relationship to our own action trajectory.

[15] An example of these foci you can find in chapter 13 of “Watch The Ball Trajectory!”. There a consistency training of the tennis service is appointed. Consistency is all about creating a set focus image of the specific Motoric Movement Action which you are able to repeat over and over again.
[16] *Game dualism* in games/sports

In focus research this is a new and revolutionary understanding. One still considers only one focus out of one perspective. That there could be more than one perspective has never been proposed. However the current state of science has reached a definite agreement to the fact that an external focus is better than an internal one[17]. When one compares this to the primary focus appointed by the Motoric Movement Action one can clearly see that the external focus should have been pointed even more *external*. On the other hand the external focus went much too far external if we compare it to the secondary focus of the Motoric Movement Action. In retrospect we can see that the current state of science was far from a break through.

The focus image is being instructed out of the Motoric Movement Action. It is not a free choice. We have to develop thoughts and perceptions when we execute a Motoric Movement Action because there is a task involved. In games/sports we continuously have to develop tactical plans. The perception processes need to check the actual situation constantly but also have to create future images of the (movement) action object continuously. So we must develop a strategy, which we use as a basis for near future places of the (movement) action object and act in the present. That is 100% contradictory to all mental methods that tell you to be without thoughts or to be in the present. You don't play chess without thoughts or drive your car without thoughts? Do you? In daily traffic you determine purposely your route and you compare your action trajectory with the action trajectories of other participants. With the latent and with the manifest parts. Out of the current position and the manifest part of the action trajectory of other participants you sketch the near future places where they probably will be. You look at the *nothing* of their action trajectories and use that as space to manoeuvre.
Your motoric movements (MM) in driving a car are probably automatized. However you are still executing the secondary focus towards the transition point subconsciously. You will notice that if you have to use a different car one day. The foot pedals feel strange for a while but you integrate it soon because of your vast knowledge concerning this motoric movement (MM).

When we switch on the light we also mainly focus on the action trajectory. The motoric movements (MM) are automatized in such a way that we think we don't focus on it anymore. And that is logical because it became part of one combined focus image. Besides that it is a simple Motoric Movement Action and that is why we can pay full attention to the essence, the action trajectory, of the Motoric Movement Action. However it wouldn't be wrong to address the secondary focus in a more active way. It will not be detrimental to the Motoric Movement Action as long as the primary focus is aimed at the action trajectory.
In more complex Motoric Movement Actions the action will not be able to avoid a more conscious secondary focus. Motoric movements can be so complex that mere mortals need to focus more on how to perform a Motoric Movement Action.
For example tennis contains strokes which make the action extra complex. The movement trajectories are expanded with one extra movement line of the racket because a racket must be qualified as a (motoric) movement object that can be manipulated freely[18]. So in retrospect we can see it was a logical step to pay attention to control the motoric movements (MM) in tennis. And because it was that hard to do it kept the main focus. But the more we focussed on that wrong primary focus the more we got separated from the real primary focus. Because the primary focus should have been pointed to the action trajectory or the ball trajectory. That appoints the structural historical mistake in tennis. "Watch The Ball Trajectory!" repairs that mistake.

"Movement effectiveness

[17] Wulf, G.; Attentional focus and motor learning: a review of 15 years
[18] See chapter 3.5

The line of research examining the influence of an internal versus external focus of attention began with my personal experience in windsurfing (see Wulf, 2007b). While practicing a power jibe, I found that directing attention to the position of my feet, the pressure they were exerting on the board to change its direction, or the location of my hands on the boom, resulted in many failed attempts and frequent falls into the water over several hours of practice. With the spontaneous decision to simply focus on the tilt of the board while turning came instantaneous success. Even though not all subsequent jibes were flawless, the difference in the quality and fluidity of the jibes resulting from my change in attentional focus was striking. Perhaps not coincidentally, the first experiments we conducted to examine the effectiveness of instructions inducing an internal or external focus of attention involved balance tasks."[19]

It is funny that Wulf uncovers where the focus really should be but then the right conclusions are not drawn. I will appoint the right conclusions she needed to draw.
Wulf is windsurfing in this example but I will appoint the Motoric Movement Action *surfing*. Windsurfing follows surfing in general lines. Windsurfing is complicated severely due to the arm actions towards the rigging. They also contribute to the action trajectory although the arm action towards the rigging is mainly about board speed. For a good appointment a precise description of all these influences are beyond the goal of this item. That is why I leave the sail out of the equation and only appoint the Motoric Movement Action *surfing*.

The Motoric Movement Actions *surfing*, walking, biking, rowing, driving a car etc. are examples of a Motoric Movement Action *moving A-B*. The displacement, the transfer, is the task. The whole distance A-B creates the whole action trajectory. However, like in many more Motoric Movement Actions, it is possible to subdivide the action of surfing. A jibe, a turn, a jump can be considered one Motoric Movement Action as long as the action trajectory is limited to the specific distance of that element and as long as that remains a part of the whole action trajectory at the macro level. This fact complicates the focus. You will have to primary focus on the action trajectory of the selected subdivided Motoric Movement Action but you will have to relate that to the whole action trajectory.

So although Wulf experiences the *tilt* more externally she must witness it in relation to the specific action trajectory of that element. What she doesn't state here explicitly but seems like it is that she must perceive the action trajectory out of the perspective of the board. The action trajectory is then the specific line A-B that the board will have to execute during this specific element.

What she really misses is that her feet, like the hands hold a letter, *hold* the board all the time and are able to influence its action trajectory continuously. The bottom/outside of the feet create a transition point (TP) on the outside of the board on which they stand. The movement trajectories just end on the inside of the body against the bottom/outside of the feet. The biomechanical main action of the motoric movement (MM) has to influence the action trajectory in that transition point. And that also has to be the goal of the secondary focus. The movements in surfing are so complex that a surfer can't avoid this secondary focus. A different focus that completes the primary focus pointed at the action trajectory. Because the two foci must be perceived at the same time they have to be combined to one *complex* focus image.

Before I close the quote of Wulf I want to make two remarks.
1. The Motoric Movement Action *surfing/windsurfing* shows a clear action trajectory of the board. That has no relationship whatsoever with the motoric action *balancing*[20]. In a static balancing task there is no movement or a 0-movement involved. And so no action trajectory is involved. Motoric Actions cannot be compared with Motoric Movement Actions. They belong to different worlds.

[19] Wulf, G.; Attentional focus and motor learning: a review of 15 years
[20] See chapter 3.2

2. For *flow* or surfing/windsurfing *in the zone* the complex focus image must be completed with a very well stocked cognitive basis. This cognitive basis must contain the majority of possible occurring waves, weather conditions etc.. In that way a surf matrix of an experienced surfer must already be filled with a huge spectrum of reference action trajectories. Just like tennis the Motoric Movement Action *surfing/windsurfing/sailing* constitutes many and complex action trajectories. If laymen look at the water they see nothing. An experienced sailor observes a very complex matrix in which the latent *sail/windsurf/surf* trajectories change continuously. So in sailing/windsurfing/surfing the actual *sail/windsurf/surf* action must be built upon a large amount of abstractions which cover reality almost completely.

So if one observes a seemingly thoughtless elite surfer performing the most incredible movements one needs to keep in mind that it is based on one complex focus image and a wide cognitive basis in which thousands of hours of training come together.

Images: Who says that if athletes seem to gaze that they are actually not making perceptions? Could it be that the diver visualizes her *in*-jump into her dive trajectory? Could it be that Federer hits the incoming ball into a visualization of the outgoing ball trajectory and that he is making all kinds of perceptual images in that process?

"From a cognitive psychology perspective, the term attention is used to refer to three different processes. First, the construct of attention has been postulated to explain the selectivity of attention (i.e. focused attention). Second, it relates to our ability to distribute attention across several concurrent tasks (i.e. divided attention). Third, it refers to our state of alertness or readiness for action.
Selective attention is viewed as 'the preferential detection, identification, and recognition of selected stimulation' (Woods 1990:178). It is the process by which certain information is processed whilst other information is ignored. An example is the skilled baseball batter's ability to focus only on pertinent aspects of the pitcher's delivery action while disregarding extraneous information. Selective attention is involved at some level in almost all tasks, since even if the subject only attends to one visual or auditory cue, proprioceptive and interoceptive inputs simultaneously compete for attention (Woods 1990). The second meaning of the term attention relates to the fact that skilled performers can regulate their mental resources or capacity across several concurrent actions. Consider the skilled racing driver who changes gear at a difficult hairpin bend while scanning the upcoming road layout and monitoring the position of opponents in the rear view mirror. This ability to perform two or more tasks concurrently distinguishes between controlled and automatic processing (Schneider, Dumais and Shiffrin 1984). The skilled golfer is likely to process information automatically whilst playing a drive shot off the tee. Clearly, sports require a combination of both automatic and controlled processing. In

some situations performers function in a 'reflexive', automatic manner, but in others, they are required to make decisions and process information consciously (Boucher 1992; Nougier, Stein and Bonnel 1991).''[21]

This quote very well shows the current state of the scientific research concerning focus in Motoric Movement Actions. General processes which must be there and what a motoric action subject in general terms is supposed to do are appointed. That is how far the substance of focus reaches. It remains vague what needs to be done and no hierarchy is appointed concerning the parts of a Motoric Movement Action. All actions are more or less appointed evenly and equally. The explanatory model of the Motoric Movement Action appoints every part precisely and shows no vagueness anymore.

For the *batter* the Motoric Movement Action *throwing* has to follow the Motoric Movement Action *catching* directly. This complex process has been appointed into the last detail in "Watch The Ball Trajectory!". It shares the exact same principles as tennis. In general *the skilled racing driver* has to follow the Motoric Movement Action *surfing*. He is confronted with a specific action trajectory in the specific element of the whole action trajectory of the whole circuit. This complicates the primary focus. The primary focus must be pointed to the specific action trajectory of the specific part towards the action trajectory at a macro level. The changing gear is part of the motoric movement (MM) of the same Motoric Movement Action. Shifting gear is a simple movement which is performed in a proprioceptive way. Skilled drivers are able to execute it fully automatized. Although it doesn't hurt to maintain a more conscious secondary focus. Opponents also belong to the same Motoric Movement Action. In tennis the motoric movements of an opponent can be observed. One is able to derive information from these movements. In racing this can't be observed. A driver is only able to focus the action trajectories of his opponents and he can't anticipate any prior motoric movement. So in driving a third focus must be pointed towards the position and the latent action trajectories of opponents. All these foci must lead to one complex focus image. This image has to be an important part during training sessions. If a lot of cars try to execute the same *hairpin bend* at the same time then the matrix is very complex. All cars have a matrix connection with all the other cars[22].
The movement action (MA) describes how, out of a very experienced general knowledge base, the tactical movement action finally decides to one action trajectory and executes that during the actual movement action. Sports like tennis and car racing need high level and fast decision making and involve so many options that there needs to be a cognitive basis which contains reference action trajectories which can be used as blue prints. It takes years to own such a cognitive basis. The only thing what can be automatized is the shifting of the gear belonging to the motoric movement (MM). Other actions which the quote describes as *automatic* or *reflexive* are actually very conscious and deliberate actions. They are only happening very fast because the skilled driver already possesses a lot of blueprints. This is very important because outsiders label these actions as *automatic* or *reflexive* hinting towards the label of *thoughtless* or *being in the present*. Because they think they see thoughtless athletes when they look at very skilled athletes. But the opposite is true. Skilled athletes execute a very conscious, active and fast mental process within every Motoric Movement Action. A mental process which is not hazy at all but contains very concrete perception processes.

6. Complex system versus linear system

The complex system thinking approach is known as the science of complexity.

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[21] A. Williams, K. Davids, J. Garrett; Visual Perception and Action in Sport; P. 27-28
[22] See appendix A; *foot racing*

"*This approach consists of perceiving complexity and trying to find an order and to simplify it as much as possible.*[23]"

The explanatory model of the Motoric Movement Action follows the principles of a complex system[24]. "Watch The Ball Trajectory!" proves that the processes in tennis can only be explained out of a complex system model. Till now tennis is mainly explained out of linear approaches. Those explanations will have to be rejected from now on.

"(...)current thinking has shifted from linear to nonlinear and from uni-dimensional to multi dimensional models for research. Sport psychology scientists now believe that the interactional approach of individual and situational factors will take the field closer to the goal of understanding, explaining, and predicting behaviour (...). However, this focus on multiple variables, complex systems, and nonlinear relationships is in direct opposition to the current Newtonian approach of trying to understand the world by examining individual components (...). Rather, a macroscopic examination of complex, nonlinear systems is needed to aid our understanding. Therefore, the purpose of this paper is to provide a brief overview of such an approach, namely chaos theory. We acknowledge that in our attempt to explain and apply chaos theory to sport behaviour, there is the potential for over simplification of a complex mathematical theory.[25]*"*

"We are convinced that eventually also the other universal properties of complex adaptive systems will prove to be helpful not only in understanding but also in coaching the multitude of current and most likely future types of sports and games both on physical as well as on virtual playing fields and arenas.[26]*"*

"Tennis coaching and training has traditionally been dominated by a mechanical concept of the player and the game (i.e. the consideration of the tennis player as a sum of different parts: mind and body; and the notion of the game as composed of different areas: technique, tactics, conditioning, psychology, etc.).1 This ideological stream, known as "mechanicism", imposed a fragmented and mechanical approach to the perception of the environment, and was originated during the industrial revolution in the 19th Century by emphasising the notion of progress and technological development.

This paradigm coupled with the traditional scientific method, which basically assumes that the understanding of the parts of a given system would provide the understanding of the whole, and is also known as "reductionism". As such, this linear reductionist approach requires that the researcher isolates a variable or variables within the system under study for data collection at a specific time.

Sport sciences applied to tennis have followed the use of a reductionist philosophy (either deductive or inductive) which has been the predominant paradigm throughout the fields of science for centuries. This approach is a microscopic and not a macroscopic one since it investigates isolated parts of a system. It has also been called a linear (as opposed to non-linear), isolated (as opposed to integrated) and a reductionist (as opposed to holistic) approach. Although the deductive or inductive approaches have contributed to our understanding of the game, the results using these classical frameworks and methodologies have shown that it is difficult to understand complex sport behaviour."
"The concept of integrated training for tennis states that the traditional distinction between technique, tactics, conditioning, and mentality is more artificial than real.[27]*"*

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[23] https://en.wikipedia.org/wiki/Complexity
[24] https://en.wikipedia.org/wiki/Complex_system
[25] Chaos Theory: A New Science for Sport Behaviour?, M. Mack; http://www.athleticinsight.com/Vol2Iss2/ChaosPDF.pdf
[26] Complex Systems As Fundamental Theory Of Sports Coaching; G. Mayer-Kress; http://arxiv.org/html/nlin/0111009v1
[27] Miguel Crespo; J Med Sci Tennis 2009; 14(2):20-25 "Tennis Coaching in the Era of Dynamic Systems"

The complex system thinking approach is recently getting a foot over the threshold. But only for those Motoric Movement Actions which we consider to be complex. Normal daily actions one still tries to explain linearly. With this book I will demonstrate that even the simplest Motoric Movement Action must be researched as a complex system. That doesn't mean you can't appoint it linearly to a user.

> *Opening your front door with a key must be studied as a complex system. However from the perspective of a person who wants to enter his house it is easy. Key out of your pocket, put it in the lock, turn, et voilà.*

In retrospect we can determine that the complexity of the Motoric Movement Action has never been understood. One only tried to find solutions in linear explanations. This never gave a really satisfying answer. That is also the reason why most of you are very interested in hearing my ideas. I didn't convince you yet but you are on my side. Because you probably tried at least a few linear methods and never got really convinced. Besides that you saw, in for example tennis, that the linear explanations were too simple. The feeling differed too much from the explanation. There was a gap between the two. In retrospect it is very obvious that this gap was hijacked by the many, very many, mental methods and courses. With the slogan *we don't understand this so it must be mental*. In that way it became a ragbag for the not understood complexity and also a nice hiding place for many teachers who didn't get any blame. Tennis is still appointed as a hazy form of art.

The Motoric Movement Action is appointed as a complex system which fully explains all the relevant parts. It leaves no room whatsoever for gaps or haziness. The notions *flow*, *focus*, *being in the moment* etc. are now completely embedded and explained by the explanatory model. All these notions have been appointed now in the most concrete way possible and all mysticism has been removed. In comparison to the linear explanations the complex explanation is harder to understand but it doesn't show any gaps anymore. "Watch The Ball Trajectory!" shows that all mental methods, which interfere with the Motoric Movement Actions in tennis, must be rejected. Of course there will remain mental processes but they are much more concrete.

Now a big disadvantage for teachers will be that they can't hide anymore. They really will have to work very hard to take care that students will finally play tennis in *flow*. Motoric learning is still formulated from the perspective of what a student should learn. Chapter 8 (motoric learning) of this book will turn this principle around by stating what a teacher should teach in actually taking care of the fact that pupils will learn in a definite way and finally will reach the stage of *flow*. The quintessence of that chapter is that pupils will learn automatically if teachers do their job.

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Chapter 2 – The Problem Definition – *The Quiet Eye* versus *The Active Eye*

With the DemoClip[28] in "Watch The Ball Trajectory!" the action trajectory in tennis has been proven. It is the line over which the (movement) action object fulfils the task of the Motoric Movement Action. In tennis this is an action out of the perspective of the ball. This line will then officially be the ball-action trajectory or ball-line but commonly is known as the ball trajectory.

There are not many, either static or moving, images of action trajectories. The description of the Motoric Movement Action is new and we don't think or communicate out of the perspective of the (movement) action object. The DemoClip is a lucky shot because the beer brand Corona decides to show us an exciting angle towards tennis. So I am not able to show you a DemoClip of the Motoric Movement Action *posting*. However you yourself are able to create a *letter*-trajectory with the tennis DemoClip in mind. If you look upon the motoric *post* action as one whole than you make one action trajectory from your writing desk to the slit of the mail box. If you look upon the motoric *post* action, at a micro level, as more Motoric Movement Actions you make a chain of connected action trajectories from your desk to the slit. The same chain which is the characteristic in the rally in tennis. The action trajectories are connected in such a way that it is possible to also observe them as one long action trajectory.
So conform the black part of the DemoClip you are now able to connect all separate places P of the letter from your desk to the mail box. Then you will witness the same line as in the tennis DemoClip. By the way from now on you will be able to do that for every Motoric Movement Action.

Simultaneously with the prove of the action trajectory out of the perspective of the (movement) action object is shown that the action object is solely making the action trajectory and that the (movement) action *subject* has nothing to do with it. This means that only the object is fulfilling the task and that we are not able to post a letter. And that we never have posted one. Only the letter itself is capable of fulfilling that task within the movement action (MA). We are only able to execute that task indirectly with movement trajectories within the motoric movement (MM) of the Motoric Movement Action. Motoric movements (MM) which are glued to the outside of the movement action (MA) and form the only two parts of the Motoric Movement Action. The formula MMA = MM x (MA) shows that relationship very well. Because the movement action (MA) is fulfilling the task the motoric movement (MM) is formulated towards the movement action. From that perspective the motoric movement (MM) is serving the movement action (MA). However the formula also shows that they can't exist without each other. A letter can severely look forward to being posted but if we don't execute it the letter, to perhaps a unattainable love, remains on the writing desk. On the other hand if we don't write (love-)letters then there is nothing to create an action trajectory. So both don't have anything in common but need each other to become one successful Motoric Movement Action.

[28] https://www.youtube.com/watch?v=JuD4cLlt5ik

Till this point the explanatory model of the Motoric Movement Action is transparent with a clear distinction in movement trajectories and action trajectories. The question however is how our perception processes behold this all. One of the leading scientific perception theories in regard to this matter is the theory of The Quiet Eye (TQE). It is the theory of Joan Vickers. I will compare this theory to the explanatory model of the Motoric Movement Action with its very active perception processes. In comparison to TQE I call these active perception processes The Active Eye or TAE.

In "Watch The Ball Trajectory!" I already showed that TQE is a naïve linear explanation of the Motoric Movement Actions in tennis. Tennis, as one of the most complex Motoric Movement Actions, certainly doesn't allow that. However even the simplest Motoric Movement Action doesn't escape the fact that the perception processes have a complex nature. Maybe it is possible to describe them in a linear way towards a user but we have to study them in a complex way. The perception processes of the movement action (MA) must be viewed upon out of the perspective of the (movement) action object while at the same time totally different perception processes must observe the movement trajectories of the motoric movement (MM) out of the perspective of the (movement) action subject. This is already a complex situation. It even becomes more complex because the directions of the involved trajectories, the movement trajectories and the action trajectory, don't have any relationship whatsoever. Besides the difference in perspective, movement trajectories need to be adjusted towards the action trajectory in a dosed and timed way. This happens in the transition point[29] (TP) of the movement trajectories towards the action trajectory. The transition point doesn't contain a linear transition qua perception processes. The perception processes of the action trajectory and the movement trajectories are working from the beginning to the end of the Motoric Movement Action. From before the transition point till after the transition point. In the transition point the actual mechanical transition occurs. Within tennis for example the perception processes for one stroke aim at the task to actually hit a ball in the transition point or contact point. The contact point is the actual beginning of the outgoing ball trajectory. However the perception processes of the motoric movement (MM) don't stop there and the perception processes of the movement action (MA) don't begin there. Before a racket is able to transfer energy it must obtain energy first. So first the racket needs to be guided far away from that contact point if a lot of energy needs to be transferred in the transition point. The body has to perceive this path in a proprioceptive way and especially the way back has an obvious relationship with the biomechanical main action of the motoric movement (MM). Because the cognitive basis holds information concerning the timeframe involved we are able to bring the racket back to the transition point in an optimal way. And these are only the perception processes of the motoric movement (MM). At the exact same time the perception processes of the movement action (MA) are playing a game by executing the Game Idea during the whole chain of ball trajectories.

With *Caught In A line* I will prove that even the simplest Motoric Movement Action contains complex perception processes which can be appointed universally conform the explanatory model of the Motoric Movement Action and that the complex explanation justifies the facts much more. I regard the explanatory model as the proof of the Motoric Movement Action.

The Quiet Eye versus *The Active Eye*

Every action in which a person executes a task with a movement of the body we can define as a Motoric Movement Action (MMA). This covers almost all of the movements we make except for unconscious actions like for example the beating of the heart, blinking of the eyes etc.. All tasks where a conscience will of a person is involved can be considered a Motoric Movement Action. You can think

[29] See chapter 3.4

about turning on the light, to open a lock, to poor tea, to drive a car, cooking, eating, play games/sports etc..

Every Motoric Movement Action we execute has a cognitive basis. Even in a comfortable chair at home we can make a cognitive image about any Motoric Movement Action. If for example we want to post a letter we know what is the task. In our minds we can observe ourselves executing this task. We can imagine this task at *our own* mailbox but also as a general action at all mailboxes there may exist. Besides that we can make an abstraction of this task. You know that you have to deliver an object, that you have to keep that object parallel to an insert possibility, that once the object is close to that insert possibility you have to make a little throwing action, etc.. These abstractions also consider that the object must *fall down* into a collecting object. So the insert possibility must be at some height to make that possible.

Image: Lines within the matrix are just the consequences of the linking of all still standing perceptual images of all places P of an (movement) action object.

If we are really going to post a letter at a *new* mailbox we first make a tactical plan with the cognitive basis as a reference. We construct a perception of a latent trajectory from the letter in our hand to the slit of the mailbox. The action trajectory. Than we are going to actually execute this perception. We bring the letter into the action trajectory which will guarantee a successful delivery and follow the tactical plan. With other words we throw the letter into the letter trajectory which is already there and which the letter cannot escape. While actually executing this task many more perception processes will take part. They are processed in two streams. The ventral and the dorsal stream. The ventral stream is mainly concerned with the action trajectory. The letter is observed but the emphasis is laid on the trajectory. The dorsal stream is mainly concerned with the letter. The action trajectory is observed but the emphasis is laid on the letter. During the actual action these streams audit each other in an ongoing mutual process. If the letter deviates from the perception of the action trajectory a new perceptual trajectory is created immediately. The letter will have to follow this new trajectory again and is audited again by the dorsal stream. This will continue till the letter reaches the slit of the mailbox.

Now most mailboxes are solidly attached to the ground and so most motoric *post* actions won't need a lot of corrections. But let's try to imagine that you are in another country and the mailbox is stably moving horizontally side to side over a length of 50 centimetres. Than you will witness this mutual process much better.

The cognitive basis has not changed. When you arrive at this mailbox you conduct a very quick research and again you make a tactical plan based on the actual environment information. From your position you can reach the slit of the mailbox. The difference with the stationary mailbox is that the perception now made more perceptions of possible action trajectories. A global image of possible action trajectories. Because you can't make a precise action trajectory and at this moment there is no need for a precise action trajectory.
After you made a tactical plan you are really going to execute the actual *post* action. It would be nice if you would really join me in this action from this point. With the global perception in mind you bring the letter up into most of the global perceptions of possible trajectories. The main goal now is to get the letter closer to the slit. The two processing streams are more active now. The ventral stream shows changing action trajectories every following time unit which you try to follow for a bit as a global leading guide. The dorsal stream is correcting more actively.

Perception processes are happier with nothing than with something in the action trajectory. So they are actively looking for nothing. Then the action trajectory is able to be performed freely. Because there is nothing to be seen in the nothing researchers never noticed that purpose of the perception processes.

Still you manage to get closer to the slit. The perceptual action trajectory is now actually completed for most of its part. There is just a little part of the latent action trajectory left. The more an action trajectory is actually completed, the more the chance to deviations diminishes. It will diminish exponentially. In this last phase the actual *post* action can there for change the emphasis from bringing the letter closer to the slit to actually inserting the letter into the slit. Although all perception processes will maintain to do their jobs like mentioned before. You will have to keep feeding the latent perceptions of the action trajectory. The dorsal stream will audit the process from the actual position of the letter. They will keep processing till the task is fully completed.
In the mean time you brought the letter in your hand parallel to the slit. The cognitive basis is responsible for this. This will lead to posting this letter as well. Although you wonder if you ever will come back at such a mailbox

Of course this is an exaggeration. But this is what you normally do when you move yourself, a part of yourself or an object you control. In the actual action trajectories we make in everyday activities there are multiple little deviations. We don't experience them consciously. If you are not convinced than try the next game. If you really make straight lines you will have no problem whatsoever with the *nerve spiral*.

Image: A *nerve spiral*; The nerve spiral defines a set action trajectory.

Because the explanation of the Motoric Movement Action is universal you can apply it as well to this situation. You have a cognitive image of the task at hand. If there were a *new* nerve spiral in front of you now, you would make a tactical plan based on general cognitive knowledge and the one specific spiral in front of you. You can visualize all the specific curves of this spiral. The final goal of the tactical plan is to come up with only one whole action trajectory. It is necessary for leading the Motoric Movement Action.
When you are actually going to perform the task you will be caught in the two processing streams of the perception. That produces all the irregularities people experience while executing this task. When I would execute this nerve spiral in the image above the bell would ring at least ten times. I hate these things.
We don't possess one processing stream but two. The ventral stream mainly considers the trajectory for the completion of the task. The dorsal stream mainly considers *the ring* of the apparatus you are holding relative to the spiral. They work together in an ongoing mutual auditing process till the task is done completely. Because signals from both streams take a little time to be processed you will experience these little *hiccups*. This is very well known and produces – *ring* – the touching – *riing* – of the spiral – *riiiing* – and the ring.

"The dorsal stream and the ventral stream (see diagram 3 & 4)[30]

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 frontal cortex).
The ventral stream runs from the occipital lobes to the back of the brain at the bottom (called the temporal lobes).

The Dorsal Stream

The motor cortex is responsible for bringing about movement of the body. In an adult who has had a stroke and who cannot move the right side of the body, it is the left motor cortex or the pathways from the left motor cortex which have been damaged. The top of the motor cortex is responsible for moving the foot and the side of the motor cortex is responsible for moving the hand. The task of picking up the apple involves both the visual system and the motor cortex. First, the apple has to be recognised, it then has to be mapped along with everything else in 3-dimensional space by the posterior parietal cortex.. This information is passed to the frontal cortex which is responsible for making the executive choice of attending to and picking up the apple. The information about where it is then passed to the motor cortex responsible for moving the hand, which reaches out accurately in 3-dimensions using the coordinates given to it by the parietal cortex, in order to pick up the apple. At the same time, the hand is being shaped so that the fingers are separated far enough to encompass the apple. Once the hand has reached the right position, the fingers grasp the apple and pick it up. Throughout this task, the visual system and the movement system are working in perfect harmony. The action of picking up the apple has been brought about by the interconnecting pathways of the dorsal stream. The picture was formed in the occipital lobes. It was mapped by the parietal lobes. The choice of the apple was made by the frontal lobes. The action was executed by the motor cortex and the whole system was interconnected by the dorsal stream.

[30] 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

The Ventral Stream

The ventral stream runs from the occipital lobes into the temporal lobes on each side. The temporal lobes contain the visual library. This library contains a general store of objects and shapes which enables us to recognise one object from another. There is also a special store of people's faces and a library of route finding methods both of which are usually located in the right side of the brain. When you walk down a busy street and recognise someone, your brain has accomplished a fantastic computing task for you. First, you probably know where you are going. Then, for every person you do not recognise, you compare the facial appearance of that person with your personal store of hundreds if not thousands of faces. When it does not match, you walk past that person. When you meet the person you recognise, you have a matching comparison which allows you to greet your friend. You were then able to recognise the facial expressions of your friend and to communicate accordingly. Children who have damage to the ventral stream can have difficulty differentiating one object from another and in particular, may have great difficulty recognising people's faces and differentiating different types of animals, one from another. They may be unable to recognise the language within facial expressions. In addition, route finding can be particularly difficult. This applies on a large scale when out and about and on a small scale within the home where, for example, it can be particularly difficult to know which drawer items are kept in.

It is clear that the dorsal stream and ventral stream pathways work in harmony with one another because we see and recognise, with our temporal lobes, what we choose to reach out and pick up using the dorsal stream, posterior parietal lobes. and motor and frontal cortex. However, when brain damage takes place, specific parts of these tasks are deficient and it can be difficult to understand why a child with such damage is able to see one thing but not another."

The description of posting a letter is the description for every Motoric Movement Action. So it is also the explanation for all actions in tennis. It is only a matter of finding the right perspective. Most of the time we approach this in an egocentric way. I want to post the letter. But that is not the perspective of the Motoric Movement Action. It is not the mailbox as well. The task of posting a letter must be approached from the perspective of the letter. Even not from the hand holding the letter. The letter must be placed into the action trajectory from the hand to the slit of the mailbox. A trajectory we can adjust because we can hold on to the letter. There for the perspective in tennis for the Motoric Movement Action is from the ball. The Motoric Movement Actions in tennis follow every step mentioned above. The perception processes of the motoric movement (MM) on the other hand must be regarded out of the perspective of the (movement) action *subject*. These two different perspectives already turn a simple Motoric Movement Action into a complex one.

"So the task in tennis is from the perspective of the ball. The ball is glued to its ball trajectory and the Game Idea tells us that a player has to make chains of ball trajectories and try to prevent the opponent to continue this chain. A player has to receive an incoming ball trajectory and lead that to an outgoing ball trajectory with an optimal Game Intention. Based on the cognitive basis we can make a perceptual image of that task even while sitting in a comfortable chair at home.

If we actually are going to play the game we have to continually create tactical perceptions of the places where the ball will be in the near future. We can only achieve this task if we precisely predict how the shape of a ball trajectory globally will be. The game situation, cognitive knowledge about the execution of the Motoric Movement Actions of the opponent and the Initial Phase of the incoming ball trajectory will make that possible. Elite players decide in a very early stage where the incoming ball trajectory globally will be met and what outgoing ball trajectory will be created. Like in the posting task the ventral and dorsal stream check the images of perceptual ball trajectories from global to very

refined. I will appoint this task completely in this book. This description will reveal very active perception processes related to the ball and the ball trajectories."[31]

And this is only the description of the movement action (MA) or Game Action in tennis. The complex perception processes of the motoric movement (MM) which also need to be timed toward the action trajectory add more than a factor of complexity. Due to the fact that tennis belongs to the most complex Motoric Movement Actions. Mainly due to the many perception processes.

"Keep your eye on the ball?
The example above seems to question whether skilful games players need to fixate the ball for the whole of its flight as demanded by the coaching edict: 'Keep your eye on the ball!' Even now the advice of most coaches of ball games is to keep your eye on the ball—regardless of expertise. But is this appropriate? Rather, at critical moments, experts seem to be able to switch attention between important, alternative sources of environmental information such as the position of opponents and teammates and the location of surfaces and targets. Despite some individual differences, the data seemed to suggest that skilled batters only needed to foveally track the ball up to 2.4–4.5 m from the bat. No further head or eye movements were recorded after this point. Furthermore, the batters seemed to reduce the scope of the motor-control problem by gearing the step before strike to the release of the ball from the pitcher's hand. That is, step duration was regulated by pitch velocity. Faster pitches induced shorter steps and slower balls warranted longer steps. What is the significance of this behaviour by skilled batters? This strategy had the effect of allowing the duration of the swing to be kept remarkably constant and independent of ball speed."[32]

Now we switch to Joan Vickers. Joan Vickers invented the theory of The Quiet Eye (TQE). The results are not homonymous and there is a debate about it in scientific circles. But still these same scientific circles fully accept the theory.

TQE: "Traditional visual search experiments, where the researcher pre-selects video-based scenes for the participant to respond to, shows that elite players make more efficient decisions than non-elites, but disagree on how they temporally regulate their gaze."

"1.2. Gaze control research in closed sports

Gaze control research has been carried out in closed skills such as the golf putt (Vickers, 1992), basketball shooting (Ripoll et al., 1986; Vickers, 1996), pistol and rifle shooting (Ripoll, Papin, Guezennec, & Verdy, 1985; Janelle et al., 2000), and billiards (Williams et al., 2002). Performers of these skills orient their gaze to a fixed target or target(s), such as the hole or ball in golf, the hoop in basketball, or the bullseye in shooting. Elite performers have a longer duration of final fixation on the target than near-elites (athletes with lower game statistics), and the duration of this fixation has been shown to be longer on successful than unsuccessful trials.
This object-oriented type of gaze control has been termed a ''quiet eye'' (QE; Vickers, 1996) and expert performers differ from non-experts in having an earlier onset and a longer duration of this gaze suggesting a sustained focus on one location or object is required prior to the initiation of the final movement. Williams et al. (2002) reduced the QE period experimentally in billiards and found that the accuracy of both elites and novice players declined as a function of the amount of reduction in the QE period. Harle and Vickers (2001) trained players to control the onset and duration of QE period in the basketball free throw, and their shooting accuracy improved in both the experimental and competitive

[31] "Watch The Ball Trajectory!" - Chapter 2
[32] A. Williams, K. Davids, J. Garrett; Visual Perception and Action in Sport; p. 18

setting. The QE period in closed skills has been deemed a perception–action variable, one that specifies the optimal regulation of the gaze relative to a final motor response (Janelle et al., 2000; Vickers,1996; Williams et al., 2002).

1.3. Gaze control in open skills

Research has also been carried out in interceptive-timing skills and sport tactics where the context is dynamic and influenced to a greater degree by external events than in closed skills. In interceptive timing skills where the flight of the object is predictable, an early onset of pursuit tracking on the object occurs, followed by a long duration of tracking which normally does not occur to contact (Bahill & LaRitz, 1984; Ripoll & Fleurance, 1988; Rodrigues et al., 2002; Shank & Haywood, 1987; Vickers & Adolphe, 1997; Vickers, Rodrigues, & Brown, 2002; Williams & Ward, 2003).
However, in skills where the flight of the object is unpredictable, such as in cricket batting, the elite batsman adjusts the gaze to deal with the uncertainty of late flight information. Land and McLeod (2000) found that while both low and high skilled cricket players tracked the ball as the ball was first delivered, only the highly skilled performer used a rapid anticipatory saccade to the bounce point, followed by a brief period of tracking before the ball was struck.
In open skills of an interceptive timing nature we therefore see that when the flight of the object is predictable, pursuit tracking is directed early to the object and over the first part of flight, but when the movement of objects is unpredictable then the gaze adapts to deal with late changes in object flight and it is the elite performer who is better at adapting the gaze so that the rapidly changing conditions can be perceived in time to effectively adjust the action."[33]

"Expert free throwers exhibited less frequent head movements, fewer visual fixations and a longer fixation on the basketball hoop during the preparation and pre-shot phases. Moreover, they showed a longer 'quiet eye' duration than near-experts. Quiet eye duration was defined as the period of time from fixation on the target to the first observable movement of the hands into the shooting action. In contrast, once the movement was initiated experts moved their visual fixation away from the target earlier, while they employed more fixations and eye blinks with a higher incidence of head movements during the shot and flight phases. Vickers (1996) proposed that the higher blink rate may be used to suppress interference from the moving hands and ball in the visual field. To explain these findings, she proposed a location-suppression hypothesis to explain high levels of performance in aiming tasks such as the basketball free throw. In this hypothesis, a long fixation duration is initially required on the target location (i.e. basketball hoop or backboard). In the second impulse phase, movement should be initiated slowly for fixation to be maintained. Finally, during the execution phase, fixation offset should occur early, followed by a suppression of vision to avoid interfering visual input during task execution. Future research is required to verify whether this location-suppression hypothesis extends to other far aiming tasks such as archery, snooker or dart throwing."[34]

So TQE doesn't see any trajectory. No action trajectory. No movement trajectories. TQE observes players aiming at something and for example assume that they throw the ball into the basket just like that. Without any guidance. Without any guide-*line.* Because they don't see a thing between the goal and the target[35]. Gazing is then defined as the thoughtless process of visualizing the goal. So the target becomes an active part of that gaze. TQE doesn't explain however why basketball players focus at the basket and why golfers and ice hockey players gaze at the ball/puck.

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[33] Gaze characteristics of elite and near-elite athletes in ice hockey defensive tactics; Stephen G. Martell; Joan N. Vickers. http://www.sciencedirect.com/science/article/pii/S0167945704000065

[34] A. Williams, K. Davids, J. Garrett; Visual Perception and Action in Sport; p. 169; http://www.imd.inder.cu/adjuntos/article/632/Visual%20Perception%20and%20Action%20in%20Sport.pdf

[35] I remember that I once possessed that same idea. So I am able to imagine that you want to know how long an athlete gazes at the target.

The explanatory model of the Motoric Movement Action on the other hand visualizes *a whole ball trajectory* between the target and the ball. This ball trajectory makes the task, unfortunately only for insiders, very *visible*. Outsiders don't see a thing. Mainly the execution of the ball trajectory is the task. If one throws a ball in the beginning of a sound visualization of a ball trajectory the ball will automatically end in the basket. Because in throwing tasks you are only able to influence the Initial Phase of the ball trajectory.

Unfortunately almost all instruction follows TQE as in the following quote. Internet and books are full with the same advices.

*"**Locate the target.** If you want the ball to go into the net, then you need to look at the net. If you're planning to bank the ball in off the backboard, then look at the spot on the backboard you want to hit. Your eyes are an incredibly important part of a good shot in basketball. Once you release, you may either follow the flight of the ball (which is common among great NBA shooters) or continue to look at the rim."*[36]

The goal of TQE is that the body and head quiet down because of the gaze. Vickers comes no further than the aiming and the checking of the target a few times and then an athlete mainly needs to become thoughtless. Those are the obvious actions she apparently thinks to witnesses in elite players. If you quiet down you will improve the execution of a task. To a certain point those observations are not completely wrong. Only the difference is that these observations are not the cause but they are the effect of the many perceptual perception processes. Therefor a problem definition would evolve around the question whether gaze is the main goal in a Motoric Movement Action or if gaze is the consequence of other processes within the Motoric Movement Action. From the perspective of the explanatory model of the Motoric Movement Action Vickers is turning around cause and effect.

The task within TAE of the Motoric Movement Action is concerned with many and careful observations. Latent perceptions of action trajectories must be compared continuously with the actual place of the (movement) action object. Perception processes are delicate processes which can be disturbed easily. The head and body need to remain as stable as possible to obtain the best outcome. So in TAE the head and the fixation of the eyes will quiet down because of the task at hand. So, although in a different way, both TQE and TAE come to the conclusion that the head and body become as stable, as quiet, as possible. Because TQE primarily reinforces the consequence of TAE it also finds better results. So Joan Vickers is experiencing positive results and for her that proves the existence of TQE.

"The performance results supported our primary hypothesis, with QET children catching 23% more balls after training, compared to a 4% improvement for TT children"[37]

"QET and TT training interventions

Table 1 provides a summary of the content of the QET and TT instructional videos for the three phases of training. The QET videos were based on training the key QE behaviors uncovered by Wilson et al. (2013) for this task, and emphasized focusing gaze on an imaginary target on the wall prior to the throw, then continuously tracking the ball as it came towards them prior to the catch. The TT instructional videos were based on 'best practice' for learning throwing and catching and emphasized a smooth arm swing through to the release of the ball when throwing, followed by assuming a readiness position and holding the hands in front to cushion the ball during the catch (Bunker, Hardy, Smith, & Almond,1994)."

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[36] http://www.wikihow.com/Shoot-a-Basketball

[37] Quiet eye training improves throw and catch performance in children Charlotte A.L. Miles a, Samuel J. Vine a, Greg Wood a, Joan N. Vickers b, Mark R. Wilson; http://www.researchgate.net/publication/262342333_Quiet_eye_training_improves_throw_and_catch_performance_in_children

She doesn't only instruct to gaze but also gives the children set tasks. Although the tasks in catching approach the Game Action more than the throwing tasks both instructions instruct Self-1. They must be rejected both.

However these tasks do address something. Maybe the positive result of this research is due to the fact that there has been given *a* task. And only *one* task. This fact is part of my proposition that flow and playing in the zone will occur if all focus processes are occupied by *one* ongoing task.

According to the movement action (MA) of the explanatory model it would have been better to improve the understanding of these children by showing the action trajectories between the children. These ball trajectories could have been shown on paper, video etc.. They should have been instructed that they can only influence the Initial Phase where the whole ball trajectory will be created. And that they have to throw the ball in the latent ball trajectory which is already there.
Children should learn that the catching follows the reverse path of throwing. They should learn to extend the Initial Phase of the ball trajectory and make perceptions of the latent part of the ball trajectory. They should learn to make precise predictions of the global area where they will have to catch the ball. Implicitly all the perception processes will be activated.
To address the cognitive basis I would surely let the children throw three reference ball trajectories[38]. A straight line, a 45° round ball trajectory and a 30° round ball trajectory. They are occurring a lot in throwing tasks and the shapes are very clear to every person. So the outcome of executed ball trajectories in an exercise will not lie. Feedback will be accepted right away by a player. The reference ball trajectories will also act as references for each other and because all the ball trajectories are actually used no time will be wasted on reference ball trajectories you will never use. Nowadays this happens quite often in tennis with for example service exercises from the service line, the side line, the back of hall etc.. From an efficiency point of view it is important to use reference ball trajectories which have an independent use as well.
In that case I am convinced that the results would have been a lot better in throwing and catching tasks with these children.

I will prove that my take on the story is the most probable one. In retrospect one will have to conclude that TQE was a naïve linear explanation of the reality. All the perception processes need an explanation out of a complex system. And even if it will be proven that nobody is executing the movement action (MA) conform the explanatory model than the explanation out of the complex system is the best representation of what should happen.

[38] Chapter 10.8

Chapter 3 – The Motoric Movement Action – *General remarks*

1. Introduction
2. The Motoric Movement Action versus the Motoric Action
3. The Motoric Movement Action versus motoric movements
4. The transition point (TP) within the Motoric Movement Action
5. The Motoric Movement Action with (motoric) movement objects
6. The Motoric Movement Action and success rates
7. Demarcation of the Motoric Movement Action and scripts
8. The Motoric Movement Action and flow

In the chapters 3-5 the Motoric Movement Action as a whole is discussed. Parts will be appointed only in relationship towards the complete form. The parts of the Motoric Movement Action will be discussed separately as autonomous complex (sub-)systems in the subsequent chapters. After reading the chapters 3-5 the borders of the Motoric Movement Action will become clear. The explanatory model will be shown in a wide variety. Subsequently you will be able to define any Motoric Movement Action yourself. While doing that you will see that the explanatory model doesn't budge and that it explains every Motoric Movement Action in the same way.

This chapter starts with general remarks concerning the Motoric Movement Action.

1. Introduction

Every conscious action of a human involving a task and a movement of an object we are holding, a body part or the whole body can be defined as a Motoric Movement Action. So not conscious movements of the body like the beating of the heart, the blinking of the eyes etc. are not covered. Besides those movements other motoric actions like standing still or the balancing of a stick on a finger etc. are not covered as well. The task in these motoric actions is not grafted on a movement of an object we are holding, a body part or the whole body. The task in these motoric actions is optimally fulfilled if there is no movement at all. Theoretically the motoric action can be defined as a Motoric Movement Action. This can be achieved by defining the static place of an object we are holding, a body part or the whole body as a 0-movement. With the theory of relativity one could define all places P as one line with the passing of time. The perception will then not be allowed to see differences in the places P. The motoric action is then not caught in an actual action trajectory and actual movement trajectories but *caught in a time line*.

The division in Motoric Movement Actions and motoric actions is important. At a micro level one can determine that the standstill in front of a mail box as a part of the Motoric Movement Action posting can be defined as a motoric action. In that way lots of parts of Motoric Movement Actions at a micro level follow the motoric action. Only Motoric Movement Actions with the whole body will never host motoric actions at a micro level. In for example the Motoric Movement Action *walking* the whole body is being transferred.

While studying Motoric Movement Actions at a micro level it is important to notice if the eyes are part of the movement or not. In the last phase of the Motoric Movement Action *posting* the head is almost 100% static. And the same can be said about *standing still* activities like surfing, sailing, rowing etc.. In Motoric Movement Actions with the whole body the perception is always dynamic towards the whole matrix of the surroundings. However the perception naturally stays static towards a (motoric) movement object, for example the boat or a bike, that belongs to the Motoric Movement Action itself. So at a micro level one can establish that a header in soccer is more complex for the perception than the kicking of the ball. The complexity increases with a factor because the eyes are part of the movement in a header.

The Motoric Movement Action is characterized by two separate parts. The movement action (MA) and the motoric movement (MM). They are the sole parts of the Motoric Movement Action. The movement action (MA) describes how the task of the Motoric Movement Action must be fulfilled. The breakthrough in insight is situated in the fact that the movement action (MA) must be approached out of the perspective of the (movement) action object we are holding, a body part or the whole body. The motoric movement (MM) describes the execution of the movement action (MA). The motoric movement (MM) must be approached out of the perspective of movement trajectories on the inside of the body of the (movement) action subject. The separate parts don't describe anything about each other. They are two, complete and separate, complex (sub-)systems which however only together are able to achieve the fulfilment of a task in one Motoric Movement Action.

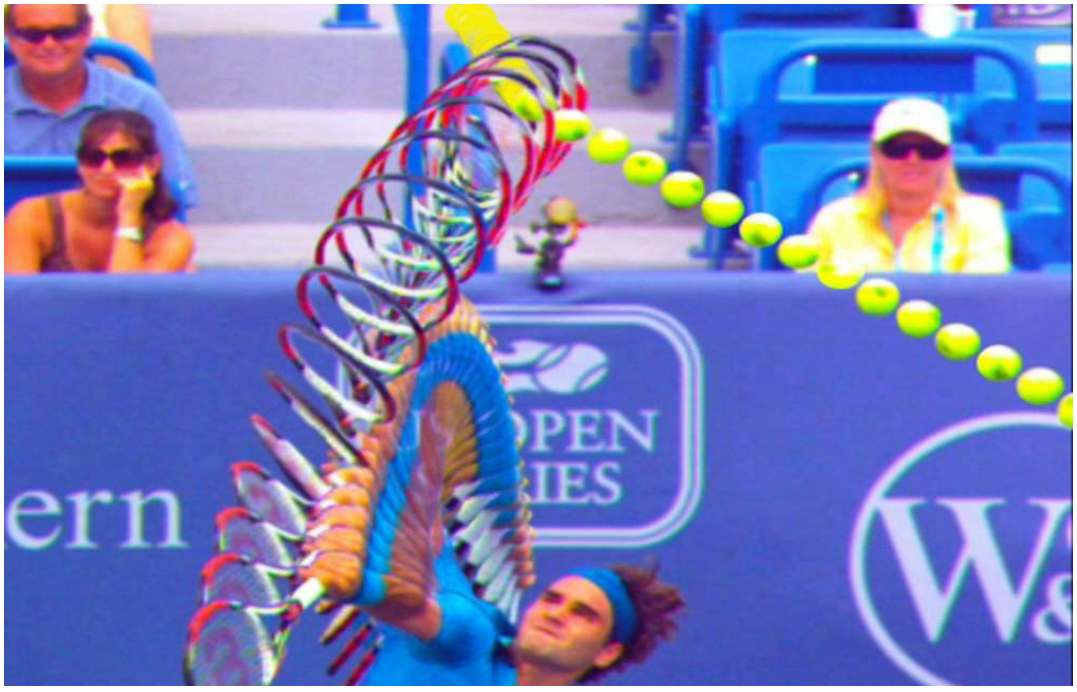

Image: Roger Federer is executing the Motoric Movement Action *serving*. The task is to create a *service* ball trajectory. The ball trajectory can only be executed by the ball. The motoric movement (MM) is only capable to activate movement trajectories which will hit the ball, during the transition point (TP), into the Initial Phase of its action trajectory. Perception processes are actively guiding the two actions. The visual perception is mainly occupied with future and actual positions P of the ball. The proprioceptive perception is mainly occupied with future and actual positions of the *sweetspot* of the racket head during the motoric movement (MM). In more complex motoric movements (MM) the latter will have to focus on the biomechanical main action in relationship to the transition point.

In a *letter posting* task the movement action (MA) demands an action trajectory out of the perspective of the letter towards the slit of the mail box. Only the movement of the letter will fulfil the task. Just like a ball in a ball trajectory only the letter will occupy all separate places P of static, still *letter* images. We will never be able to influence them directly and we never did. The motoric movement (MM) is only capable of executing the task. By making movement trajectories we can actually take care that the action trajectory will be created out of the perspective of the letter indirectly. In games/sports the movement action (MA) or Game Action is about the explanation of the game. The motoric movement (MM) or technique only explains the playing of the game. Analogous to the letter only the place of the ball determines the task in tennis. The movement action idea or Game Idea in tennis enforces the sole task to lengthen a chain of ball trajectories and keep an opponent from doing that.

These facts also show the relationship of the two parts in the Motoric Movement Action. The movement action (MA) is leading and the motoric movement (MM) has to follow. In the formula MMA = MM x (MA) this can be seen clearly. The formula shows more. It shows that there are only two parts and that they are complete autonomous phenomena. The movement action (MA) is completely autonomous and the motoric movement (MM) is clung to it but completely on the outside. Without each other no Motoric Movement Action will succeed. Without a letter no movement action (MA) is possible. And without a movement action (MA) the letter will always remain on the writing desk. The formula also shows clearly that the Motoric Movement Action is optimized by the optimization of both parts.

The division of the Motoric Movement Action in the movement action (MA) and the motoric movement (MM) linguistically shows two times the word movement. This can be explained as follows. With movements we do control we have to get movement in a matter/subject which doesn't move by itself. Although the words *movement* are linguistically the same the movements have nothing in common towards the trajectories they make. The lines of the motoric movements (MM), the movement trajectories, have no relation with the line of the movement action (MA), the action trajectory. There is only a correlation involved.

2. The Motoric Movement Action versus the motoric action

First I will continue to appoint the aforementioned difference between the Motoric Movement Action and the motoric action. If the task is to balance a stick on your index finger than no Motoric Movement Action is involved but a motoric action. If the task would be to let a stick dance on your index finger than a Motoric Movement Action is involved. However most of the time the task concerns the first description. The task in there is fulfilled when the stick is completely standing still. And then there is no movement involved of the (movement) action object. This task follows the motoric action *standing on a balance cushion* or *just standing still*. If *just standing still in one place* is the task you see right away that no movement can be registered. Balancing a stick follows that task. As well as balancing on a balance cushion. If however special movements need to be performed on that cushion to develop certain leg muscles a Motoric Movement Action is born right away. Then the making of deliberate and conscious movements form the task. Just like the Motoric Movement Action *dance*. It doesn't belong to the Motoric Movement Action why leg muscles need to be developed. The Motoric Movement Action only beholds the perspective of the movement *after* an egocentric will decided to do so.

> *The bored wandering teenager still fulfils a* **Motoric Movement Action***. A* **Motoric Movement Action** *doesn't require that there is a conscious goal during the movement. This* **Motoric Movement Action** *just follows all other* **Motoric Movement Action** *moving A-B*[39] *because the boredom needs to be shown at all different places.*

In the balancing of a stick a Motoric Movement Action will occur if the stick can't maintain its static position and the task will become to bring the stick back to that static position. So this is not an active Motoric Movement Action but a reactive one. This reaction is the same if the standing of us, in for example a train, is disturbed by another passenger. The static balance then needs to be repaired. The reactive nature of this Motoric Movement Action can be compared with the reactive Motoric Movement Action *avoiding/fleeing/not-catching.* Our perception is always occupied with this latent Motoric Movement Action. Also when we are executing other Motoric Movement Actions. Where ever we are or whatever we do if something is suddenly coming our way we will try to avoid it or to deflect it. So besides the specific goals of the perception this general reactive goal is always there in the back ground.

It is important to notice that the Motoric Movement Action differs from the motoric action. Scientific research considers them as one. Balance exercises and movement exercises are treated equally. And that is a bad thing because the focus, an important part, is completely different in both tasks. In the motoric action a static focus is involved and in the Motoric Movement Action a dynamic one. The motoric action is not the subject of this book but in short one could say that the focus of the motoric action must be pointed at a 0-movement of the movement trajectories towards a 0-movement of the action trajectory. So that is a really different focus as compared to the Motoric Movement Action. In a Motoric Movement Action the primary focus must always be pointed at the action trajectory, within your own, Motoric Movement Action. The secondary focus needs to be pointed at the biomechanical main action within the motoric movement (MM) towards that action trajectory. Besides that more foci are needed when our action trajectories are threatened by opponents. In sports for example we need to pay close attention to the action trajectories of opponents in a tertiary focus and if we can see how they create their action trajectories we might anticipate their action trajectories by observing their movement trajectories with a fourth focus. In normal daily Motoric Movement Actions most of the time only the primary focus and secondary focus are involved. This is a revolutionary new look at focus because one thought there only was one focus involved.
Classic yoga exercises and the related meditations can be considered motoric actions. In comparison to the Motoric Movement Action in there one can demand to remain thoughtless. The mind will be able to quiet down if it is zooming in on a 0-movement. Within a Motoric Movement Action that is not possible. The Motoric Movement Action demands active perception processes with the goal to find information about the movements involved. The perception processes need to make perceptions of near future places of the (movement) action object and to check these in the present with the actual place of the (movement) action object. Within a Motoric Movement Action being thoughtless is an example of a *contradictio in terminis*.

3. The Motoric Movement Action versus motoric movements

The previous paragraph shows that if movement is missing there is no Motoric Movement Action. Another category which can't find shelter under the definition of the Motoric Movement Action are the motoric actions which are executed without a task. If a dancer only wants to move his body and body parts and has no goal whatsoever to translate a feeling into a specific movement then we can just appoint this as motoric moving. Because then no action can be distinguished. But be aware this only occurs if the moving is only there with the goal of moving.

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[39] See chapter 4.3

You could also perform the Motoric Movement Action *running* with this motive. But although many runners run with this as their main motive they also want to run a distance. That makes it a Motoric Movement Action right away. It doesn't matter how relative this personal motive may be because if the perception has to focus on a *movement A-B* action trajectory it becomes a Motoric Movement Action. It would be different if we could really execute every step of the running in a different direction. Then maybe we could bring it under motoric moving. It will be hard though because at a micro level every sole step is bound to one certain direction.

So a lot needs to be done if we want to call it motoric moving. I can't mention a lot of examples. The example of dance can be broadened to balancing on a balance cushion. If the demand is just to move on that cushion then there is motoric moving. Like I said a treadmill needs a definite direction with every step while running. On the other hand *running* on an elliptical is not really running. Because the limbs are linked to the machine in a set way this can be called motoric moving.

Image: Treadmill (left) versus Elliptical (right); A Motoric Movement Action versus motoric moving.

Just going for a ride on the bike is not motoric moving as well. That would only be possible if you were not limited to roads. The roads restrict just motoric moving because of their shape. Whatever road you choose you are bound to the set direction of that road and that makes just riding a bike into a Motoric Movement Action.

4. The transition point (TP) within the Motoric Movement Action

In the formula MMA = MM x (MA) it is obvious to notice that the movement action (MA) is fully autonomous and that the motoric movement (MM) is glued to it. Although the parts have no relationship whatsoever qua lines they always share one point. This is called the transition point (TP). In the transition point the motoric movement (MM) is linked to the movement action (MA). Or to put it otherwise the motoric movement (MM) and the movement action (MA) come together in this point.

When I want to switch on the light with my index finger then the action trajectory is formed between the small area on the outside of the index finger which will touch the outside of the switch and the outside of the switch that will be touched. The movement trajectories are situated on the inside of the

body and end exactly to the inside of that outer area of the index finger. The transition point is situated right between the inside and the outside of that index finger.

When I carry a letter, I carry it with my thumb, middle and index finger. Also in here the little areas on the outside of the mentioned fingers are responsible for holding the letter. These areas press in opposite directions against the outside of the letter. That is how we hold on to a letter and that is how we control a letter during its action trajectory. Also in here the movement trajectories run on the inside of the body an end just on the inside of those outside areas of the fingers. The transition point is situated between the end of the movement trajectories and the outside of the letter.

The transition points in Motoric Movement Actions with the whole body are harder to visualize. You really have to make an effort in there. Imagine yourself posting a letter but with the letter glued to the chest. Or you have to imagine pushing yourselves a wheeled walker. Or running with a baton in a 4 x 100 meter relay. Those are Motoric Movement Actions with an obvious (movement) action object which you hold in a transition point. Just, as mentioned above, like you hold a letter in a transition point. The Motoric Movement Action *moving* then becomes a part of a wider Motoric Movement Action. With Motoric Movement Actions with the whole body you have to think the same like with moving with an object but then without the specific object. Then you also move something only it is less concrete. So in case you visualized a letter glued to the chest you make an action trajectory from that position to the mail box. Because a letter must go to a mailbox. If you now want to imagine the Motoric Movement Action *moving A-B* than you will have to remove the letter and are allowed to go everywhere.

In the relay events within athletics the action trajectory is rigorously changed because of the baton. The action trajectory is now shaped by the baton and no longer by the body of the athlete. That is obvious because at the changes it only matters if the baton is passed on. However the last runner finishes traditionally and just follows the Motoric Movement Action *touching/taking etc. as usual. If the idea of the changes was followed structurally the last runner also had to let the baton finish.*

In case of foot racing[40] the task is fulfilled when any point of the outside of the upper torso touches the front outside of the imaginary vertical finish line. The point of the torso which touches the finish line first marks the transition point. This touching will follow the general Motoric Movement Action *touching/taking* and is not that abstract yet. But when I am going to teach somewhere then the task of the Motoric Movement Action *moving* is not to move a certain point of my torso but then I want to

[40] See appendix A-6

move my *being*. The moving of my *being* or my *essence* is much more abstract. In that case the main task of the movement trajectories is to move something immaterial. So at an academic level one can debate about what fulfils the task and what is the transition point then. It doesn't really matter what is being appointed the important thing is to understand that all (movement) action objects concerning this Motoric Movement Action, either abstract or not abstract, are dependent of the moving of my whole *concrete* body from A to B.

The transition point plays an essential role in the execution of the Motoric Movement Action. It determines consistency and has a direct relationship with the success rate of a Motoric Movement Action. There is a set relationship between the biomechanical main action, the transition point and the action trajectory.
Like aforementioned[41] the primary focus must be pointed at the action trajectory and the secondary focus must be pointed at the biomechanical main action towards the action trajectory. Because they must be performed at the same time both foci need to be combined in one focus image. This focus image is part of the whole Motoric Movement Action from the beginning to the end. This general focus image needs a specific focus during the transition point of Motoric Movement Actions which need to be timed.
In tennis the racket or to be more specific the outside of the sweet spot of the racket head, as the continuance of the movement trajectories, needs to hit a ball in the beginning of an action trajectory/ball trajectory at the transition point or contact point. The movements before or after that moment are not that important as long as we try to create a certain *freeze*, a dynamic balance, during the transition point. Because the ball trajectory is actually created there. Like "Watch The Ball Trajectory!" shows that is more than a sole contact point. In combined Motoric Movement Actions where the throwing directly must follow the catching there is still a short time frame in which the movement trajectories influence the action trajectory. In sole throwing tasks, except for kicking, the duration of the Initial Phase is longer because we can hold on to the ball longer.

In chapter 12 of "Watch The Ball Trajectory!" I show where consistency is situated in the tennis service. In an example lesson I show how it needs to be trained. Out of the aforementioned general focus image a player only needs to focus specifically on the constellation of the arm and racket action in comparison to the Initial Phase of the ball trajectory during the transition point. Consistency is situated only at that moment. A player will never ever have to hit over a net or to a certain place. That belongs to the premises of the ball trajectory and is evaluated in earlier phases. The service is created at the base line where the player is standing and has to be created there during the transition point of the movement trajectories towards the action trajectory.

Besides the term transition point one is able to maintain the term contact point linguistically. In some Motoric Movement Actions the contact point is literally the point that makes contact. This happens when we touch the light switch with the outside of our index finger or if the outside of a (motoric) movement object, like a hammer or a racket, contacts a nail or a ball. In tennis the transition point is traditionally called the contact point.

5. The Motoric Movement Action with (motoric) movement objects

Within the movement action (MA) the (movement) action objects fulfil the task. The letter which is used in a posting task or the bottle which is used in the launch of a new vessel are examples of these kind of objects. Objects which we use during a Motoric Movement Action but not fulfil the task of a

[41] Chapter 1.5 focus

Motoric Movement Action are automatically (motoric) movement objects within the motoric movement (MM). If we pour wine out of a bottle than the (movement) action object is the wine and only the wine shapes the action trajectory. The bottle is then a continuation of the movement trajectories. Like a hammer or a tennis racket.
We also have to reckon a different group to those (motoric) movement objects. A rowing boat, a bicycle or a car are also examples of (motoric) movement objects. Those are objects which hardly can't be manipulated. One can appoint Motoric Movement Actions with these objects as Motoric Movement Action with a set intermediary constellation. This also comprises the Motoric Movement Actions *opening a water tap* or *working on the computer*.

With (motoric) movement objects a space is created between the movement trajectories of the body and the action trajectory. Within the Motoric Movement Action *turning on the light* the little area on the outside of the index finger is the direct link between the finger and the outside of the switch. This little area is situated very close to the end of the movement trajectories which end just to the inside of that outer area. The transition point then comprises a minimal distance.

With a hammer, racket or bottle the transition point is situated near the end of the object (hammer face, racket head, bottle opening). This is because these objects can be manipulated freely. In that way the object creates at least one extra movement trajectory. Some (motoric) movement objects, like nunchaku sticks, maybe even create two or more extra movement trajectories.
With those objects the movement trajectories of the body end in the holding of the specific (motoric) movement object but must be continued in, not bodily, movement trajectories to finally produce the specific movement in the transition point. In this way the complexity of technique models grows with at least a factor.

Image: *Nunchaku*; two sticks linked together with a flexible material. It is possible to appoint the sticks as a 3rd and 4th link within the arm.

With (motoric) movement objects with a set intermediary constellation the manipulation of the movement trajectories of the body will hardly influence that constellation. The set intermediary constellation is in the possession of its own autonomous movement sequence. Within these (motoric) movement objects the movement trajectories are not lengthened in the object. The movement trajectories in here stop where the outside of the set intermediary constellation is touched by the outside of the body. In rowing there is a set intermediary constellation which can hardly be influenced. In this Motoric Movement Action the outside of the handle of the oar is manipulated with the outside of the palms of the hands. The point where the hands touch the oars marks the transition point out of the perspective of the movement trajectories. The set intermediary constellation in rowing takes care of a push against

the water with the outside of the blade of the oar. A push which forms the negative resultant in relationship to the action trajectory. This is typical for all Motoric Movement Actions *moving A-B*. The push against the water shapes the transition point out of the perspective of the action trajectory. These transition points show a significant difference in distance when we compare them to switching on the light with the index finger.
The same can be applied to biking. The movement trajectories within the body on the inside of the sole of the shoe influence the outside of those parts of the sole that touch the pedal. The movement trajectories of the feet are converted into a push against the road by a similar set intermediary constellation. Again with a certain distance and also resulting in a push which is the negative resultant in relationship to the action trajectory.

In Motoric Movement Actions with a set intermediary constellation it is very clear to see that there is no relation between the movement trajectories and the action trajectory. There is a direct relationship with the negative resultant of the set intermediary constellation, caused by the movement trajectories, and the action trajectory.

6. The Motoric Movement Action and success rates

Within most daily Motoric Movement Actions we don't think in success rates. Most of them succeed in one time. However there are Motoric Movement Actions which don't succeed in one time or succeed just partially. Think about blowing out the candles on a birthday cake. To put a thread into a needle. To hit a nail with a hammer. To pour fluids into a glass. The number one message in the smallest room of the house. For a lot of men it is a lifetime struggle to deliver all the fluids a 100%. But also think about parking a car backwards. Every Motoric Movement Action actually has a success rate. The success rate is 100% if an action always succeeds in one time.

The success rate will diminish if an opponent decides to prevent us from blowing out all the candles or continuously would pull our arm if we wanted to get a thread into a needle. A penalty kick can be executed perfectly but a goal keeper can just have anticipated to that perfect trajectory. If we had to throw a letter into a mailbox from a distance of one meter than the success rate would be very low. That is why we arrange daily Motoric Movement Actions in such a way that they succeed almost every time.

Catching and throwing actions will not have a 100% success rate because of their complexity. Sports in general will not have 100% success rates. Then there is no challenge and the sport will not be a sport. In ball games with a small ball and high ball speeds and where an opponent is keeping you from succeeding there will be a definite decrease of the success rate.

Knowledge about success rates is an important part of our cognitive basis. The tactical movement action has to consider all the relevant variables if more action trajectories are possible. That happens a lot in sports. In tennis this is appointed into detail in the Tactical Tennis Action[42]. In daily activities we also make a choice for a certain action trajectory if we want to move from A to B. There is always a shortest route. But this route must be compared to the chance that more people own this knowledge. So the longer route can maybe safe you time.

[42] "Watch The Ball Trajectory!" - Chapter 6

7. Demarcation of the Motoric Movement Action and scripts

The explanatory model of the Motoric Movement Action is with the action trajectory very clear about the demarcation. The task of the Motoric Movement Action at the macro level determines the whole action trajectory. The complete action trajectory of the Motoric *Posting* Action is the whole distance of the letter from the writing desk to the slit of the mail box. In tennis that is the whole chain of ball trajectories regardless of the amount of separate ball trajectories. The movement action (MA) or Game Action in tennis is not concerned about that number at all. In golf that is the whole chain of ball trajectories from the tee to the hole. The primary concern in there is also the creation of a chain. Once it is made the number of ball trajectories needed are compared with opponents. In the Motoric Movement Action *moving A-B* it is the whole distance from A to B. Within the Motoric Movement Actions *free diving* and *bobsleighing* it is the whole dive/run.

At a micro level the whole Motoric Movement Action can be very well divided in parts. My Motoric Movement Action *posting* can very well be divided in three parts. 1. A Motoric Movement Action *moving with the legs* to the mail box, 2. A Motoric action standing in front of the mailbox with a Motoric Movement Action *moving of the arm* and 3. A Motoric Movement Action *throwing* of the letter into the slit of the mail box. The rally in tennis can very well be divided into the Motoric Movement Action *moving* and the Motoric Movement Actions *catching* and *throwing*. In free diving or bobsleighing all separate curves and turns can be studied independently as well. It doesn't matter how they divide it as long as the parts of the action trajectories at the micro level shape the whole action trajectory at the macro level.
As a teacher most of the time I appoint the Motoric Movement Action out of a functional angle. You could however study it at a micro level from other perspectives. It is all possible as long as the research pays it respect to the whole action trajectory.

"One can divide the Motoric Movement Action in many ways. The explanatory model doesn't budge. It depends on what one wants to research. For tennis I explained the Motoric Movement Action towards the users, the players. For that purpose you need to break down one rally into separate ball trajectories. If one should study tennis out of the scoring system one wouldn't have to do that at all and would only have to regard each rally as just one action trajectory. The scoring in tennis has no interest in the number of ball trajectories of a chain. The scoring system is only interested in the last part of one whole chain. In fact which player wasn't able to add an extra ball trajectory or wasn't able to add a ball trajectory to the beginning of a chain (double fault). However I don't really see why you want to study the chain of ball trajectories as one whole Motoric Movement Action. I do see however that, although separate ball trajectories remain important, in the development of a player that the player must become aware of the fact that one ball trajectory is part of a chain of ball trajectories. More and more the cognitive basis of a player needs to be developed in such a way that every ball trajectory has a set relationship with the next ball trajectory. Conform the Game Idea of linking ball trajectories a player needs to learn to link Game Intentions. An experienced tennis player mainly needs to think in patterns rather than separate ball trajectories."[43]

The action trajectory defines the Motoric Movement Action. When I grab my keys out of my pocket to open the front door at least two Motoric Movement Action are involved. The grabbing of the keys must be visualized from the perspective of the fingertips towards the keys. The moment I hold the keys one Motoric Movement Action is completed. Then the second Motoric Movement Action starts from the perspective of the keys towards the lock. So two totally different action trajectories and perspectives are involved.
The same can be applied when I pour something. The grabbing of the bottle, the actual pouring and the replacing of the bottle are three completely different Motoric Movement Actions. In the Motoric Movement Action *grabbing* the bottle is just the end of the visualized action trajectory. In the Motoric Movement Action pouring the bottle becomes a (motoric) movement object which adds an extra movement trajectory. The bottle must now be viewed upon as a free manipulative object. The bottle

[43] "Watch The Ball Trajectory!"

will produce the action trajectory of the wine out of the bottle opening. When the bottle is replaced the action trajectory is shaped between the bottom of the bottle and the place where it stood.

You can clearly see that the action trajectories of the separate parts have nothing to do with each other. The only thing you can say is that they belong together because at a higher level they fulfil one common goal. Tasks, like making tea or opening a door, which need linked Motoric Movement Actions can be appointed in scripts. But although Motoric Movement Actions can be linked in scripts that doesn't mean that the separate Motoric Movement Actions will ever have a relationship.

"There are (at least) two levels of organization to be considered in these kinds of tasks. There are the individual actions themselves (pick up knife, put a teabag in the pot etc.), and there is the sequence of actions — the 'script' of the task as a whole. Here we are concerned mainly with the roles of vision in individual actions, although the transition from one action to another, which is under the control of the script, is also of interest. Schwartz, Reed, Montgomery, Palmer and Mayer (1991) and Schwartz, Montgomery, Fitzpatrick-DeSalme, Ochipa, Coslett and Mayer (1995) have developed a useful system for categorizing the individual actions. These basic object-action conjunctions they call 'A1s', defined as 'simple actions that transform the state or place of an entity through manual manipulation'. Larger units of action incorporating a number of A1s Schwartz describes as A2s (e.g. fill the kettle) but these refer to sub-goals.
In the study of tea-making (Land et al., 1999) we found that the A1 description fitted the pattern of eye movements associated with the actions very well. We have called the combination of A1 actions and the eye movements that go with them 'object related actions' (ORAs). For our purposes an ORA comprises all the acts performed on a particular object without interruption (e.g. the sequence: pick up mug, move it to new location, set the mug down, would constitute one ORA). Thus in Fig. 1a the ORA sequence would be 'inspect and pick up kettle', 'remove kettle lid', 'turn on taps', and 'put kettle in water stream'. An ORA usually began with a 'defining moment', when gaze moved from the last object to be manipulated to the next in the sequence (Figs. 1 and 2). In both the tea-making and sandwich-making studies the eyes typically fixated each object before any sign of manipulative activity occurred. In the tea-making task the average lead time was 0.56 s, but for the sandwich-making it was much shorter, 0.09 s."[44]

The Motoric Movement Action disagrees with this classification. The action trajectory needs to define the action. Although the classification in ORA's seems logical, it is not correct. The picking up, the moving and the putting down of the mug are presented as three Motoric Movement Actions within one ORA. The explanatory model looks upon this ORA as only two Motoric Movement Actions. I.c. the picking up of the mug with an action trajectory out of the perspective of the hand towards the grip of the mug and the putting down of the mug out of the perspective of the bottom of the mug towards the place of the table where one needs it to be. As a script they belong together but as actions they belong to different worlds. The fact that the word *mug* is involved in all these tasks doesn't mean that they can be linked as actions. The Motoric Movement Action doesn't care how scripts are categorized as long as the action trajectories stay separated.

By the way current scientific research towards scripts shows full congruency with the explanatory model of the Motoric Movement Action. If you want to visualize this you need to fulfil a tea making task for example in a strange but normal kitchen. You have your own script. One person first fills the kettle and another first gets the cups. That is not relevant. Within your script you select the next following script item. For example the grabbing of the kettle. Actual perception occurs initially to shape one latent action trajectory, out of the perspective of the hand towards the handgrip of the kettle, out of the cognitive basis and the tactical movement action. In spite of the fact that also in this kitchen you already have a good idea of where the kettle is your perception will check the handgrip out of your current specific position. You have already seen the kettle before but from a different position and

[44] Michael F. Land, Mary Hayhoe; In what ways do eye movements contribute to everyday activities? http://www.sciencedirect.com/science/article/pii/S004269890100102X

maybe you need to approach the handgrip in a different way from here. And didn't you put that big sugar jar somewhere on the counter? Actual perception has the goal to create one action trajectory out of a global perception of possibilities but maybe even more important to acknowledge that *nothing* will disturb or is disturbing the action trajectory.
If we start the actual *grabbing* action we throw the hand in the beginning of the perceptual shaped latent action trajectory and we correct it with the two processing processes of the perception, the dorsal and ventral stream. The more the action trajectory becomes manifest, the chance to deviations diminishes exponentially, the less chance there is to deviations. When your hand is close to the handgrip, I estimate within ten centimetres, the chance of deviation is so little that the actual perception is no longer needed. The perceptual perception then finishes the job. The actual perception will then be able to transfer to the next script item. So when you actually grab the kettle you are already creating a latent perception of the action trajectory from the kettle to the tap where the kettle will be filled.
As a remark I have to add that we do it like this in a *safe* environment. If we are in an unsafe environment then we actually follow the action trajectory till the last moment and only then transfer to the next script item. When for example you are painting your walls you sometimes work with open sockets because you want to do it properly. While the paint is drying and you also want to drill a hole and you want to connect the drill to the open socket you will definitely follow it the whole way till it's really connected. Take it from me that it would work in the same way when there was a working chain saw hanging in the middle of the kitchen during a tea making task. You would definitely not fulfil any part of any trajectory *unseen*.

8. The Motoric Movement Action and flow

Flow is a state of the body itself. One is looking for rational ways to achieve flow consciously but recorded life experiences are characterized by the fact that the body mainly returns something to a user when flow is occurring. That is also the basic idea of how instructional methods introduce flow. If one complies to certain demands than the body will, *maybe*, hand you flow in return. So those demands are the demands of the body itself. It is logical that those demands will have a relationship with the specific processes which the specific action demands. Only and completely outlined out of the action itself. The explanatory model of the Motoric Movement Action provides a full list of demands out of the perspective of the action itself. In chapter 8 these demands are translated into a set list to create an actual motoric learning process. When one complies with those demands flow will occur automatically. The explanatory model is therefore able to be very clear about the development and existence of flow.

*"Flow stands for the **optimal mental performance state**. In flow psychological and physiological variables are perfectly aligned towards each other and to the task at hand. In that way you are able to perform in an optimal way and experience an ideal state of awareness. In flow you are only occupied with the activity itself. In flow one even loses himself. The always judging ego/self which is normally there will disappear into the back ground. The absence of the ego/self doesn't mean that a person who experiences flow gives away the control over his spiritual energy or is not aware of what is happening in his body or his mind. Just the opposite is true. In flow the ego/self takes a very active role and just because of that everything goes automatically without thinking. The loss of the self-conscience is not a loss of the self/ego and especially not the loss of the conscience itself but only the loss of the conscious of the self. And especially in this state a sportsman is able to push his boundaries and to excel and because of that is able to achieve results which he never has achieved before."*[45]

The explanatory model of the Motoric Movement Action wants to add to the last part of this quote that the conscious of the self must be lost and that it has to be replaced by the conscious awareness of the

[45] http://flowinsports.nl/sports/info/view/id/37/Wat%20is%20Flow?

action. The Motoric Movement Action imposes you with the obligation to only fulfil those demands which the action really needs you to fulfil. The action itself demands these compulsory processes. As if it was an independent outsider who wants to make a commitment with you but only with strict conditions.
The explanatory model completely endorses this quote towards the awareness of a person. Many methods and media state regularly that in flow *you are not here* or you are *thoughtless*. That is not so. The Motoric Movement Action demands a lot of very *thoughtful* and *actual* perceptions of the specific (game-)situation. Perceptions in the present but also of perceptions of near future shapes of the action trajectories. Within the movement action (MA) those are part of the cognitive basis, the tactical movement action and the actual movement action. So you really need to be present and have lots of focused thoughts and perceptions.

Besides that the Motoric Movement Action poses that flow only will be able to occur if the cognitive basis is equipped with sufficient information to balance action trajectory alternatives in a quick and adequate way. In for example chess, tennis and sailing there is a very complex matrix involved with a huge amount of latent action trajectory possibilities. The tactical movement action has to fulfil a fast and adequate deduction process to finally produce only one action trajectory. That will only be possible if the cognitive basis of a player contains a huge amount of reference action trajectories which will cover the majority of the possibilities in relevant game situations. So in those sports flow will only occur after years of hard study. Flow is more likely to occur in for example rowing. And faster. Due to the fact that rowing has a very simple straight action trajectory of 2000 meters.

Besides the cognitive basis the explanatory model shows another demand for flow. The motoric movement (MM) needs to be automatized in such a way that every occurring action trajectory can be executed with a large amount of consistency. In chess the movements are simple and in sailing, although more difficult than chess, the movements are not that difficult as well. Tennis however belongs to the category of most difficult Motoric Movement Actions. Also due to the motoric movements (MM). With the racket one extra flexible movement trajectory is added which makes the technique even more complex. First potential energy needs to be gained. Therefore the racket head needs to be moved away from the contact point/transition point while other perception processes are occupied with the incoming and outgoing ball trajectory. After that the racket needs to return to the contact point in a set and timed way. Because the action trajectories are also very complex in tennis there is a need to develop as many techniques to be able to anticipate every separate action trajectory. This shows that a beginner in tennis is a long way from flow in that sport.

> *Even the very complex Motoric Movement Actions in tennis can be mastered. Although one will have to study very hard before flow will occur. It will take many hours before you built a huge cognitive library. A cognitive basis containing the relevant ball trajectories which cover your relevant game situations. But once that basis is there you could play tennis in flow. The nice thing of that flow is that you learned to look for information in ball trajectories. You are able to execute this essential quest quite well but it will occupy your mind in such a way that you can't pay attention to other things anymore. There will be no room anymore for disturbing thoughts like for example winning or losing. The game and especially the perception processes in there will occupy your mind in such a way that there is no other possibility than being in the moment. You have to play a game where of lot of perception processes actually are needed. To look at the seams of a ball has nothing to do with it and never did.*

The Motoric Movement Action endorses the fact that in flow you are only occupied with executing the action. That is mainly the essence of the explanatory model of the Motoric Movement Action. However the Motoric Movement Action strenuously denies the fact that a player is able to rise far above his standard level as quoted. By executing the Motoric Movement Action you will achieve, as long as you meet the required demands, flow automatically and will reach your maximum potential within your capabilities of that moment. But what is not inside the player will not come out.

"In flow you perform at the top of your game and you are completely absorbed in what you are doing. Fear and worries disappear into the back ground. Self-confidence is at its highest point and everything goes automatically without a sense of time. In flow body and mind are aligned perfectly."[46]

So flow will make it possible to *just* perform at your maximum level. Not more. However you don't get absorbed into the game because of flow. That happens because you execute the compulsory processes of the Motoric Movement Action. And that will cause flow. So cause and effect needs to be changed in there. Also the worries and fears don't disappear but just aren't there because they don't play a role during training. While training the Motoric Movement Action there is no space and energy anymore to pay attention to other thoughts than the demanded ones.
Although it is not a goal within the Motoric Movement Action it can endorse that the sense of time can be lost. The Motoric Movement Action denies however that a Motoric Movement Action will fully be executed in an automatic way. Automatic points at something unconscious taking over. The Motoric Movement Action wants to stay far from that because this is able to create the, incorrect, effect that outsiders will think that they are executed with an absence of mind. The Motoric Movement Action prefers to address the actions as very conscious embedded processes which are executed in such a fast way that it looks like they are automatic responses.

The explanatory model of the Motoric Movement Action shows that you already execute a lot of actions in flow. This happens in all actions where you can fully focus on the action trajectory and in which you own a lot of experience with all possible action trajectories. You turn the light on in flow, you post letters in flow, you are working on the computer in flow etc..

In the media flow is linked to winning most of the time. The explanatory model shows however that flow has nothing to do with winning or losing. Although it recognizes that a person in flow has done a lot and then also is likely to win a lot of matches. You can turn on the light in flow but just miss the switch once. In flow you can drive nails into pieces of wood with a hammer. The movement trajectories in this task are simple. They are completely dedicated to the perception processes concerning the action trajectory. However sometimes the perceptual perception of the latent action trajectory is not the right action trajectory. And because you really need to transfer energy the initiated beginning of an action trajectory can hardly be manipulated in the right way. The transmission of the processing processes of the perception of the ventral stream towards the object within the dorsal stream will then happen too late and the action trajectory can't be adjusted in time. And so in flow you will be able to hit your thumb as well.

Although more and more research was done in the field of flow it kept the feeling of something magical. It was appointed as something that *maybe*, *suddenly*, *possibly* could manifest itself. The explanatory model of the Motoric Movement Action shows the concrete and only way to flow. From now on flow can be trained fully and rationally. After reading this book you will be able to appoint flow in the most concrete way. All magic will disappear. And that in itself is the only minor point of the new insights. Magical things draw more attention.

[46] http://flowinsports.nl/sports/info/view/id/37/Wat%20is%20Flow?

Chapter 4 – The Motoric Movement Action – *General types*

1. The Motoric Movement Action *catching*
2. The Motoric Movement Action *throwing*
3. The Motoric Movement Action *moving A-B*
4. The Motoric Movement Action *touching/feeling/grabbing*
5. The Motoric Movement Action *placing/letting go*
6. The Motoric Movement Action *avoiding/fleeing/not-catching*

In the chapters 3-5 the Motoric Movement Action as a whole is discussed. Parts will be appointed only in relationship towards the complete form. The parts of the Motoric Movement Action will be discussed separately as autonomous complex (sub-)systems in the subsequent chapters. After reading the chapters 3-5 the borders of the Motoric Movement Action will become clear. The explanatory model will be shown in a wide variety. Subsequently you will be able to define any Motoric Movement Action yourself. While doing that you will see that the explanatory model doesn't budge and that it explains every Motoric Movement Action in the same way.

This chapter will appoint Motoric Movement Actions which can be classified as having a more general appearance. Besides the fact that they occur as independent Motoric Movement Actions themselves they most often function as the components of other Motoric Movement Actions.

1. The Motoric Movement Action *catching*

I appoint in here the basic catch action with the hand. We can catch with several body parts and with a lot of attributes but that all follows the process of catching with the hand.

In catching we use general cognitive knowledge we have buffered in life. People with a lot of catching experience have all kinds of references of catching actions in their memory. They know how an object behaves ballistic wise. Besides that there is abstract knowledge about the task. Something flies through the air and we have to be there where the object trajectory is coming down. This all contributes to a perceptual tactical basis.
If we are really going to catch that basis is completed with actual information about the location. Which object must be caught? What is the distance? Which object trajectory will approach us. That all contributes to the shaping of a precise image of what will globally approach us. That image not only guides the upcoming catching action but also limits the uncountable latent possibilities of a general throwing action drastically. Although the picture is much more limited because of this tactical movement action still a considerable amount of perceptions of latent incoming object trajectories are considered from the throw area.

If the object is actually thrown than the pattern of the tactical movement action is quickly placed as a frame work upon the actual situation. The actual movement action is forced to make images of the incoming object trajectory from global to precise. There for it uses the Initial Phase and the manifest parts of the object trajectory. There are a lot of perception processes involved.

"There is much more to perfect vision than having normal eyesight. While the term "sight" emphasizes the clarity of image on the retina, vision encompasses a broader meaning as the mental process of deriving meaning from what is seen and is the output of visual pathway integrity, visual efficiency and visual information processing.

Although, the eyesight plays a critical role in image formation in the retina of the two eyes, the complex process comprising of the relay of the ball efficiently. A set of visual skills are required not only for the batsman but also for all of those trying to catch the ball. For instance, the ability to catch a ball requires continuous convergence of the eyes, assessing the speed of the ball and predicting its path [7]. To actually catch a ball, one must combine the eye's inputs with activation of the body's motor system to get the hands in the correct place. This complex process requires a set of visual-motor skills in the form of depth perception, saccades and pursuits, eye hand coordination, vergence, peripheral awareness and visual reaction time.[47]"

I limit myself to the processing processes of the perception. The dorsal stream and the ventral stream. The ventral stream tries to make predictions about the latent part of the object trajectory out of the tactical *catching* action, the Initial Phase of the object trajectory and the actual manifest parts of the object trajectory. The ventral stream observes the object but the shape of the trajectory is dominant. The dorsal stream is mainly observing the object. It sees the object trajectory but now the object is dominant. It's concerned with the actual locations of the object and the actual motoric movements linked to these places.

The two systems have a mutual ongoing relationship till the task is completed. With every unit of time the ventral stream provides the possible end of a ball trajectory and the dorsal stream checks for deviations of that trajectory. Deviations will give a new perceptual image which will be checked again etc..

Image: A *catcher* (baseball) makes a perceptual image of the latent part of a ball trajectory out of the manifest part. Obviously the ball is not coming towards him[48]. The catcher first has to *move* his glove with a running action to the now globally assumed end of the ball trajectory.

In the beginning the image of the end of a trajectory is allowed to be global. A precise prediction is not possible at that time but it is also not necessary. Though it is very important to create a precise global

[47] Impact of Visual Skills Training on Sports Performance: Current and Future Perspectives; S. Khanal; http://medcraveonline.com/AOVS/AOVS-02-00032.pdf
[48] "Watch The Ball Trajectory!" Chapter 10.10

image. In that phase the object still has to travel for a relative long time. The chance of deviations decreases exponentially with every next time unit.
When the object comes closer a catching position must be appointed. The best catch position is a position sideways of the incoming object trajectory. The shape of the trajectory can best be observed from there[49]. In the last phase of an object trajectory the hand will be raised in a general position where most perceptions of the end of the latent object trajectories end. The hand stays in a position where it actually can be observed. The focus is still mainly on the perception processes of the trajectory. So we see our hand with our peripheral vision with the main image of the object trajectory.

Only until the object is really close (approximately 1 meter) we transition from receiving the object trajectory to the actual catching. At that time it is possible to do that. The object trajectory is almost completely manifest. The chance of deviations is now limited to a minimum. The perceptual, still latent, end of the trajectory needs less attention of the dorsal and ventral stream. Although they will continue to perform this task the emphasis will now transition to the actual catching of the object.
The perception processes clearly change focus at this moment. The final task is the catching part. The eyes make a saccade. In the earliest phase after the saccade the perception focuses again on the processing processes but now the object trajectory is in peripheral vision and the hand is in the actual image. Now there is only a really short piece of latent trajectory left. The ventral and dorsal stream will still mutually influence each other till the object almost reaches the hand. The dorsal stream already activated gross motoric movements of the body and is now fine tuning the actions needed. At the moment of actual catching the hand opening and the muscle tension are completely adjusted to the incoming object. The shape of the object determines the shape of the hand.

"Zoals ik zo juist beweerde is een correcte perceptie onlosmakelijk verbonden met een succesvolle bewegingsuitvoering. Dit wordt geïllustreerd in het volgende filmpje. Zoals u ziet, pakt de jongedame het glas probleemloos op – een eenvoudige dagelijkse beweging die een samenspel vereist van het benutten van visuele informatie en het genereren van de juiste krachten in arm en vingers. Veranderen we de visuele input, bijvoorbeeld door het glas te vullen met water, dan zien we dat de beweging naar het glas en het optillen daarvan iets langer duurt. Het volle glas vereist dat het glas behoedzamer gemanipuleerd wordt, terwijl de kracht van de vingers groter moet zijn vanwege de hogere massa. Wanneer het glas ondersteboven staat, wordt het zo opgepakt dat het meteen kan worden gebruikt (Rosenbaum e.a., 1992). Straks na afloop bij de receptie mag u dit zelf uitproberen, mits u eerst uw glas heeft leeggedronken.[50]"

After the saccade the perception just kept sight on a little zone where the incoming trajectory could emerge from. In the beginning of the trajectory it considered many more incoming trajectories. The perception processes work from global to very refined. So now there are only a few incoming trajectories left. The hand takes account of just very little deviations and is now in a position where most of those trajectories will find their perceptual end. So from that position the hand only needs to perform a little adaptation. For the greatest consistency the hand must stay in the global position and mainly let the object come to the hand. This last sentence contains the key to elite catching. Until the moment you really feel the object touching your hand you are receiving the object. Till that moment you must let come the object to the hand. This essence is never acknowledged in tennis.
The greatest mistake in teaching tennis is the mantra: "Watch the ball!". The main subject of the book "Watch The Ball Trajectory!". But in second place another mantra: "Go to the ball!" has been the wrong and detrimental line coaches used. That means that sometimes you have to make a sprint towards the ball but then you also have to let the ball come to the imagined catching point. That contains the essence of catching.

[49] Like the volley in tennis
[50] G. Savelsbergh; Tussen de linies spelen; http://www.fsw.vu.nl/en/Images/Oratie_Prof._Savelsbergh_tcm250-108263.pdf

In daily live we don't catch a lot. It happens when we or somebody is pouring a drink and we have to catch it into our glass. That is a simple catch action. More difficult catch actions only exist in sports. So sports can't rely a lot on references out of daily live.
On the other hand we continuously execute the reactive Motoric Movement Action *not-catching* from the moment we open our eyes. In almost every surroundings matrix we enter we catch precisely like is described in the Motoric Movement Action *catching*. The only difference is that we don't want to touch or catch something, or in other words we execute the same actions to deliberately *not-catch* a thing. Or to *avoid*. At the high way, on our way to the mail box, in a crowded shopping mall we don't want to catch things which would disturb our specific action trajectory of the moment.

As a last remark I want to mention here that the opening of a kitchen cupboard can be seen as a Motoric Movement Action *catching*. If one approaches a cupboard handle in a kitchen to grab it one could appoint this, with the theory of relativity in mind, as a catching action for the perception. By walking towards the handle the visual perception experiences the same like in actual catch actions. Namely that the latent part of the action trajectory becomes smaller every time frame. Because for the perception it is not important what is actually moving. The difference with actual catching is that we in this case cognitively know that the handle is not making an action trajectory and neatly stays in place. The processing processes of the perception don't need to do anything with the handle they only have to adjust the hand.

2. The Motoric Movement Action *throwing*

I appoint in here the basic throwing action with the hand. We can throw with several body parts and with a lot of attributes but that all follows the process of throwing with the hand.

In throwing we use general cognitive knowledge we have buffered in life. People with a lot of throwing experience have all kinds of references of throwing actions in their memory. They know how an object behaves ballistic wise. Besides that there is abstract knowledge about the task. We know we have to throw an object into a trajectory where we can only influence the beginning of that trajectory. During that Initial Phase the end of that trajectory must already be shaped. This all contributes to a perceptual tactical basis. This is what we can do at home sitting in a comfortable chair.
If we then transfer to an actual throwing occasion this tactical basis is completed with information about the location. Which object must be thrown? Over what distance? Which object trajectory will reach the goal destination? That all will complete the Tactical Throwing Action. Finally it has to come up with one precise prediction of an action trajectory which will reach the goal and reduce that to an Initial Phase. The Initial Phase must contain the conditions for the perceptual end of the trajectory to arise *out of the blue*.
The Actual Throwing Action considers this Initial Phase of this specific trajectory as the only existing trajectory in the world and just starts to execute this Initial Phase. During the Initial Phase a pitcher throws the object into its object trajectory and can't control it anymore after this phase.
The Initial Phase in just a throwing task is relatively long. One can visually guide an object for quite an amount of time. Now the ventral stream and the dorsal stream accompany the trajectory of the Initial Phase. The Tactical Throwing Action has made a perception of the shape of the Initial Phase. This now becomes the guide for the actual place of the object. Deviations of the perceptual object trajectory will be adjusted in an ongoing mutual perception process.
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When the Initial Phase of the Actual Throwing Action is completed actual vision has little more function. It can only give guidance to expectations we can have towards the object reaching its goal while the object is still in flight. We can compare the actual trajectory with the perceptual trajectory. Maybe we want something with throwing actions but we can't control the end of a trajectory when the object

is at the end. So actual perception processes stay more pregnant in catching actions than in throwing actions. Actually processing the outcome of the Initial Phase is very important when we have to create feedback when we get second chances to perform the same throwing task again. The feedback will enrich the cognitive basis in a short period of time and so the next tactical throwing action can take that new information into consideration by adjusting the Initial Phase.

So in a throwing action the perceptual shape of the object trajectory gives maximal support to the realization of the shape of the Initial Phase. The crucial point is the point where the object is released and starts to make its trajectory on its own.

"The locations of the fixations were also very reproducible between subjects, for example, subjects fixate the mouth of the bottle when pouring and then transfer gaze to the level of cola in the glass when about half-way through. Thus many details of the fixations, and by inference the ongoing visual computations, are governed by the task goals, together with the physical constraints of the world.' (Hayhoe, 2000). It seems that the way the human visual system is constructed ensures that competent subjects acquire very similar oculomotor techniques when they interact with objects.[51]"

In daily live we know several throwing actions. There is a lot of *throwing* with fluids if we pour drinks or if we empty a package into a cooking pan. We also pour if we open a water tap. Also think about the number one message in the smallest room of the house. Even a letter posting task contains a very small throwing action in the last phase. The Initial Phase of that throw is manipulated maximally due to the fact that the shape of the letter is already parallel stuck into the slit of the mailbox. In that task there is no specific goal the letter must reach. The execution of the Initial Phase will provide a 100% success rate.
In all those tasks the beginning of the object trajectory and the perceptual shaped latent object trajectory are essential parts of the perception processes.

"These parts will induce the most important conclusions in the Game Action in tennis. In a sending/throwing task we only need a perceptual perception of the outgoing ball trajectory. Because the tennis court always stays the same we only need actual perception in creating an intersection point of the two curves and we need actual vision of the Initial Phase. That is all. There is no need to hit over the net and there is no need to look at a goal area in the opponent's court. In fact those actions feed Self-1. It withholds a player from the real tasks at hand and must be rejected.
The perception only needs to find an intersection point and to visualize an outgoing ball trajectory from there out of the Tactical Tennis Action. The Actual Tennis Action needs to allow the ball to come to that intersection point and to execute the Initial Phase of the outgoing ball trajectory at that spot. The ball trajectory comes into existence completely at the side of the player and nowhere else. One of the many conclusions which can be derived from this is that consistency in a service must be trained at the baseline where the player is standing[52]. Consistency is only due to the consistent construction of the Initial Phase. If the first part of the ball trajectory is made correctly the service will cross the net and will go into the service box.
After the actual hit the perception will have to transition to the tactical outcome of the outgoing ball trajectory. The actual perception must check how the actual ball trajectory differs from the perceptual ball trajectory which was the guide for this task. Any deviations in that image might have consequences for the Tactical Tennis Action."[53]

3. The Motoric Movement Action *moving A-B*

[51] Michael F. Land, Mary Hayhoe; In what ways do eye movements contribute to everyday activities?
[52] See "Watch The Ball Trajectory!" - chapter 12
[53] See "Watch The Ball Trajectory!" - chapter 5

Moving occurs a lot in Motoric Movement Actions. Moving in here means the movement of the whole body from A to B. We move in the Motoric Movement Actions walking, biking, driving a car, horse-back riding, swimming etc., but also within a lot of other Motoric Movement Actions we regularly move. When I execute a Motoric *Post* Action I need to walk five minutes. In a kitchen I constantly execute two to five steps to go to the fridge and then again to the cupboard in the left upper corner.

From the time we are able to crawl we want to move from A to B. So we created a huge cognitive base of possible action trajectories. Either we make two steps or bike fifty kilometres to a church we always make a tactical plan first. In a kitchen you may have to avoid the cat or a shopping bag and the location of the church we check with a map. Is it better to take road C because of the wind and stay sheltered or take road D in the open field?
We not only possess a lot of information about horizontal action trajectories. We also are able to move vertically very well. If you want to reach the church tower you have to take the church stairs and things high up in the kitchen we reach with a soup spoon and a jump or we use a small stepladder.
Like in all Motoric Movement Actions the tactical *moving* action has to come up with one latent action trajectory.
If we are going to execute the chosen action trajectory in the actual *moving* action then we throw our whole body, with or without the (motoric) movement object (bike, car etc.), in the beginning of the perceptual visualization of the latent action trajectory. In Motoric Movement Actions *moving A-B* our whole body becomes part of the action trajectory. And because our eyes are part of the moving body we are not able to observe the action trajectory from the outside like we do in for example catch and throw actions. So we don't actually see our place in the *moving* trajectory.
Still the processing processes of the perception are active in the same way like in every Motoric Movement Action. This is possible because we cognitively know that our eyes are attached to our body. So like we are able to observe a ball trajectory from the outside while catching we are now able to observe a *ball* trajectory on the inside. In Motoric Movement Actions *moving A-B* we are the ball and the distance A-B is the ball trajectory. So our perception processes literally see the action trajectory out of that perspective. The ventral stream mainly keeps on making perceptual images of the latent part of the action trajectory as compared to our actual position. The dorsal stream mainly keeps an eye on our actual position in relationship to the perceptual image of the action trajectory. As soon as the actual position deviates from the perceptual image the tactical movement action will present a new action trajectory right away.
In Motoric Movement Actions *moving A-B* the whole matrix is getting more complex due to the fact that all matrix lines are changing continuously in relationship to the *mover*. For the perception everything is going to move except for the (motoric) movement object which is part of the Motoric Movement Action. The bike is standing still for a cyclist. The increase of the complexity has the consequence that we have to time our actual actions. If we want to post a letter while biking all the actions are bound by a certain moment in time in which all needs to be executed. If we stand still before a mail box that doesn't need to happen.

Out of the above one is able to conclude that we probably don't experience the first phase of the Motoric Movement Action *posting*, the walking towards the mail box, out of the perspective of the letter. The letter can then be seen as the same (motoric) movement object like the bike or car during a Motoric *Moving* Action. During the walking phase we probably mainly execute the Motoric Movement Action *moving A-B* in which we cognitively know that if our body is going from A-B the letter will end in B as well. When we stand in front of a mail box we are much more occupied with the action trajectory of the letter. Probably because of this we only consider the standing in front of a mail box as the Motoric Movement Action *posting* and we consider the first part as a Motoric Movement Action *moving A-B*.

4. The Motoric Movement Action *touching/feeling/grabbing*

The Motoric Movement Actions *touching/feeling/grabbing* etc. are those actions which have the sole task to grab, to touch, to feel etc.. When that task is fulfilled the Motoric Movement Action is completed right away. The feeling involved can be for example the sole touching of a light switch. Or to feel if a heater is warm or cold by just putting your hand on it in a static way. The feeling as belonging to stroking is part of a completely different Motoric Movement Action with an autonomous action trajectory.
The Motoric Movement Action *switching on the light* might be one or two actions. That depends on the fact what kind of switch is used. Within classic, analogue, switches you will in the end have to press or push something after the touching. The fact that only minor distances are involved doesn't take away the fact that this pushing or pressing needs to be considered as a new Motoric Movement Action. Because the Motoric Movement Action *touching* stops the moment the fingertip touches the switch in the transition point. The action trajectory of the Motoric Movement Action *touching* is then fulfilled. Some, most digital, switches you only need to touch to activate the light. So with these switches the job is done with one Motoric Movement Action.
The Motoric Movement Action *grabbing* follows this principle. When I feel the door keys in my hand this Motoric Movement Action is completed. Then a new action trajectory must be created out of the perspective from the keys to the lock. The opening of a cupboard follows the same principle. The first Motoric Movement Action of grabbing the handgrip must be created out of the perspective out of the fingertips towards the handgrip. The moment we feel the handgrip the first Motoric Movement Action is completed. Then another action of the opening of the door starts with an action trajectory out of the perspective of the cupboard door.

There aren't that many Motoric Movement Actions where only touching is involved. Most of the time another Motoric Movement Action must be executed. Most of the time the switching of the light normally constitutes two Motoric Movement Actions which have to be executed in a script. The fact that they are simple doesn't change that.
A similar script we execute a lot is the pressing of the keys on a keyboard of the computer. This script contains the same simple Motoric Movement Actions as in switching on the light. The first action trajectory of the first Motoric Movement Action *touching* is the action trajectory out of the fingertip towards the relevant key. This Motoric Movement Action ends when the outside area of the fingertip actually touches the outside of the key. The second action trajectory of the second Motoric Movement Action *pressing* is the distance we need to press that key down to actually create a syllable on the computer screen. Because the first Motoric Movement Action had the main goal to feel the key we are now able to execute the pressing of that key in a proprioceptive way.
The pressing of keys looks simple but that is not always true. The differences in the quality of pressing of piano keys, beside the handling of the script, mainly shows the differences in quality of piano players. All advanced pianists are able to execute the first Motoric Movement Action of feeling the keys. The quality of the music is not depending on that. The second Motoric Movement Action of pressing the keys divides the group of advanced pianists in concert pianists and piano teachers.

The Motoric Movement Action *touching/feeling/grabbing* etc. is characterized by the fact that seemingly nothing happens for most part of the action trajectory and when something happens the Motoric Movement Action is over right away. When we walk to the hall way to turn on the light we walk with our fingertip through *nothing* till we are close to the switch. When we are in front of the switch the arm will continue through *nothing* to move the fingertip until the moment we touch the switch. And that is also the abrupt end of the action. It seemingly looks a lot of *nothing* with a little bit of something at the end. That is not true. The perception processes are very occupied with that *nothing*. If we are busy executing an action trajectory within one specific Motoric Movement Action we execute the Motoric Movement Action *not-catching/avoiding* etc. at the same time in a very active way. We don't want other action trajectories to disturb our current task. This perceiving of *nothing* is connected to the latent reactive Motoric Movement Action *avoiding/fleeing/not-catching* which we execute in every surroundings matrix.

5. The Motoric Movement Action *putting-down/letting-go/re-placing/dropping*

The Motoric Movement Actions *putting-down/letting-go/placing* etc. are most of the time linked to the Motoric Movement Actions *grabbing/taking* etc.. When we need an object to fulfil a task we *take* it, use it and most of the time *let it go* in the end. When we use an (movement) action object the perspective of the action trajectory is most of the time different then if we want to get rid of that same action object. When we use a bottle to pour a drink the action trajectory is shaped by the fluid from the bottle opening to the glass. If we want to replace the bottle in the bottle-cabinet the action trajectory is shaped from the bottom of the bottle to the place where it belongs. When we use a key to open the front door the action trajectory is shaped from the tip of the key to the lock. When we replace the key in our pocket the action trajectory is shaped out of the perspective of the whole key.

"Directing. Many actions begin with a movement of the hand to contact an object. These are nearly always preceded by a fixation on the object (there were one or two cases where an object was contacted while the eyes were looking elsewhere; presumably this was done from memory). Typically only a single fixation is involved, and the eye usually moves away from the object just before the hand reaches it. Thus the grasp itself is often not executed under visual feedback. It seems that the main function of the directing fixation is to provide fovea-centred goal-position information for the motor system of the arm, which then concludes the movement in a (visually) open-loop manner. Some information about the shape of the object to be grasped is probably also obtained, as the hand 'preshapes' on its way to the target. Another example of a directing movement is putting an object down. As in grasping it is the destination that is fixated, in this case the place on the bench or shelf where the object will be put down.[54] *"*

Image: *Dodgeball* is characterised by two obvious Motoric Movement Actions. The Motoric Movement Action *throwing* and the Motoric Movement Action *avoiding/fleeing/not-catching*.

6. The Motoric Movement Action *avoiding/fleeing/not-catching*

[54] Michael F. Land, Mary Hayhoe; In what ways do eye movements contribute to everyday activities?

In comparison to the previous Motoric Movement Actions this Motoric Movement Action is not often executed actively. Most of the time this Motoric Movement Action is initiated out of a reaction to another matrix subject or object which suddenly shows a threatening action trajectory towards our action trajectory or position. It has the same *reactive* nature when a Motoric Movement Action is initiated when we are pushed over by someone when we fulfil the motoric action *standing still* and we again have to regain that balanced position.
I will however appoint in here a Motoric Movement Action in which we deliberately don't want to catch[55]. Let's assume for example that I know that an egg will be thrown at me and that I decided to not catch it deliberately. This Motoric Movement Action will completely follow the Motoric Movement Action *catching*. The perception processes are as active in both actions. The only difference is that we actually don't catch something. That means that we don't have to make a saccade when the object comes close and we don't have to place the *catch* hand. When an egg is really thrown at us at a certain speed you actively have to move out of the way of the latent *egg* trajectory. It is important to notice that the movement action (MA) is the same but that the motoric movement (MM) is the only part that is different. This *not-catching* can also be assessed as *fleeing* or *avoiding*.

The task of a line judge in tennis is to observe foot faults or *ball faults*. A line judge who is signalling with the arm that the ball is out doesn't however fulfil a Motoric Movement Action belonging to the perception processes of that task. The Motoric *Extending the arm* Action is an independent Motoric Movement Action. The movement of the arm is related to the fact that the line judge gained cognitive knowledge which that line judge, out of an egocentric will, wants to translate in a Motoric Movement Action. Out of the perspective of the Motoric Movement Action there is no causal relationship in the perceiving that the ball is out and the extending of the arm. The Motoric Movement Action has no interest whatsoever in why an action is executed.

Image: The perception of a line judge is not only occupied with tennis rules. The perception processes in every surroundings matrix are also busy with the latent reactive Motoric Movement Action *avoiding/fleeing/not-catching*. This Motoric Movement Action becomes manifest if the perception perceives that a latent part of an action trajectory of a matrix object or subject is threatening the individual. In every environment we are always fleeing latently.

[55] This is the Game Idea of a few games/sports like dodgeball; https://en.wikipedia.org/wiki/Dodgeball

The perception processes within the Motoric *Extending the arm* Action are mainly focussed on the placing of the arm in a proprioceptive way. The only thing one can do with the perception of the *ball fault* is to link it in a script to this arm extending task. So a line judge is looking at *faulty* and at *proper* balls in the same active way and those perception processes don't belong to a Motoric Movement Action. The line judge is only executing the motoric action *standing still*. There is no task in which a movement is involved. The task of the line judge within her function as a judge is only to perceive if the ball touches the tennis court or not.

However the line judge as a human being is not only occupied with that task. A human being is always scanning the whole surroundings matrix in every environment. So a line judge is not only scanning the ball but also witnesses a slipping player, the running ball boy, the streaking spectator and the racket that is thrown to the ground out of anger. That this is a part of the perception processes of the line judge becomes obvious when the player or a tennis ball is threatening the position or the action trajectory of the line judge. Then the Motoric Movement Action *avoiding/fleeing/not-catching* becomes manifest instantly. Then that person will really try to avoid the latent parts of the threatening action trajectories.

If we consider all Motoric Movement Actions we could now make a clear distinction in those Motoric Movement Actions where you either engage an action trajectory or you don't engage an action trajectory. We either are avoiding or looking for a confrontation. There is no other way.
In the Motoric *Post* Action you deliberately want the letter to move without interruption during the two first phases. Without being disturbed by other action trajectories. The perception is then focussed on that *nothing*. If a street is blocked or if a horde of people are blocking the mail box then the cognitive basis and the tactical movement action create a new action trajectory with *nothing* to a new mail box as soon as possible. In the last phase of the Motoric *Post* Action the letter is deliberately seeking the confrontation with the mail box. The same can be applied to rowing or the grabbing of the kettle. In the beginning we don't want to hit anything with the boat or to hit a cup of hot tea or a vase of flowers and at the end we deliberately want the boat to touch the finish line or want to get the kettle into our hands.
With this insight another entrance is being created towards the theme of *fleeing* or *fighting*. The deliberate engaging or disengaging of the action trajectory of a threatening matrix subject or object.

Chapter 5 – The Motoric Movement Action – *Special Motoric Movement Actions*

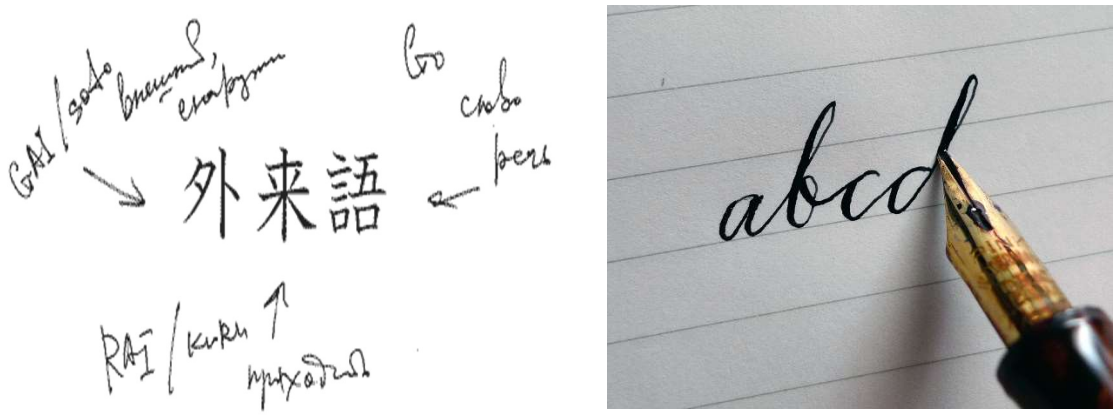
1. The Motoric Movement Action *writing*
2. The Motoric Movement Action *pouring*
3. The Motoric Movement Action *playing chess*
4. The Motoric Movement Action *swimming*
5. The Motoric Movement Action *flying*
6. The Motoric Movement Action *high jump* and *long jump*
7. The Motoric Movement Action *juggling*
8. The Motoric Movement Action *gymnastics*, *free diving* and *ice skating*
9. The Motoric Movement Action *creating a chain reaction*
10. The Motoric Movement Action *playing the piano*
11. The Motoric Movement Action *eating*
12. The Motoric Movement Action *dancing*
13. The Motoric Movement Action *riding horse back*
14. The Motoric Movement Action *blowing* and *talking*

In the chapters 3-5 the Motoric Movement Action as a whole is discussed. Parts will be appointed only in relationship towards the complete form. The parts of the Motoric Movement Action will be discussed separately as autonomous complex (sub-)systems in the subsequent chapters. After reading the chapters 3-5 the borders of the Motoric Movement Action will become clear. The explanatory model will be shown in a wide variety. Subsequently you will be able to define any Motoric Movement Action yourself. While doing that you will see that the explanatory model doesn't budge and that it explains every Motoric Movement Action in the same way.

This chapter will appoint special Motoric Movement Actions. A wide variety of Motoric Movement Action will be shown in such a way that the borders of the Motoric Movement Action must become visible. It is impossible to fully appoint every Motoric Movement Action in all its finesses. Only those parts will be appointed which make the specific Motoric Movement Action special.

1. The Motoric Movement Action *writing*

The Motoric *Writing* Action is a very special Motoric Movement Action. It is characterized by the fact that it becomes very visible how many different sorts of action trajectories a cognitive basis is able to contain in relationship to one Motoric Movement Action. The action trajectories comprise all punctuation marks, syllables etc. which we use in writing. So that is much more than only 26 syllables of the alphabet. Numbers, capital and block letters etc. all have their own unique action trajectory. In writing there is also a lot of abstract cognitive knowledge about the inflexion points of all the action trajectories. In that way we can link all syllables to words.



Images: An experienced writer possesses a huge cognitive basis with a lot of specific action trajectories (left). Abstract knowledge of the specific inflexion points of all the curves makes it possible to connect the syllables (right).

The script in writing contains three Motoric Movement Actions. 1. Picking up the pen. This Motoric Movement Action follows the general Motoric Movement Action *grabbing/touching/picking-up*. The action trajectory is shaped out of the fingertips towards the pen. 2. The touching of the point of the pen against the paper. This also follows the Motoric Movement Action *grabbing/touching/picking-up*. Only this time the action trajectory is shaped from the point of the pen to the point where the pen will touch the paper. 3. The Motoric Movement Action of the actual writing. The cognitive basis came forward with an image of a syllable or word. The tactical *writing* action is now checking this perceptual information with for example the actual space on the paper. Is there enough room for the whole word? Do I have to hyphenate the word or do I have to adjust the size a little? If the tactical *writing* action made up its mind and came to one perception of an action trajectory the actual *writing* action is just going to execute the word. The actual *writing* action starts by throwing the point of the pen in the beginning of the latent trajectory of the syllable or the word and follows the tactical plan. The ventral stream will adjust the point of the pen out of the whole action trajectory. The dorsal stream mainly observes the point of the pen. It also notices the action trajectory of the whole syllable or word but it mainly focusses on the actual action moments the actual position of the point of the pen will provide.

The Motoric Movement Action *writing* is also special because of the fact that the action trajectory, just like in the Motoric Movement Action *pouring*, becomes visible.

2. The Motoric Movement Action *pouring*

The Motoric *Pouring* Action follows the Motoric Movement Action *throwing*. However the throwing of liquids has an extra dimension. It belongs to just a few Motoric Movement Actions in which the action trajectory becomes actually visible.

The task in pouring is to throw a liquid from one object into another object. So the liquid is shaping the action trajectory. When pouring out of a bottle, the bottle creates an extra movement trajectory. A bottle is namely an object what can be manipulated freely. The transition point is situated on the outside of the bottle opening. There the liquid is thrown into the Initial Phase of the *fluid* trajectory. With actual visual perception we want to know when the action trajectory starts and if the actual shape of the Initial Phase follows the shape of the perceptual image of that Initial Phase. From there we are able to influence the fluid trajectory just a little because of cohesion of the fluid. We are able to influence the success rate of this Motoric Movement Action by moving, the glass, the receiving object.

"The locations of the fixations were also very reproducible between subjects, for example, subjects fixate the mouth of the bottle when pouring and then transfer gaze to the level of cola in the glass when about half-way through. Thus many details of the fixations, and by inference the ongoing visual computations, are governed by the task goals, together with the physical constraints of the world.' (Hayhoe, 2000). It seems that the way the human visual system is constructed ensures that competent subjects acquire very similar oculomotor techniques when they interact with objects.[56]"

Image: In the Motoric Movement Action *pouring* the action trajectory actually becomes visible.

The throwing of one drop of a fluid will proceed like the throwing of one ball in a ball trajectory. However most of the time we throw with a lot of drops. When the first drops reach the end destination there are still drops that have to start with the action trajectory. That is why one is able to observe an action trajectory.

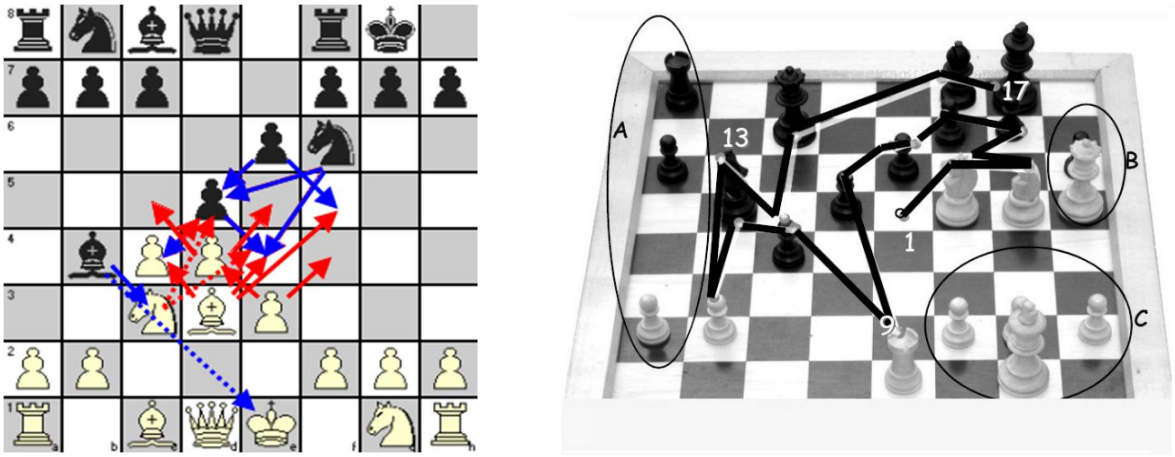
The script of the Motoric Movement Action *pouring* usually contains the following actions. The first Motoric Movement Action follows the general Motoric Movement Action *grabbing/taking/touching*. The action trajectory must be shaped out of the fingertips that will touch the outside of the bottle to the places of the bottle that will actually be touched. The moment the fingertips hold the bottle this Motoric Movement Action is completed. Then the aforementioned Motoric Movement Action of the pouring follows. With the action trajectory out of the perspective of the wine. The script is closed with the general Motoric Movement Action *letting-go/re-placing/dropping*. The action trajectory is now shaped out of the perspective of the bottom of the bottle towards the place at the table where it will be (re-)placed.

3. The Motoric Movement Action *playing chess*

In the Motoric Movement Action *playing chess*[57] the motoric movement (MM) is very simple. In chess you are allowed to hold on to a chess piece till the moment you put it down. When you let it go there is no way back anymore. In chess there are no high demands for the motoric movements. The only demand is that a piece will have to touch most of the square of the end destination. In general a chess player doesn't have to work on the efficiency or effectiveness of the motoric movements. Technique models and secondary focus are therefore not relevant in chess.

[56] Michael F. Land, Mary Hayhoe; In what ways do eye movements contribute to everyday activities?
[57] In here the Motoric Movement Action *playing chess* is appointed. Board games like checkers, go etc. follow this action in a similar way.

But as easy as the motoric movement (MM) is in chess, as hard as the movement action (MA) is. Chess is characterized by a very complex matrix. All the chess pieces have different latent action trajectories and complex relations with all other pieces on the board. In chess there is a direct game dualism. Players are only allowed to make one move each turn.
The appointing of the movement action (MA) in chess can be compared with the movement action (MA) in tennis or sailing. An elite player needs to possess a huge cognitive basis of matrix possibilities. Nowadays a chess player needs to possess a wide variety of actual knowledge of chess openings, mid play and end game in action trajectories. Besides that they also need to possess the same arsenal of more abstract knowledge in action trajectories when a total strange constellation of chess pieces occurs on the chess board. With all that general knowledge out of the cognitive basis they enter the tactical *chess* action when one match is actually played. This tactical action has to come up with only one action trajectory. So the outcome of the tactical *chess* action is the essence in chess. Like what has been said before the motoric movements (MM) don't play a role of any importance. The deduction process of creating one perceptual action trajectory is much more difficult than executing this action trajectory.



Images: Impressions of a matrix in chess; the red and blue lines show a very limited part of the actual matrix in chess.

In chess there is also the phenomenon of playing chess *blind*. Some players are capable to play a whole match without actually seeing the chess pieces. This means that those players also see the whole constellation of the actual positions of the pieces in one matrix image. This image is not necessary for *normal* playing but makes it possible to derive all the relationships of the pieces while playing blind. This total image can be compared with the total image of a juggler while executing a seven ball saccade. A juggler needs to make images of seven action trajectories which must be created at the same time. Therefor the juggler creates one image which combines all these trajectories because he can't make them all separately.

The script of the Motoric Movement Action *playing chess* follows the two general Motoric Movement Actions of *grabbing* and *putting down*. The grabbing of one chess piece is one Motoric Movement Action. The action trajectory is shaped between the fingertips and the outside of where the piece will be touched. The moment the chess piece is held the first Motoric Movement Action is completed and the second Motoric Movement Action of *placing/putting down* starts. The action trajectory is now shaped between the bottom of the chess piece and the actual destination square on the game board.

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4. The Motoric Movement Action *swimming*

The Motoric *Swimming* Action follows the general Motoric Movement Action *moving A-B*. It is similar to the Motoric Movement Action *walking* and *jumping* where the moving is executed by the sole body. So the body creates the action trajectory as well as the movement trajectories. That is still hard to understand because it is hard to grasp that the body contains different autonomous entities which don't have a relationship during the Motoric Movement Action. In a conventional way we think that the body is one and undivided in relation to the Motoric Movement Action. And that is not the case. The Motoric Movement Action contains two separate organs. We have to get used to that idea in the same way we are already very familiar with the fact that in for example human metabolism many different autonomous organs/entities are involved while we know that they belong to only one body.

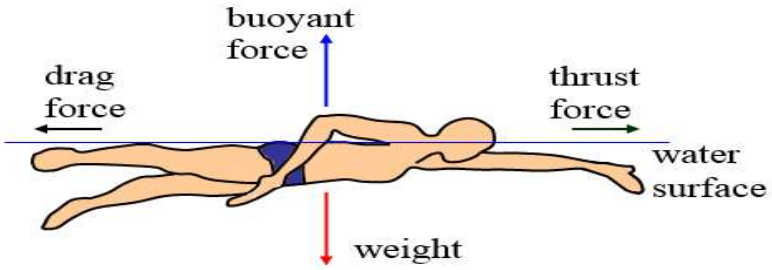

Image: A swimmer doesn't need *ground reaction force* to move the arms and legs. As long as the body processes (BP) provide energy they are able to push themselves off the torso *endlessly*. Although the arms and legs will have to push against the water in order to create the negative resultant which will provide the action trajectory in the other direction. This negative resultant is the characteristic of every Motoric Movement Action *moving A-B*.

At a micro level the Motoric Movement Action *swimming* needs to be studied as at least four separate Motoric Movement Actions.

a. The start. The start in swimming follows the Motoric Movement Action *throwing*. The dive trajectory, with the whole body, is the action trajectory. One latent dive trajectory needs to be visualized as a result of the tactical *diving* action. At the actual start a swimmer needs to throw himself in the Initial Phase of that perceptual latent trajectory. He will be able to correct the dive trajectory during the execution in a proprioceptive way.
b. The straight line. During the straight line the swimmer will mainly execute the required stroke. The action trajectory must be visualized out of that part of the body which is stable and is situated in the front section of the body. In a rowing boat that is the front tip of the boat. With a swimmer that can be the head or the torso. The shape of the action trajectory is simple. Just like in rowing that is a straight line.
   The motoric movement (MM) in swimming is characterized by two separate biomechanical main actions. The swim technique, the biomechanical main action, out of the perspective of the arms must be observed out of the movement trajectories from the arm/arms towards the action trajectory. Here one can notice the *pulling* action. The arms pull the torso/body forwards. The swim technique, the biomechanical main action, out of the perspective of the legs must be observed out of the movement trajectories from the leg/legs towards the action trajectory. Here one can notice the *driving/pushing* action. The legs drive/push the torso/body forwards.
   So the focus in swimming is more complex because the secondary focus must be created out of two different biomechanical main actions towards the primary focus of the action trajectory.

c. The turn. The turn mainly follows the Motoric Movement Action of the start. However the big difference with the start is the fact that the visual perception is not static before the turn. The complexity of the perception, already limited by the position in the water, increases in that way with a factor. That is why good timing in turning is essential. Just like in the long jump. An elite swimmer therefor needs to possess an extensive cognitive basis with a lot of abstractions of turn shapes. Because at the moment the turn is required the circumstances will always differ. The tactical *turn* action needs to take care of the actual wave pattern of the water, swim speed, phase of the specific swimming stroke etc. and place them over the blueprint of the cognitive basis. The tactical *turn* action needs to finally produce one shape of a turn. One latent action trajectory. The tactical *turn* action will have to estimate from where the turn must be initiated. In that estimation the margins, which the actual *turn* action allow, must be processed optimally.
   Although the perception of a swimmer never comes to a complete standstill, swimmers try to create a certain *freeze* just before they turn.
d. The finish. The finish mainly follows the Motoric Movement Action *touching/grabbing/picking-up*. This Motoric Movement Action shapes an action trajectory out of the *touch* part of the hand towards the place where the finish plate will be touched. So a few strokes before the finish the perspective of the action trajectory has to change from somewhere in the body to the hand. The perception is dynamic like aforementioned.

Although a swimming match can and should be studied in separate Motoric Movement Actions the whole length of one swimming event creates only one action trajectory at the macro level. The separate action trajectories will always have to pay responsibility to that macro action trajectory. That means that for example the focus within one element should always be linked to the next action trajectory.

5. The Motoric Movement Action *flying*

Without aids humans are not able to execute the Motoric Movement Action *flying*. So we are not able to execute the Motoric *Fly* Action like a bird. Still this action needs to be appointed in here. Because the principles of the explanatory model of the Motoric Movement Action and the principles of the unity model within the motoric movement (MM) start to show a gap with the conventional way of thinking within locomotion processes. The explanatory model demonstrates that Motoric Movement

Actions like *flying*, *swimming* and for example *walking* share lots of commonalities. In which the Motoric Movement Action *flying* paints the clearest picture. They all belong to the Motoric Movement Action *moving A-B*. And if humans could fly then all of them would be executed without a (motoric) movement object. Or with other words all the actions would be executed with just the whole body. Even more important to notice in there is that the motoric movements (MM) are solely created by limbs which push off the torso. There they find their starting point and nowhere else. So the movement trajectories run from within the body to the outside and have nothing to do with the Ground Reaction Force.
However the action trajectory in these Motoric Movement Actions are created due to the negative resultant of the push off against respectively the air, the water and the ground. Which is characteristic for the Motoric Movement Action *moving A-B*. So in walking the ground has a relationship with the push off in the creation of the action trajectory within the movement action (MA) and no relationship with the movement trajectories within the motoric movement (MM). The movement trajectories are only making it possible that in the end a push off can be executed in the transition point towards the action trajectory.
These examples much more show a line of thinking within the explanatory model that we have to consider the role of the body in a different way. Much more that the body is a fully independent entity which *hangs* in a surroundings. And if that body wants to move then it pushes of legs and/or arms of the torso to push of against the air, the water, the ground etc.. So for us humans it is very convenient that we are able to push off against something really concrete like the ground and not for example against the air like these *pitiable* birds have to do. In this way one could make an argument that humans are also flying or floating. In this perspective we only use the legs to create a push off against the ground and to keep us floating during the inactive phase of the legs.

6. The Motoric Movement Action *high jump* and *long jump*

The Motoric Movement Action *high jump* and *long jump* mainly follow the general Motoric Movement Actions *moving A-B* and *throwing*.
In the long jump as well as in the high jump the goal of the movement trajectories within the motoric movement (MM) is to generate a lot of *body* speed. During the take-off this speed needs to culminate in respectively a vertical and a horizontal action trajectory within the movement action (MA).
Because the whole body is moving the perception is also moving. The complexity of the perception is now increased with a factor. Because of this the long jump is more difficult to time than the high jump because in there an athlete is confronted with an take-off board. And that is due to the fact that the direction of the biomechanical main action of the movement trajectories has the same direction as the action trajectory. The take-off board forces an athlete to time the take-off very precisely. In the high jump it doesn't matter where exactly the athlete crosses the bar. A high jumper will just roughly time the length of the approach but he will need to time the exact distance from the take-off place towards the bar.

7. The Motoric Movement Action *juggling*

I will appoint in here the Motoric Movement Action *juggling* of a cascade with three balls. Of course the Motoric *Juggling* Action follows the general Motoric Movement Actions *throwing* and *catching*.
This Motoric Movement Action is special because of the fact that at the same time three action trajectory must be created and be caught. Of course the action trajectories differ in phase. Otherwise juggling wouldn't be possible.

Because the shape of the action trajectories and the throwing action are simple the juggler doesn't need to execute a complicated tactical *juggling* action. The shape of the cascade is so familiar and will show so little deviations that it is possible to throw the balls into the cascade blindly. Slight deviations will be corrected within the margins of the catching. The same situation occurs if we hold the bottle and the glass when pouring a drink. However a juggler will never be able to catch the balls blindly. One can never recreate an exact copy of a ball trajectory.

Within *catching* actions the task is fulfilled only at the last moment. The precise global prediction, out of the cognitive basis and the tactical *catching* action, of the incoming ball trajectory needs to be checked till the ball is actually caught. A juggler needs to check if the actual shape is following the perceptual latent shape. It is obvious that experienced jugglers look at the apex of the ball trajectories[58]. The height of the apex gives information about the time a ball trajectory will need. The width of the apex gives information about where the hand needs to be placed in relationship to the width of the body. Because deviations decrease exponentially when a ball trajectory becomes more manifest a juggler doesn't need to catch the ball with actual vision. A juggler will perform the actual catching with peripheral vision. In that way a juggler is able to actually perceive the main phases of the action trajectories or the ball trajectories. In that way he gives maximal attention to what needs maximal attention and minimal attention to what needs less attention.

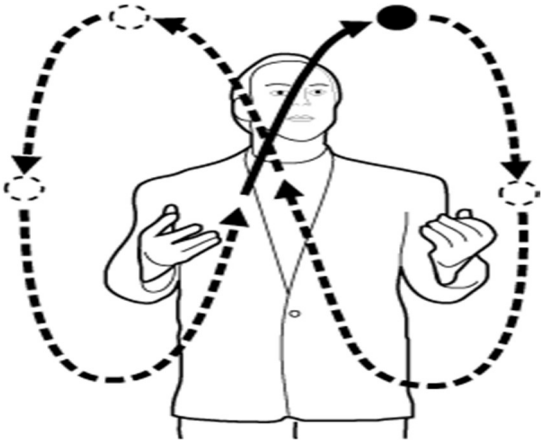

Image: Cascade juggling with three balls. One ball needs to be thrown in the Initial Phase of its ball trajectory. The hand which did that has to mainly receive another ball which is halfway its ball trajectory. The receiving will soon be followed by catching. The other hand has just caught a ball in the last phase of its ball trajectory and is now preparing the Initial Phase of a new mirror image ball trajectory. The image shows the phases of one ball trajectory.

This Motoric Movement Action is special because the primary focus must be pointed at three action trajectories at the same time. That makes it very complex. Fortunate enough the motoric movements (MM) in juggling are easy to execute. The more the motoric movements (MM) demand a certain level of attention, the sooner the border of the human faculty in executing these Motoric Movement Actions will be reached.
There are two ways of focusing on the action trajectories. Or a juggler experiences three actual separate action trajectories. Or a juggler experiences one image in which the three ball trajectories are observed as one ball trajectory pattern. It is more likely that an experienced juggler experiences one complex blueprint of three combined action trajectories.

[58] https://www.youtube.com/watch?v=x2_j6kMg1co ; In this video clip the visual perception can be observed very well. The apex/height of the perception, the saccades, the peripheral vision etc..

8. The Motoric Movement Action *gymnastics*, *free diving* and *ice skating*

In sports like *gymnastics*, *free diving* and *ice skating* the performance of an athlete can't be compared in a distance (far jump), a time (bobsleighing) or actual scored points (darts). Those sports are rated in two ways. First the action trajectories of the movement action (MA) which will be executed are just rated for their intrinsic difficulty level. In that way the performance will get a *technical value*. Besides this value the actual execution of these action trajectories will be judged as well. This judgement comprises the quality of the motoric movements (MM) of the routine. This will provide an *execution value* and together with the *technical value* this will determine the end score.
The focus within these sports will still follow the universal explanatory model of the Motoric Movement Action but the secondary focus becomes much more important because of the technical judgement.

9. The Motoric Movement Action *creating a chain reaction*

Since the rise of YouTube the producing and recording of *chain reactions* is a popular activity. From olden times we are familiar with marble runs. Many have stared at it in many nursery schools. Entranced by the running marble *caught in a line*. The cover image is a fine specimen of a marble run. The genre became huge because of the domino runs. The domino chain reactions. This Motoric Movement Action is special because of the fact that with a very brief and limited movement trajectory a huge action trajectory will be created.

Images: The evolution of marble runs in two pictures.

The task of this action trajectory is officially to let the last domino drop or to make the final picture[59]. However, if we are honest, the creation of a long and funny action trajectory is the actual goal of the builders. Which coincides with a phrase of The Buddha: "There is no way to happiness, happiness is the way!". This contemplation adds a nice touch to this Motoric Movement Action.
This Motoric Movement Action has a relationship with the Motoric Movement Action *throwing*.

[59] https://www.youtube.com/watch?v=E_P0yZlhVQ4

10. The Motoric Movement Action *playing the piano*

The Motoric Movement Action *playing the piano* doesn't really exist because playing the piano is a combination of two Motoric Movement Actions. In fact the Motoric Movement Action *touching* and the Motoric Movement Action *pressing.* The task in the Motoric Movement Action *touching* is to create action trajectories out of the fingers towards the relevant keys of the piano. At an elite level both hands relative to each other and all fingers relative to the hand must be able to create autonomous action trajectories. Although it seems unlikely that a concert pianist is creating three separate action trajectories within a three finger chord. It is more likely that this pianist executes the chord out of one image that includes the separate action trajectories. Like an elite juggler will probably also see one image of all the present ball trajectories.
New simple chords can be improvised on the spot. However more complex chords, as a part of a chord diagram, need to be practised extensively. Also by master pianists. Nothing is improvised during big performances. Fingerings will be practised extensively until they form a steady element of the cognitive basis. Even in jazz music one will not newly create action trajectories within one Motoric Movement Action. Jazz musicians mainly improvise with the script.
The second Motoric Movement Action of *pressing* a key is actually a rather simple action. Once the key is touched the key has to be pressed down for maybe two centimetres. The key is fixed so the action trajectory of the moving key can't deviate. And that is true for the *physical* movement of the key. Like it is simple to press the keys of a keyboard belonging to a computer. But with the piano it is also not true. The *musical* movement of the key belongs to another world. There are uncountable ways to press a piano key musically. This also shows how rich a cognitive basis can be in executing a fixed action trajectory of less than two centimetres.

The movement trajectories are not that difficult in playing the piano. There must be a rigid torso. The arms must be able to push of that torso continuously. Like we also noticed in swimming, this push off doesn't need a *ground reaction force*. The push off will finally have to reach the transition points in the fingertips. The transition point is situated on the outside of the fingertip and from that perspective the action trajectory is created towards the point where the key will be touched.

The biomechanical main action within the motoric movement (MM) *piano playing* needs a special description. Like aforementioned the actual pressing of a key can be done in a simple mechanical way. The biomechanical main action can then be described out of the hand and maybe even from within one finger. But then all the institutes of arts would start to protest. Of course they would acknowledge that there is a mechanical way to produce sound. Only artists are raised to make art and not mechanical music. In education programs of institutes of arts the feeling/the expression form the basis of every action and therefor also in every Motoric Movement Action. So a student pianist is forced to play with the heart and with the soul. Although every emotion origins from the brain, institutes of arts associate that feeling more towards the heart region in the torso. They define it to the student as "Play with your heart!" or "Play out of your guts!". I think I will earn the appreciation of my fellow colleagues in arts if I state here that the biomechanical main action of the motoric movement (MM) must originate from that part of the body. The biomechanical main action then needs to be transferred from *the soul* to the transition point at the end of the fingertip.

One can very well play the piano blinded. It is connected to the Motoric Movement Action *blind typing*. That is because of the fact that playing the piano needs a script of two Motoric Movement Actions. The first action only comprises the Motoric Movement Action *touching*. This first action stops when the fingertip feels the outside of the key. So out of a reference point we can first feel the key and complete that Motoric Movement Action before we actually press the key and produce sound. If piano playing only required one Motoric Movement Action then we couldn't play blindly.

11. The Motoric Movement Action *eating*

The Motoric *Eating* Action is a special but ordinary daily action. We gained tons of experiences in the execution of this action since our earliest years. It is probably the first Motoric Movement Action we execute with a (motoric) movement object. The spoon is an object that can be manipulated freely and therefor adds an extra movement trajectory to the motoric movement (MM). In that way the complexity of eating is raised with a factor.
The Motoric Movement Action *eating* comprises two parts which are executed simultaneously. One part contains the grabbing of the food and the bringing of the food to the mouth. This can be seen as *sending/throwing* the food. The other part is the *receiving* of the food. There are several Motoric Movement Actions involved. They can be compared with the actions which are involved when we pour a drink and at the same time hold the glass in which we receive the liquid.

Images: Left – The Motoric Movement Action *receiving/catching* food needs to be timed. Right – In a certain period in life the (motoric) movement object is new, the timing is new and the action trajectory is new. Besides that the fine motor skills are still at an insufficient level. So it is normal for little errors to occur. Most of the time the attire is adjusted to these errors.

The script in eating comprises the Motoric Movement Action *touching/grabbing/scooping*, the Motoric Movement Action *placing/letting-go* and the Motoric Movement Action *catching/receiving* (mouth).
The action trajectory within the first Motoric Movement Action must be observed out of the perspective of the empty bowl of the spoon towards the food. As soon as the food is in the bowl the perspective needs to be changed to the action trajectory from the perspective of the food towards the mouth. At that same time the third Motoric Movement Action *catching/receiving* the food starts. So the last two actions are executed simultaneously. Like aforementioned they can be compared with the pouring of a drink with one hand and the catching of that drink with a glass in the other hand. In that way a juggler also executes two Motoric Movement Actions when he throws a ball which he will catch himself later on.
The script of the sending of the food mainly follows the Motoric Movement Actions *grabbing/taking* and *putting down/releasing*. Only within the Motoric Movement Action eating the (movement) action object is released into an opening of the body. That makes it special.

Out of the tactical *eat* action we make a perceptual image of the latent *food* trajectory. During the actual *eat* action we accompany the food with actual vision to the point where we normally would have to make a saccade if we actually want to follow the food the complete action trajectory. But we don't do that. And our peripheral vision is also limited. In such a short distance the chance to deviations is reduced to a minimum. Besides that we use proprioceptive perception and we know cognitively everything about the timing of that last part of the action trajectory. We are able to actually see the food approaching the mouth but that is much to exhausting. By solving it in a proprioceptive way we are able to watch the game of the day while eating.

12. The Motoric Movement Action *dance*

The Motoric *Dance* Action hosts the Motoric Movement Action *moving A-B.* This action is experienced at two levels. Amateur dancers mainly learn to move. They make steps. Left foot to point 1, right foot to point 2, left foot closes besides right foot at point 3. Professional dancers definitely do not experience dance like that. Professional dance only contains shapes and form. And shape and form only have a relationship with the motoric movement (MM) within the Motoric Movement Action. So the difference in dance levels is explained by which elements of the Motoric Movement Action are emphasized. Both groups follow the whole Motoric Movement Action *moving A-B* but the amateurs emphasize the movement action (MA) and the professionals emphasize the motoric movement (MM). The latter determines the quality of the shape/form. Because the shape/form also includes an action trajectory the whole Motoric Movement Action can be followed. But in professional dance the movement trajectories are the cause and the action trajectory is the effect. Amateur dancers execute it vice versa and are actively creating the action trajectory. They add quality, form and shape in a later stage.

The biomechanical main action within the motoric movement (MM) needs to follow the biomechanical main action of *playing the piano*. Professional dance needs to originate from your soul/heart. And from there it needs to flow to all body parts where movement is wanted.
In basic exercises dancers must be able to move every body part independent to all other body parts. The specific movement trajectories are trained in specific *isolation* exercises. The continuous moving head from side to side in for example Indian dance is not executed by one specific *move-the head-sideward* muscle group. This head movement is the consequence of general muscle groups working together in the upper torso. Antagonistic moving muscle groups provide the specific movement trajectory. So the movement trajectory always hosts at least one translation from specific muscle groups to a more abstract movement trajectory. This translation process is what professional dancers train all their lives.

Finally I want to take you to a special dance genre named Berjozka[60]. This genre shows a clear action trajectory however we don't see the movement trajectories of the feet. The action gets a magical touch. It looks like the dancers are floating. It says something about our expectations about linking motoric movements (MM) to an action trajectory. Like we want to see the tyres of a car or the legs of a horse to move, we apparently want the same in dance.

13. The Motoric Movement Action *riding horse back*

The Motoric Movement Action *riding horse back* is following the general Motoric Movement Action *moving A-B* with a (motoric) movement object. But in comparison to a car, a boat or a bike a horse is

[60] https://www.youtube.com/watch?v=TM3e3FDU4QM ; after 1'.00" the dance starts.

not a set intermediary constellation. Although the horse is much bigger it must be compared to a tennis racket, a bottle or a hammer. Those (motoric) movement objects can be manipulated freely.
In this Motoric Movement Action the horse makes the action trajectory. An experienced rider determines exactly what the horse will do. He manipulates the horse like a tennis player is manipulating his racket. So the transition point is situated between the inside of the hooves and the outside of the hooves which push off the ground and it is not situated somewhere around the reins.
The negative resultant of this push off will create the action trajectory. This is conform all Motoric *Moving* Actions.

14. The Motoric Movement Action *blowing* and *talking*

The Motoric Movement Action *blowing* follows the Motoric Movement Action *throwing* and more specific the Motoric Movement Action *pouring*. The special feature of this action is that an action trajectory of air is created. Because, like in pouring, some of the air particles already reach the goal while others still have to leave the mouth adjustment of the action trajectory is possible. Besides that blowing follows the Motoric Movement Action *throwing* in a normal way.

The Motoric Movement Action *talking* has a big overlap with the Motoric Movement Action *blowing*. They share similar movement trajectories from the lunges to the movement trajectories of the mouth. One can determine that the motoric movements (MM) are very similar. The action trajectory of the movement action (MA) however is really different. In *blowing* one wants to get an air stream at a certain place. So the end of that action trajectory is important. In *talking* the sound is produced at the beginning of the action trajectory and then thrown. Once a sound is made it cannot be adjusted anymore.

The Motoric Movement Action *blowing* is a clear Motoric Movement Action. With the Motoric Movement Action *talking* we are entering a border area of the Motoric Movement Action. We are able to bring *talking* under the umbrella of the explanatory model but then the sequential stream of words needs to be perceived as an action trajectory. Like we actually see written words in sentence *lines* from left to right.
To be clear about things an action trajectory is never shaped between a speaker and his audience. A Motoric Movement Action only explains the action and will never have anything to do with the egocentric intentions of an action subject.

If we can place talking under the umbrella of the explanatory model then the phenomenon of stuttering can very well be explained. For flow in every Motoric Movement Action we have to be primarily fo-

cused on the action trajectory of the movement action (MA). An eventual secondary focus can be allowed as long as it is pointed from the biomechanical main action out of the motoric movement (MM) towards the action trajectory. Good story tellers are only occupied with the movement action (MA). From their rich cognitive basis they generate plots and general storylines which they let become to one story in the tactical *story telling* action. Then the story is actually delivered to an audience during the actual *story telling* action.

On the other hand people who stutter will more and more focus on the motoric movement (MM) like a self-fulfilling prophecy. They will focus on the execution, the technique, of talking. The primary focus will then shift from the story to the technique. The more they themselves and the environment will emphasize *how* it is said the further they will be removed from *what* is being said. It is noticeable that therapies are mainly reinforcing the motoric movement (MM) and keep on harassing their clients with the technique. The explanatory model of the Motoric Movement Action mainly thinks that the solution must be found in reinforcing the movement action (MA). People who stutter need to learn to tell stories. There is a great overlap between stuttering therapies and the current way of tennis teaching. They both reinforce the technique. The secondary focus of the Motoric Movement Action.

Chapter 6 – The Movement Action (MA)

1. The perspective of the movement action (MA)
2. The components of the movement action (MA)
3. Timing and the movement action (MA)

The Motoric Movement Action can only be appointed as a complex system. It hosts two fully autonomous complex (sub-)systems. The motoric movement (MM) and the movement action (MA). The Motoric Movement Action doesn't host other components.
The movement action (MA) only explains the action. The motoric movement (MM) only explains the execution of the action. They explain nothing about each other. The execution has nothing to do with the description of the action and the action has nothing to do with the description of the execution. However they are both needed at the same time for one successful Motoric Movement Action. In the Motoric Movement Action they form an inextricable pair but the movements of the two have no relationship whatsoever. Of course there is a correlation but there is no relation in the trajectories they make. The essences of the two parts, the action trajectory and the movement trajectories belong to two completely different worlds. There is always only one action trajectory in one Motoric Movement Action and always more movement trajectories. However the explanatory model of the Motoric Movement Action appoints the motoric movement (MM) in singular and not the plural form. The explanatory model wants to push everything towards the action trajectory. And because that is one line the explanatory model wants to appoint the motoric movement (MM), how complex it maybe is and how many movement trajectories maybe are involved, much more as one happening towards the movement action (MA).

In this chapter only the movement action (MA) will be appointed. The main object in the movement action (MA) is the action trajectory. The perception processes need to produce one action trajectory and to actually take care that this latent action trajectory is executed.
The movement action (MA) is based on a set structure with three crucial elements. The cognitive basis contains general knowledge about the specific Motoric Movement Action. The tactical movement action uses this information as a blueprint and adds precise information of the location once the action is actually performed. The actual movement action creates the action trajectory.
People with a lot of experience in a specific Motoric Movement Action possess an extensive cognitive basis with a lot of abstract knowledge about the relevant action trajectories. This basis is always there. Together with the tactical movement action, when the Motoric Movement Action is actually executed, it has to initiate a deduction process with the final goal of producing just one action trajectory. The cognitive basis and the tactical movement action comprise the *how* of the movement action (MA).
The actual movement action just copies the choice for that one action trajectory. So from that perspective the cognitive basis and the tactical movement action work towards one action trajectory in service of the actual movement action. On the other hand the actual movement action just has to execute what has been ordered. The actual movement action only executes and asks no questions.

1. The perspective of the movement action (MA)

The task of a Motoric Movement Action will be fulfilled only by an (movement) action object, a body part or the whole body. With objects this task can be visualized easily. The letter is posted if the letter,

and the letter alone, has dropped into the collecting device of the mail box. The match rowing boat finished its task when it reached the finish line. Therefor the outside of the first part of the boat needs to touch the outside of the imaginary connected vertical finish line. When we blow out candles the task is finished when the air stream *blows away* the flames. "Watch The Ball Trajectory!" shows that only the ball provides the Game Idea. Only the position of the ball determines the scoring. The action trajectory in tennis is the ball trajectory. The game dualism forces a player to hit a ball into its trajectory and to prevent an opponent from doing so.
The task of a Motoric Movement Action is only fulfilled by the action trajectory out of the perspective of the (movement) action object. And the only thing our egocentric will wants is that this task will be fulfilled. Our egocentric will doesn't really care about anything else. But the funny thing is that the *lifeless* (movement) action object can't do anything by itself. It needs to be executed. This line of reasoning can be understood easily in relationship to lifeless objects. It is harder to widen that line of thought to body parts or the whole body. But they also follow the principles of the letter. In free diving we throw our whole body in a trajectory. Then all parts of the body will have to follow. Also for example our hair. Our hair however doesn't contribute anything to the fulfilment of the task. Specific muscle groups on the inside of the body take care of that. These *general* muscle groups make really different trajectories than the action trajectory. Those movement trajectories are situated on the inside of the body and end *just at the inside of the outside of the body.* There they form the transition point with our shell.
So, although it is our own body, we only indirectly control the outside of our body. Just like the letter. So the shell of your fingertip while touching a light switch is just controlled in an indirect way. You move this outside of the fingertip with movement trajectories on the inside of the body. In that way the fingertip is able to create the action trajectory.

Image: It is obvious that the man only observes his partner as an object in an action trajectory. He is completely occupied with the Motoric Movement Action *catching*. The whole body of the lady shapes the action trajectory. She doesn't execute the Motoric Movement Action *catching*. She is executing the Motoric Movement Action *moving A-B* and more specific the Motoric Movement Action *jumping*. She fulfils an action trajectory with her whole body. She assesses her movement out of the perspective of a ball in a ball trajectory.

So it becomes apparent that the action trajectory in any Motoric Movement Action has a different perspective than the movement trajectories. The formulation of it all can possibly be improved but this is the way our perception processes perceive it all. So the perception processes in the movement action

(MA) mainly differ in the perspective from where they are observed in comparison to the motoric movement (MM). That is why they belong to two incompatible worlds.

> *When we for example want to touch a light switch the action trajectory is shaped out of the tiny little area of the outside of the fingertip that will touch just a small part of the switch. The line between these two areas will fulfil the task of the Motoric Movement Action. So our perception processes are mainly focussed on this trajectory. The outside of the fingertip is an abstract lifeless phenomenon. The motoric movement (MM) let that part move but not at the exact place of that area. The motoric movements (MM) which make it possible that this outside is able to move are situated on the inside of the body. And although it sometimes is only a matter of millimeters the one has nothing to do with the other.*

2. The components of the movement action (MA)

a. The cognitive basis
b. The tactical movement action
c. The actual movement action

The movement action (MA) has a set structure in how an action trajectory is deduced and executed. Also in this part of the Motoric Movement Action the explanatory model of the Motoric Movement Action doesn't budge as well and remains the universal explanation of all Motoric Movement Actions.

The movement action (MA) always starts with the cognitive basis. The cognitive basis contains the general tactics. The tactical movement action takes the blueprint of this general knowledge and puts it on top of the actual situation. The tactical movement action has to finally come up with one perceptual action trajectory. One could also call the cognitive basis the *general* tactical movement action and the tactical movement action the *specific* tactical movement action. I didn't make that decision. I think the cognitive basis comprises much more abstractions than actual images of the specific action situation. The actual movement action just copies the choice for an action trajectory without any comment and executes it with her specific processing processes of the perception. Namely the ventral and dorsal stream.

The description of the cognitive basis, the tactical movement action and the actual movement action is not a linear approach. They arise linearly but they don't disappear that way. Former phases stay present, as blueprints, till the task is executed completely. In that way an experienced action subject is prepared to confront any incident which might disrupt the action trajectory every time frame.

a. The cognitive basis

There is a lot abstract cognitive knowledge within people about action trajectories. We live in a matrix of action trajectories from the day we are born. So we have a lifelong experience. All action trajectory work as a reference for each other and form a huge abstract basis for new action trajectories. How subtle those differences in knowledge can vary you can experience if you approach an electric kettle where the handgrip is able to have a flexible position. Every possible position of the handgrip will be approached with a different action trajectory with all kinds of subtle changes in inflexion points. The same subtle adaptations will occur if you are reaching for this kettle and the kettle is blocked by a

shopping bag, a cup of hot tea and a big vase of flowers. Also then you will be able to reach the grip of the kettle even without touching those items. The wideness of this arsenal becomes very visible in for example the Motoric Movement Action *writing*. All punctuation marks, syllables etc. host in capitols, written form etc. a huge variety of inflexion points and action trajectories.
Especially in daily Motoric Movement Actions we own a huge cognitive basis concerning the shape of action trajectories. Most daily Motoric Movement Actions are characterized by a rather simple action trajectory and simple motoric movements (MM). That is why we can execute these actions completely in flow. A big cognitive basis of action trajectories provides the owner the possibility to be creative in a maximal way. We can use a ladder to pick the apples but we can also use a stick to hit them out of the tree.

The cognitive basis holds information which we can reproduce at all times. We are able to make perceptual perceptions of the posting of a letter while sitting in a comfortable chair at home. We are able to do that at our *own* mail box but we can also create numerous abstractions of this action at various locations with very awkward mail boxes. We know that something needs to be delivered, that it must be held parallel to a kind of slit, that it must go up first because it needs to be collected in a collecting device etc..

Image: The use of a ladder *and* a stick to reach the fruits.

People with a lot experience in a certain Motoric Movement Action own lots of information about ballistics, inertia etc.. This abstract information makes it possible to improvise optimally in every situation. It has been scientifically proven that the pressure of the hand changes in a subtle way when we approach an empty glass or a filled glass. The cognitive basis tries to provide a precise image of the global possibilities. Your cognitive basis knows exactly how much energy globally is needed to switch on the light. So it will mainly provide the margins, the fluctuation values, with an upper and lower limit, what to expect generally.

> *If we have to carry a strange but normal suitcase then our cognitive basis tells us that it can be very light but that it will not exceed the 40 kilo limit. With that tactical plan we approach the suitcase. We take into account a big but limited fluctuation of the weight of the suitcase. When the suitcase then weighs a 100 kilograms the body needs to make a recovery program right away. If we have to carry only these kinds of suitcases the cognitive basis adapts very fast.*

In not daily Motoric Movement Actions the action trajectories can be very complex. Many sports disciplines host very specific and very complex action trajectories which find no reference in daily Motoric Movement Actions. Elite players in chess, tennis, soccer, sailing etc. need to possess a huge cognitive basis of all possible action trajectories which are likely to occur in match situations. Because the reality asks for an almost limitless number of action trajectories an elite player just can't train them all. Therefor elite players will have to train and fill their cognitive basis with *reference* action trajectories. So a tennis player will need a huge cognitive basis with *reference* ball trajectories. It takes years of hard training to build a minimal cognitive basis in these sports.

The explanatory model of the Motoric Movement Action is new. So therefor there is no scientific evidence which underpins this model. However a lot of scientific research supports the existence of a cognitive basis.

*"**4.3 De perceptie verbeteren door de informatieopname te sturen: top-down processen***

De bottom-up informatiestroom kan geoptimaliseerd worden door de informatie niet louter passief te registreren, maar actief te sturen op basis van kennis die we hebben over de omgeving waarin we ons bevinden. Dit veronderstelt top-down processen, signalen die vertrekken vanuit de hogere hersencentra en de dataverwerking in de lagere stadia van het informatieverwerkingsproces beïnvloeden. Wanneer onze verwachtingen bepaalde voorwerpen waarschijnlijker maken, is het mogelijk om hun representaties te preactiveren (primen) zodat de patroonherkenning sneller verloopt.

Evidentie voor top-down invloeden

Als top-down invloeden een rol spelen bij de perceptie, dan moeten we die kunnen aantonen door middel van visuele illusies, stimuli die zo gekozen zijn dat de waarneming iets oplevert dat niet in de proximale stimulus gegeven is. Als top-down invloeden een rol spelen, dan moet het mogelijk zijn om figuren te creëren die anders waargenomen worden afhankelijk van de context waarin ze voorkomen (ABC/12 13 14). De context geeft het perceptuele systeem een hypothese om te toetsen. Als de stimulus voldoende past bij de hypothese, dan wordt de hypothese aanvaard en treedt herkenning op. In de loop der tijd zijn er afbeeldingen ontworpen die inherent ambigu zijn, omdat ze op twee verschillende manieren geïnterpreteerd, gepercipieerd kunnen worden (oude/jonge vrouw). Hoewel de kenmerken van de afbeelding dezelfde blijven en ook de gewaarwordingen volledig identiek zijn, geven ze toch aanleiding tot twee totaal verschillende percepties. Daarnaast zien we in sommige figuren silhouetten zonder dat hier fysische randen voor aanwezig zijn in de stimulus. Men begint te vermoeden dat bij deze subjectieve contouren zowel bottom-up als top-down processen een rol spelen. Immers, het aanvullen van ontbrekende stukken lijkt in sterke mate op het aanvullen van de blinde vlekken in het retinale signaal. Als zodanig zijn subjectieve contouren meer een illustratie van de voortdurende interactie tussen bottom-up en top-down processen dan een illustratie van een pure top-down invloed. We kunnen verwachten dat de herkenbaarheid van een geheel beter zal zijn dan de herkenbaarheid van de onderdelen, als het geheel een voorwerp is waar we heel goed vertrouwd mee zijn. Reicher toonde bijvoorbeeld aan dat een woord helpt bij het herkennen van de letters waaruit het bestaat. Dit heet het woordsuperioriteitseffect . Dit geldt ook voor onderdelen uit andere vertrouwde stimuli. Top-down invloeden werken optimaal wanneer het voorwerp en de gezichtshoek zeer vertrouwd zijn. Het is niet voldoende om de onderdelen in een vertrouwde context te zien, de context moet ook op een zodanige manier worden aangeboden dat we er vertrouwd mee raken. Een ander effect van het geheel op de delen is dat de omgevingscontext helpt om de voorwerpen te herkennen. Het duurt enige tijd voordat de top-down invloed van de omgeving sterk genoeg is om de herkenning van voorwerpen te beïnvloeden."[61]

[61] Marc Brysbaert; Psychologie; https://syneratio.com/sites/default/files/samenvatting_hoofdstuk_3_4_5_psychologie.pdf

"1. The Functions of Vision

Standard accounts of vision implicitly assume that the purpose of the visual system is to construct some sort of internal model of the world outside -- a kind of simulacrum of the real thing, which can then serve as the perceptual foundation for all visually derived thought and action.
--Of course, the visually guided behavior of many animals, particularly complex animals such as humans, is not rigidly bound to a set of visuomotor modules, however subtle those mechanisms might be. Much of our behavior is quite arbitrary with respect to sensory input and is clearly mediated by some sort of internal model of the world in which we live. In other words, representational systems have evolved -- systems that permit the brain to model the world, to identify objects and events, to attach meaning and significance to them, and to establish their causal relations. In humans and other primates, vision provides some of the most important inputs to these representational systems. Such systems are not linked directly to specific motor outputs but are linked instead to cognitive systems subserving memory, semantics, planning, and communication. Of course the ultimate function even of these higher-order systems has to be the production of adaptive behavior. The distinction between systems of this kind and the dedicated visuomotor modules described earlier is that the former enable us to select appropriate courses of action with respect to patterns of visual input, while the latter provide the immediate visual control required to execute those actions.
In our book The Visual Brain in Action, we argue that these two broad kinds of vision can be distinguished not only on functional grounds, but also by the fact that they are subserved by anatomically distinct substrates in the brain. Thus the distinction between vision for action and vision for perception helps us to understand the logic lying behind the organization of the visual pathways in the brain.---" [62]

"It is important to note that the successful selection of the correct movement programme is dependent on skilled perception of ball flight characteristics. Abernethy and colleagues (e.g. Abernethy 1981, 1987a, 1987b; Abernethy and Russell 1984) have pointed out that the time constraints of fast ball sports are so restrictive at the highest levels of performance that it is not feasible to readily modify the duration of parts of the movement (e.g. quicken one phase of a biphasic batting action). This type of variability would increase the programming demands upon the performer. Rather, the skilled athlete is one who 'buys' time by exploiting the advance signals emitted by the movements of opponents for decision-making and preparation of a response. Skill in rapid interceptive actions, such as catching and hitting a ball, is based upon the ability to detect and interpret perceptual information through a comparison with an internalised memory structure based on past experiences in similar situations. Top class players have developed highly sophisticated models of the world which allow them to predict events and to select pre-programmed sequences of movements specifically designed to carry out interceptive tasks. This explains why skilled athletes never seem to merely react to unexpected events, but appear to operate in the future. They use an 'anticipatory mode' of action (Whiting, Alderson and Sanderson 1973)." [63]

"The present work provides further evidence of the existence of sophisticated internal models of the structure of the environment. We suggest that such models are used to predict upcoming events and plan movements in anticipation of those events.

Conclusions
Retinal motion, stereo, and extra-retinal information from pursuit eye movements have all been implicated in catching balls (Oudejans et al, 1999; Rushton & Wann, 1999; Tresilian, 1999). We have demonstrated here that prediction is also important. This is consistent with Land & MacLeod's (2000) observations that prediction of the bounce point is important for intercepting the ball with the bat in

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[62] A. David Milner, Melvyn A. Goodale; The Functions of Vision; School of Psychology University of St Andrews Fife, KY16 9JU Scotland, U.K; http://www.theassc.org/files/assc/2367.pdf
[63] Williams, A.M., Davids,K., Garrett, J.; Visual Perception and Action in Sport; blz.78; http://www.imd.inder.cu/adjuntos/article/632/Visual%20Perception%20and%20Action%20in%20Sport.pdf

cricket. In the present study, anticipatory saccades, head movements, and pursuit movements all reveal that acquisition of visual information is planned for a predicted state of the world. Such predictions must be based on a stored memory representation of some kind. The precision of the predictions reveals the quality of the information in the stored memory. The spatial and temporal precision of the anticipatory saccades, and the fine-tuning of these movements following a change in the ball's dynamic properties indicate that subjects have an accurate internal model of the ball's spatio-temporal path."[64]

I don't have a lot to add to these passages. The last quote confirms everything. *The stored memory representation of some kind* is the precise perception of a global shape of a ball trajectory. The trajectory connects the ball with a goal. Just like in tennis the incoming ball trajectory in cricket can be visualized from the same Initial Phase. The Initial Phase tells exactly where the ball globally will be after the bounce. The perception processes work from global to very precise along the progression of the ball trajectory. The *bounce point* is important but not more important than other points of the ball trajectory. Elite players in cricket know, *far* before the bounce point, precisely where the ball will globally hit the ground. Cricket players use the Initial Phase to determine from which precise global area the ball will come up towards their bat. They also know that they can't spend more time on that task. They know that they need time for the saccade and the transformation from the reception to the sending task because there are two Motoric Movement Actions involved which must be combined. Once the first Motoric Movement Action gained sufficient information one is able and must transition to the perception processes of the second Motoric Movement Action. The actual perception in the second Motoric Movement Action waits for the incoming ball trajectory to come to the perceptual perception of the intersection point of the two latent ball trajectories. The perception waits till it can give the signal to the body to strike. But even in the main phase of the swing a player will keep on receiving the ball till he finally hits the ball. So the first Motoric Movement Action is still going on when the second Motoric Movement Action is already in the main phase of the swing towards the ball.

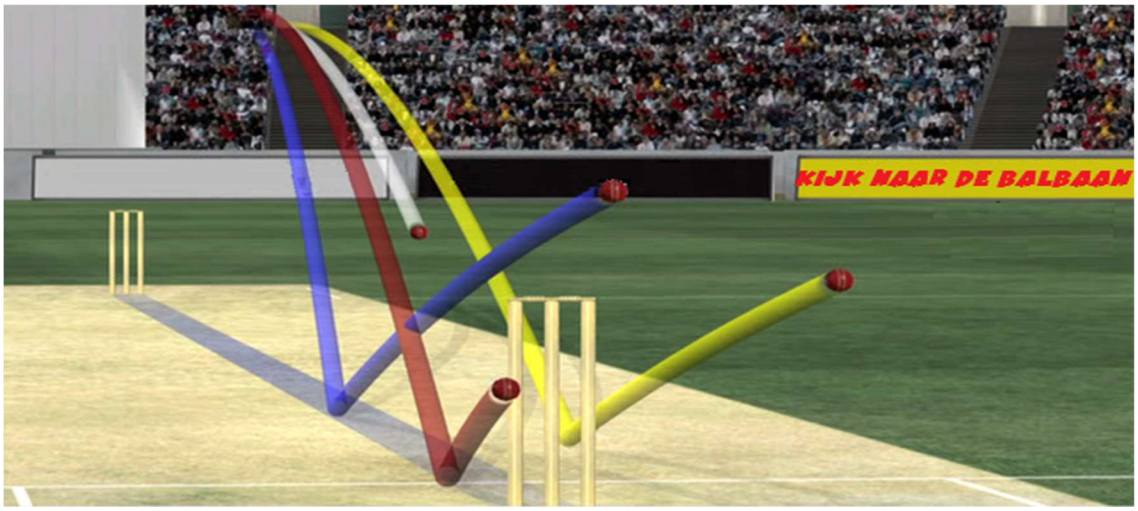


Image: During the Initial Phase of the incoming ball trajectory a batsman shapes a precise perceptual image of the global form of the ball trajectory after the bounce. This global shape also provides the zone where the ball will appear from after the saccade. An elite player just needs a little less than the white ball trajectory to gain this information. The shaping of a correct perceptual image of the latent part of a ball trajectory depends on the number and the quality of stored reference ball trajectories. Within an elite player the reference ball trajectories must cover almost all ball trajectories which he

[64] M. Hayhoe, N. Mennie, B. Sullivan, & K. Gorgos; The Role of Internal Models and Prediction in Catching Ball; http://www.aaai.org/Papers/Symposia/Fall/2005/FS-05-05/FS05-05-011.pdf

will experience during actual match play. In certain sports like tennis, sailing, soccer, cricket etc. it takes years to build an acceptable cognitive basis.

From the perspective of the spectator it looks like a cricket player is actively looking at the bounce moment. That is not what is happening. His task is to produce an outgoing ball trajectory out of the incoming ball trajectory coming out of the bounce. From his cognitive basis a player considers a few intersection points of outgoing ball trajectories after the saccade. From his peripheral view he let the ball come to one of these points.
Batsmen in cricket mainly hit outgoing ball trajectories out of the 1st tempo of an incoming ball trajectory. The 1st tempo is the rising part of a ball trajectory after the bounce. This part combined with the high speed of the ball and the short distance of the pitch makes cricket batting a very difficult task. In tennis you can only compare this with a return on service against service specialists. Tennis players can learn a lot from cricket players concerning this game situation. Cricket players always face service specialists. They highlight the reception phase and mainly let the ball come towards them. Even in the main phase of the swing of the bat. They only make a little movement towards the ball to achieve a transfer of impulse. The speed of the ball works now in favor of the batter. This has to do with the dualism in ball trajectories[65].
I will end this section with a reference to chapter 6 of "Watch The Ball Trajectory!". In that chapter the Tactical Tennis Action in tennis is appointed. It exposes the cognitive basis of one of the most complex Motoric Movement Actions.

b. The tactical movement action

The tactical movement action will be executed if we are actually going to perform a Motoric Movement Action in an environment. The tactical movement action needs to take the specific information of the location and place it over the blueprint of the cognitive basis with the final goal to come up with one perception of an action trajectory. In tennis that is a complex process because at the same time more Motoric Movement Actions are involved. In a simple Motoric Movement Action this process can be approached linearly.

Image: The classic game *Twister*. According to the outcome of a colour swivel plate a body part must be placed on a certain colour. During that task you are not allowed to touch other participants. The tactical movement action will have to continuously weigh the many possible action trajectories in relationship to the constant changing variables of the environment.

[65] "Watch The Ball Trajectory!" - Chapter 10.5

During the tactical movement action the abstract information of the cognitive basis is adapted towards the actual situation. If more options for reference action trajectories will occur then the tactical movement action is forced to come up with one action trajectory. One Motoric Movement Action allows only one action trajectory each time it is performed. If I am going to post a letter I have a choice to deliver it at mail box A or mail box B. Mail box A is the nearest one but is located across the bridge which opens regularly. Mail box B is further away and then I have the wind in my back. Well it is obvious that I can't deliver one letter in two mail boxes. If I choose one action trajectory I really have to choose it a 100%. It doesn't make sense to walk to B while still tending to go to A. That is also what the dualism in ball trajectories clearly shows.

c. The actual movement action

The actual movement action only appoints the perception processes during the actual execution of the action trajectory. Without any doubt or questions she copies the perceptual choice for one latent action trajectory out of the tactical movement action. As if it were the only action trajectory in the world. The actual movement action just starts with the execution of the chosen action trajectory. So if one latent action trajectory is determined from the hand to the kettle then the actual movement action throws the hand in the beginning of the perceptual perception of the action trajectory. So the line leads the hand. But the actual place of the hand and the manifest part of the action trajectory also provides feedback to the previous shaped perceptual perception. That is needed because we don't make straight lines[66]. The two processing processes of the perception are correcting each other in a ongoing mutual relationship. The ventral stream mainly observes the action trajectory between the hand and the kettle. It notices the hand but mainly as a part of the action trajectory. The dorsal stream observes the hand. The action trajectory is observed as well but now mainly out of the perspective of the hand. If the hand deviates just a little from the latent perception of the action trajectory the tactical movement action provides a new perceptual perception right away. Which the hand will have to follow again. This mutual process will continue until the hand actually completed the whole action trajectory.

If the action trajectory becomes more manifest the chance to deviations decreases exponentially. Every place P at any position at the action trajectory will have the same chance of deviation. A deviation which concerns quite a number of places P′. But the total deviation is the *product* of all deviations at all places P. So when the action trajectory becomes more manifest the number of latent places P diminish linearly with each passing time frame and the product decreases exponentially.
When just a short latent part of the action trajectory is left the chance to deviations becomes so little that we actually don't perceive that part of the action trajectory during safe and simple tasks. When we work out a script we are able then to continue with the perception processes within the next script item. The perceptual perception will however continue till the moment we actually feel the kettle in our hands. So the processing processes will also be active till the end.

Like aforementioned in the section about the cognitive basis there is still no scientific research that centres the actual movement action. So there is no solid evidence confirming the actual movement action. However the outcome of scientific research points to the explanatory model concerning the actual movement action. In here I will mention a few of these researches. They are mainly about ball games. It will take some time before ordinary daily Motoric Movement Actions will be the topic of scientific research. The research in ball games shows that elite players must observe an (movement) action object in relation to the perceptual perception of the latent action trajectory and that the processing processes of the ventral and dorsal stream play a very active mutual role in that relationship.

[66] Remember the nerve spiral.

a. Visual Perception and Action in Sport[67]

"That is, the ventral stream permits the formation of perceptual and cognitive representations which embody the enduring characteristics of objects and their spatial relations with each other, whereas transformations carried out in the dorsal stream, which utilise the instantaneous and egocentric features of objects, mediate the control of visuomotor actions. Furthermore, they contend that neither stream works in isolation but they engage in extensive orchestration.

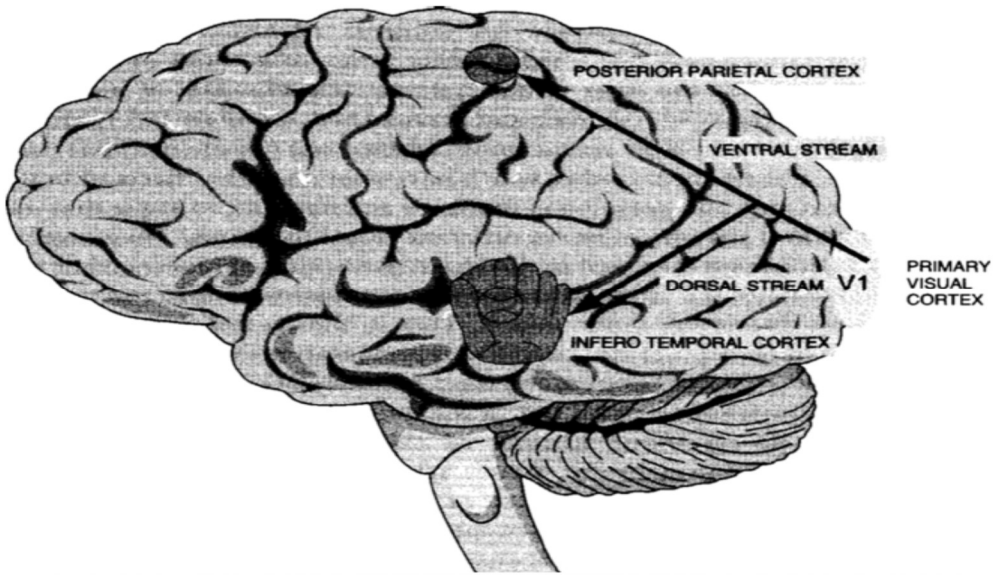


Figure 3.7 Two main streams of visual processing in the cortex. According to Milner and Goodale (1995), the ventral stream to the posterior parietal area plays a major role in object recognition and the dorsal stream to the inferotemporal region is involved with the 'on-line' control of goal-directed action as depicted by the object (baseball) and the catching action (ball-glove relationship). Despite the apparent independence of the two streams, coordinated action is dependent upon a higher degree of cooperation between the two pathways."

It is important to note that the successful selection of the correct movement programme is dependent on skilled perception of ball flight characteristics. Abernethy and colleagues (e.g. Abernethy 1981, 1987a, 1987b; Abernethy and Russell 1984) have pointed out that the time constraints of fast ball sports are so restrictive at the highest levels of performance that it is not feasible to readily modify the duration of parts of the movement (e.g. quicken one phase of a biphasic batting action). This type of variability would increase the programming demands upon the performer. Rather, the skilled athlete is one who 'buys' time by exploiting the advance signals emitted by the movements of opponents for decision-making and preparation of a response. Skill in rapid interceptive actions, such as catching and hitting a ball, is based upon the ability to detect and interpret perceptual information through a comparison with an internalised memory structure based on past experiences in similar situations. Top class players have developed highly sophisticated models of the world which allow them to predict events and to select pre-programmed sequences of movements specifically designed to carry out interceptive tasks. This explains why skilled athletes never seem to merely react to unexpected events, but appear to operate in the future. They use an 'anticipatory mode' of action (Whiting, Alderson and Sanderson 1973)."

There is a fundamental misconception in the subscript of the above *Figure 3.7*. The conception of the ball is okay but it has to be considered in relation to its ball trajectory and not with the *ball-glove rela-*

[67] Williams, A.M., Davids,K., Garrett, J.; blz.78; http://www.imd.inder.cu/adjuntos/article/632/Visual%20Perception%20and%20Action%20in%20Sport.pdf

tionship. The relationship ball-ball trajectory has to do with the action trajectory of the Movement Action (MA). That is the only concern of the ventral and dorsal stream. The glove as a part of the actual catching has to do with the Motoric Movement (MM) within the Motoric Movement Action. These Motoric Movements or technique are controlled in a proprioceptive way and not by the processing processes of the perception.
It is important to start realising that the action trajectory must be observed out of the perspective of the (movement) action object and that the technique (the movement trajectories) must be observed out of the perspective of the subject. The action trajectory and the movement trajectories belong to two irreconcilable worlds.

b. The Visual Brain in Action[68]

"1. The Functions of Vision

Standard accounts of vision implicitly assume that the purpose of the visual system is to construct some sort of internal model of the world outside -- a kind of simulacrum of the real thing, which can then serve as the perceptual foundation for all visually derived thought and action.
--Of course, the visually guided behavior of many animals, particularly complex animals such as humans, is not rigidly bound to a set of visuomotor modules, however subtle those mechanisms might be. Much of our behavior is quite arbitrary with respect to sensory input and is clearly mediated by some sort of internal model of the world in which we live. In other words, representational systems have evolved -- systems that permit the brain to model the world, to identify objects and events, to attach meaning and significance to them, and to establish their causal relations. In humans and other primates, vision provides some of the most important inputs to these representational systems. Such systems are not linked directly to specific motor outputs but are linked instead to cognitive systems subserving memory, semantics, planning, and communication. Of course the ultimate function even of these higher-order systems has to be the production of adaptive behavior. The distinction between systems of this kind and the dedicated visuomotor modules described earlier is that the former enable us to select appropriate courses of action with respect to patterns of visual input, while the latter provide the immediate visual control required to execute those actions.
In our book The Visual Brain in Action, we argue that these two broad kinds of vision can be distinguished not only on functional grounds, but also by the fact that they are subserved by anatomically distinct substrates in the brain. Thus the distinction between vision for action and vision for perception helps us to understand the logic lying behind the organization of the visual pathways in the brain.---

1. The Visual Brain

Evolution has provided primates with a complex patchwork of visual areas occupying the posterior 50 % or so of the cerebral cortex (for review, see Zeki, 1993). But despite the complexity of the interconnections between these different areas, two broad 'streams' of projections have been identified in the macaque monkey brain, each originating from the primary visual area (V1): a ventral stream projecting eventually to the inferior temporal (IT) cortex, and a dorsal stream projecting to the posterior parietal (PP) cortex (Ungerleider & Mishkin, 1982).

In 1982, Ungerleider and Mishkin argued that the two streams of visual processing play different but complementary roles in the perception of incoming visual information. According to their original account, the ventral stream plays a critical role in the identification and recognition of objects, while the

[68] A. David Milner, Melvyn A. Goodale; School of Psychology University of St Andrews Fife, KY16 9JU Scotland, U.K; http://www.theassc.org/files/assc/2367.pdf

dorsal stream mediates the localization of those same objects. Some have referred to this distinction in visual processing as one between object vision and spatial vision -- 'what' versus 'where.'

Although the evidence available at the time fitted well with Ungerleider and Mishkin's proposal, recent findings from a broad range of studies in both humans and monkeys are more consistent with a distinction not between subdomains of perception, but between perception on the one hand and the guidance of action on the other.

2. Visual Awareness

According to the present interpretation, D.F.'s brain damage has uncovered a visual processing system (specifically the human dorsal stream) that can operate in relative isolation within the domains of size, shape and orientation. D.F. has no explicit awareness of the shapes and sizes that she is able to grasp by virtue of her remaining visual apparatus. We suggest that like D.F., we too carry out these functions using visual information that is not present in our awareness. Indeed, we suggest that in providing visual guidance for our actions the dorsal stream acts in large part alone and independent of any acquired 'knowledge base'.
We propose that the processing accomplished by the ventral stream both generates and is informed by stored abstract visual knowledge about objects and their spatial relationships. We further surmise that the particular kinds of coding that are necessary to achieve these ends coincide with those that render the representations accessible to our awareness. This would fit with the idea that coded descriptions of enduring object properties, rather than transitory egocentric views, are precisely what we need for mental manipulations such as those required for the planning of action sequences and the mental rehearsal of alternative courses of action.

But of course, the mere fact that processing occurs in this generalized way in the ventral stream could not be a sufficient condition for its reaching visual awareness. For example, there are generally many items processed in parallel at any given time, most of which will be filtered out of awareness by the operation of selective attention.

4. The Visual Brain in Action

Although we have emphasized the separation of the dorsal and ventral streams, there are of course multiple connections between them, and indeed adaptive goal-directed behavior in humans and other primates must depend on a successful integration of their complementary contributions. Thus, the execution of a goal-directed action might depend on dedicated control systems in the dorsal stream, but the selection of appropriate goal objects and the action to be performed depends on the perceptual machinery of the ventral stream. One of the important questions that remains to be answered is how the two streams interact both with each other and with other brain regions in the production of purposive behavior.
At the level of visual processing, however, the visuomotor modules in the primate parietal lobe function quite independently from the occipitotemporal mechanisms generating perception-based knowledge of the world. Only this latter, perceptual, system can provide suitable raw materials for our thought processes to act upon. In contrast, the other is designed to guide actions purely in the 'here and now', and its products are consequently useless for later reference. To put it another way, it is only through knowledge gained via the ventral stream that we can exercise insight, hindsight and foresight about the visual world. The visuomotor system may be able to give us 'blindsight', but in doing so can offer no direct input to our mental life (Weiskrantz, 1997).”

These quotes speak for themselves. It is completely in line with the Game Action. *“One of the important questions that remains to be answered is how the two streams interact both with each other and with other brain regions in the production of purposive behaviour”.* I give the answer with the actual movement action. The perception processes towards the dorsal stream mainly see the ball. Relative to a ball trajectory. The action path. The perception processes towards the ventral stream mainly

see the ball trajectory. Relative to the ball. The perception path. They are both active during the actual execution of a Motoric Movement Action in an ongoing mutual way.

c. Tussen de linies spelen[69]

"Tot aan de primaire visuele schors verloopt de verwerking van visuele informatie hetzelfde, maar daarna vindt de verwerking plaats via respectievelijk het ventrale en het dorsale systeem.

Het dorsale systeem, dat projecties van de primaire visuele cortex naar de posterieure pariëtale schors omvat, dient voor het oppikken van visuele informatie die gebruikt wordt voor de sturing van bewegingen. Dit systeem wordt ook wel 'vision for action' of kortweg het actiepad genoemd. Deze stroom van informatieverwerking betreft de (onbewuste) visuele sturing van bewegingen in de omgeving (actie), waarbij voorwerpen ten opzichte van de actor in een absolute metriek gecodeerd worden als egocentrische informatie.

Het ventrale visuele systeem, dat projecties vanuit de primaire visuele schors naar de inferotemporale schors omvat, betreft de (bewuste) waarneming van gebeurtenissen en voorwerpen in de omgeving (perceptie). Dit systeem wordt ook wel 'vision for perception' of kortweg het perceptiepad genoemd. In tegenstelling tot het dorsale systeem, kent het ventrale systeem alleen maar indirecte verbindingen met de premotorische schors, zoals via de ventraal prefrontale schors, die betrokken is bij geheugenprocessen en het maken van beslissingen (Rossetti & Pisella, 2002)."

3. Timing and the movement action (MA)

An important part of the movement action (MA) is the assessment of how much time an action trajectory needs. We possess knowledge of how much time globally is involved in any action trajectory. It is a structural part of the cognitive basis. We perceive action trajectories by connecting static, still images and so we continuously link a certain time frame to certain sequences. So, like always, the cognitive basis doesn't provide exact knowledge but precise global knowledge. In a matrix with uncountable possibilities this removes already the majority of these possibilities. There will still remain a lot of options so you can't actually work with what is left but that is not the goal in this phase. The first goal is to reduce the number of possibilities drastically.
If we are actually going to execute a Motoric Movement Action then we create a more precise image of the global time frame which will be involved based on specific information of the surroundings. Although this image will be leading the actual movement action at first, it is all about the actual time a (movement) action object needs. The actual place of an (movement) action object in an action trajectory determines the actual actions. So the cognitive basis and the tactical movement action are important to provide a precise global image of the time frame that will be involved but they are only leading. The actual movement action will have to actually finish it. It is important to notice that also in timing they need each other.
It is important to see that the precise global image of the cognitive basis provides very accurately the fluctuation margins of the timing involved. On the one hand these borders will have to assure that the possible time gap is narrowed down in such a way that it only leaves room for just a few options. On the other hand it must leave so much room within the actual movement action to cover the actual fluctuations during the actual execution. If we take a position in front of the mail box the cognitive basis

[69] Prof. dr. G.J.P. Savelsbergh (2009); https://www.fsw.vu.nl/en/Images/Oratie%20Prof.%20Savelsbergh_tcm31-108263.pdf

provides us the precise global fluctuations concerning the arm length in relation to the *post* action trajectory. So we choose a position not to close to the mail box and certainly not outside of the maximal fluctuation margin. We quickly choose a position within these fluctuations and will not debate a long time what might be the most optimal position. We just let the actual movement action finish the job without ever caring about what maybe is the ultimate position. That is probably the most efficient and effective way to execute Motoric Movement Actions. This is a not timing related example but it works exactly in the same way if timing is involved. The cognitive basis needs to provide the correct fluctuations of the possible time frame involved if we want to time the actual movement action with success. It has to provide such narrow margins that the actual fluctuations in time within the actual movement action are covered.

We *time* every Motoric Movement Action. Sequential images will continuously provide implicit knowledge about the time frame involved in every Motoric Movement Action. In Motoric Movement Actions where the perception can be considered static, like the classic *post* action, timing of the action trajectory is not necessary. In Motoric Movement Actions with dynamic perception the action trajectory needs to be *timed*. That needs to happen if you decide to post a letter while riding a bike.
Most sports require dynamic perception. Elite players possess a huge cognitive basis concerning the time frames of the relevant action trajectories. Besides the fact that they have to time the action trajectory they also need to time the biomechanical main action of the motoric movement (MM). The *timing* of these movement trajectories needs to serve the *timing* of the action trajectory.

Chapter 7 – The Motoric Movement (MM)

1. The components of the motoric movement (MM)
2. The unity model
3. The kinetic chain model
4. Timing and the motoric movement (MM)

The Motoric Movement Action can only be appointed as a complex system. It hosts two fully autonomous complex (sub-)systems. The motoric movement (MM) and the movement action (MA). The Motoric Movement Action doesn't host other components.
The movement action (MA) only explains the action. The motoric movement (MM) only explains the execution of the action. They state nothing about each other. The execution has nothing to do with the description of the action and the action has nothing to do with the description of the execution. However they are both needed at the same time for one successful Motoric Movement Action. In the Motoric Movement Action they form an inextricable pair but the movements of the two have no relationship whatsoever. Of course there is a correlation but there is no relation in the trajectories they make. The essences of the two parts, the action trajectory and the movement trajectories belong to two completely different worlds. There is always only one action trajectory in one Motoric Movement Action and always more movement trajectories. However the explanatory model of the Motoric Movement Action appoints the motoric movement (MM) in singular and not the plural form. The explanatory model wants to push everything towards the action trajectory. And because that is one line the explanatory model wants to appoint the motoric movement (MM), how complex it maybe is and how many movement trajectories maybe are involved, much more as one happening towards the movement action (MA).

In this chapter I will discuss the motoric movement (MM). I also gained a few insights in there what I think is worth mentioning. I used tennis as a basis for these insights.
I will show that even the simplest motoric movement (MM) must be researched as a complex system. Besides that I will appoint, within the technique, the existence of a *unity model*. The *unity model* is fully compliant with the explanatory model of the Motoric Movement Action. The now leading kinetic chain model will never be able to provide the full explanation of the technique because it is mainly a linear explanation. It denies the complexity of the Motoric Movement Action. The kinetic chain model could provide the explanation of parts of the Motoric Movement Action.

1. The components of the motoric movement (MM)

The Motoric Movement Actions in sports/games is being formulated as follows[70]. *The Game Action explains the game. It is executed with technique.* The Motoric Movement Actions in sports/games complies with the product of the Game Action and the technique. In a formula this can be imagined like MMA = Te x (GA). This is a specific formula linguistically adapted to sports/games. It is deduced out of the general formula which explains all Motoric Movement Actions. The general formula is MMA = MM x (MA). It has the same short explanation like in sports/games. *The movement action (MA) explains the action. It is executed with a motoric movement (MM)*.

[70] "Watch The Ball Trajectory!" - Chapter 13.1

In sports/games technique stands for all facts and occurrences which are not related to the movement action (MA). In tennis I divide the technique into five complex (sub-)systems.

a. Individual conditions (IC). IC is the physical ability of a player which he genetically received.
b. Body processes (BP). Under de competence of BP we can arrange all the processes we now consider under condition (CO), fitness etc.. In my opinion this need not to be changed.
c. Body movements (BM). Except for footwork BM are all the movements a body has to make when the Game Action is executed.
d. Footwork (F). In principle F belongs under BM. However in tennis F has a historical status. In my opinion this need not to be changed. In tennis we recognize court defending footwork (CDF) and ball reaching footwork (BRF).
e. Strokes (S). In tennis the movement trajectories of the body are expanded with one extra movement trajectory by the use of a (motoric) movement object. This flexible intermediary object takes care of the fact that the movement trajectories of the body have no direct relationship with the transition point or contact point of the action trajectory.

Within tennis the technique is then the product of this five parts. In a formula Te^{tennis} = (IC) x (BP) x (BM) x (F) x (S). In tennis footwork (F) and strokes (S) are mentioned separately because that is a long time tradition in tennis but in fact they belong to the body movements (BM). So the general formula for the motoric movement (MM) can be shortened to MM = (IC) x (BP) x (BM). In research one can decide for themselves if a (motoric) movement object like a hammer, the front door key or the *atlatl* justifies the expansion of the body movements (BM). We can argue about the footwork but the strokes in tennis belong to such a complex world that this expansion can be justified easily.

Image: The *atlatl*. *"The spearthrower is believed to have been in use by Homo sapiens since the Upper Paleolithic (around 30,000 years ago)."*[71]

The formula MM = (IC) x (BP) x (BM) clearly shows that all parts are responsible for the execution of a motoric movement (MM) and not one part. If one wants to optimize the motoric movement (MM) all parts need to be optimized.
Although the attentive reader will notice right away that the individual conditions (IC) can't be optimised because that is what you got when you were born. And that in itself is true. We can't change the physical predispositions. However everybody needs to learn how to execute a Motoric Movement Action with his subject, his individual conditions. We receive general information about Motoric Movement Actions of many teachers in our lives. The unique body however needs to incorporate this. The Motoric Movement Action will have to translate the motoric movements (MM) in a motoric learning process towards the *subject related* individual conditions (IC). So this *subjective* process is different for everyone. I use a different constellation of ligaments, muscles, tendons, bones etc. than every other person. That is why I throw different than anyone else. In nowadays lessons concerning motoric learning processes there is a lot of room for the rational learning processes. There is hardly no room for this

[71] https://en.wikipedia.org/wiki/Spear-thrower

subjective learning process. Teachers are not looking for possibilities to let my body independently look for more efficient and effective solutions. The fact that I can execute a Motoric Movement Action very successfully doesn't mean that my constellation is not able to do it much better.
The relative new research of Richard Schöllhorn[72], concerning differential learning, must be situated there. The place of the individual conditions (IC) in the formula above exactly translates his research and underlines in that way the raison d'être of his findings. It shows that it is essential to let this *irrational subjective* motoric learning process happen. So we not only have to raise the level of rational knowledge of action trajectories and movement trajectories within pupils but we also have to make room to optimise the quality of the movement trajectories out of the body itself. The individual conditions (IC) must be optimized to each separate Motoric Movement Action.

Like in "Watch The Ball Trajectory!" I will not discuss the body processes (BP). We already know a lot about these processes which in tennis are categorized under condition (CO). At this moment I don't have to add anything and I don't see no reason to suggest any changes. Like one can see in the formula they are an essential part of the motoric movement (MM). In big matches an elite player needs a lot of specific energy to provide the specific Motoric Movement Action with the necessary energy. In lots of endurance sports this is the most relevant factor of the motoric movement (MM).

The third element of the formula of the motoric movement (MM) comprises the body movements (BM). I will extensively address this part. I will appoint a complex technique model which has the capability to fully explain the motoric movement (MM). Linguistically the model can be called a movement model or, in sports/games, a technique model. The term *technique* model is able to cause a little confusion. In the beginning of this paragraph I appoint everything with which we play a game/sport as technique. In daily language we only call something a technique if there is a specific combination of body movements (BM). I will however maintain the two terms. As long as you notice the difference. The explanation of technique models which will follow now only concerns the aforementioned body movements (BM).

2. The unity model

A movement model has to describe exactly what is going on within the motoric movement (MM) of a Motoric Movement Action. The action trajectory and the relevant movement trajectories must be appointed. Within the movement trajectories it needs to show the biomechanical main action towards the transition point. The movement idea, the central idea behind the motoric movement (MM), belongs in there too. The whole model needs to show which movement trajectories are motion-dependent and which are leading/dominant. A movement model provides the exact answer to the *how* and *where* the transfer of energy occurs. Such a formulated answer complies with the conditions a complex system requires.

I will now appoint two examples with this assumption in mind.

The first example is about the motoric movement (MM) in the Motoric *Post* Action. Till now you know everything about the movement action (MA) of this Motoric Movement Action. You know the action trajectory out of the perspective of the letter. You know that the cognitive basis came up with a global perception of an action trajectory which was narrowed down during the tactical *post* action and accompanied by the ventral and dorsal stream during the actual movement action. But it doesn't tell anything about the motoric movement (MM). The motoric movement (MM) has no overlap with the movement action (MA). It will just have to execute the movement action (MA). You could also say that the motoric movement (MM) has to make it happen. It will have to make it happen that the action trajectory ends in the slit of the mail box. It will make that happen as follows. Let's divide the Motoric *Post* Action in three parts. 1. The moving to the mail box with, in my case, mainly *leg* action, 2. The

[72] See chapter 8 - motoric learning

standing in front of the mail box with, in my case, mainly *arm* action and 3. The insertion of the letter into the mailbox.

The *post* action is linked to all those Motoric Movement Actions in which the (movement) action object moves through *nothing* the major part of the action trajectory. The letter does nothing in any phase (the letter just accepts it all) but it seems that the letter is even doing less during the first phase. While the legs walk it just takes an obedient position in the hand with the arm alongside the torso. The perception in this phase is actively looking for an action trajectory with *nothing*. If it notices *something* obstructing the road, like a road works, then the cognitive basis together with the tactical movement action quickly respond with a detour with *nothing* again. The motoric movement (MM) in this part is mainly the leg action. I will not appoint it here. Walking/running will be further appointed in appendix A. Actual perception of the letter is not necessary during this phase. We know cognitively that if our body is able to arrive through the *nothing* at the mail box that the letter will automatically arrive there too. So in that first phase we execute more a Motoric Movement Action *moving A-B* and that is the reason why we don't feel that the walking phase is part of the *post* action. The *post* action starts for our feeling from the moment we are standing in front of the mail box because we are then actually going to perceive the letter in its action trajectory.

I will appoint the phase in front of the mail box in a more extensive way. When we arrive at the mail box most people come to a stop. That is very important because the complexity of the perception will then diminish with a factor. And because the eyes come to a standstill we don't need to time the action trajectory.
The tactical part of the movement action (MA) determines a distance to the mail box from where I can easily reach the slit with the letter. So I don't stand too far and I don't stand too close to the mail box. From this phenomenon you can also derive that the cognitive basis and the tactical movement action estimate the fluctuations of the shape and the length of the action trajectory beforehand. So the position of the feet is based on precise global knowledge concerning the length and shape of the action trajectory. That information is connected with knowledge of how we are able to increase or decrease the *post* action trajectory within certain margins during the actual movement action.

If the actual *post* action starts my arm needs to move away from my torso to be able to create the action trajectory of the letter. The phasic muscle groups in my upper arm will take care of the abduction of the arm. The muscles in my lower arm take care of a little rotation of the lower arm and the position of the elbow will make it possible that the lower arm gets enough room to manoeuver in such a way that the letter comes close to the slit. In this phase the letter can already be manoeuvred into the slit. If we finally proceed to the insertion of the letter the Initial Phase of the very tiny *throw* is already determined. Just a little push is necessary to fulfil the whole task. In this last phase we need to gain just a small amount of potential energy to be able to throw the letter into the last part of the latent *letter* trajectory. Most people execute this phase with a small movement of the hand/wrist. Until the release of the letter we are able to adjust the position of the letter continuously because we hold the letter in the transition point. I carry my letters with three fingers (thumb, index and middle finger). The three little areas at the end and on the outside of those fingers shape the transition point with the areas on the outside of the letter they are touching. The outside of those areas hold the letter because movement trajectories in the body create pressure in opposite direction in these areas. The movement trajectories end just on the inside of those outside areas. Because a letter is constructed of a solid material we cognitively know that the whole letter will be moved if we are able to create pressure in three tiny parts of that letter. This fact will lead to very different motoric movements (MM) if we want to throw liquids. The moment we release the letter the transition point, like in every throw action, must take care of the actual transition of the energy from the movement trajectories to the action trajectory. After the throw the action trajectory cannot be adjusted anymore. So the transfer of energy in the transition point must take care of the fact that the Initial Phase of the *letter* trajectory will become the complete perceptual perception of that last part of the action trajectory. The beginning of the object trajectory, the Initial Phase, will have to host the requirements for that whole last part. In the Motoric *Post* Action that is really simple. The letter is already stuck in its Initial Phase. Just a little energy in the transition point will make a big success of each post action.

What can we tell now about the motoric movements (MM)? The letter was able to find a push off against the outside areas of my fingers. My hand was able to find a push off against my lower arm. My lower arm against my upper arm. My upper arm against my body and my body against the ground. Is there a transfer of energy from the ground up? Or were the body parts able to push off because off the rigidity and the inertia of the bigger masses involved? Astronauts are also able to execute the Motoric *Post* Action without any GRF. I will return to this issue later. What becomes obvious though is that the whole body, as a unity, took care of the fact that the arm was able to push off. The whole body was needed the whole duration of the action.

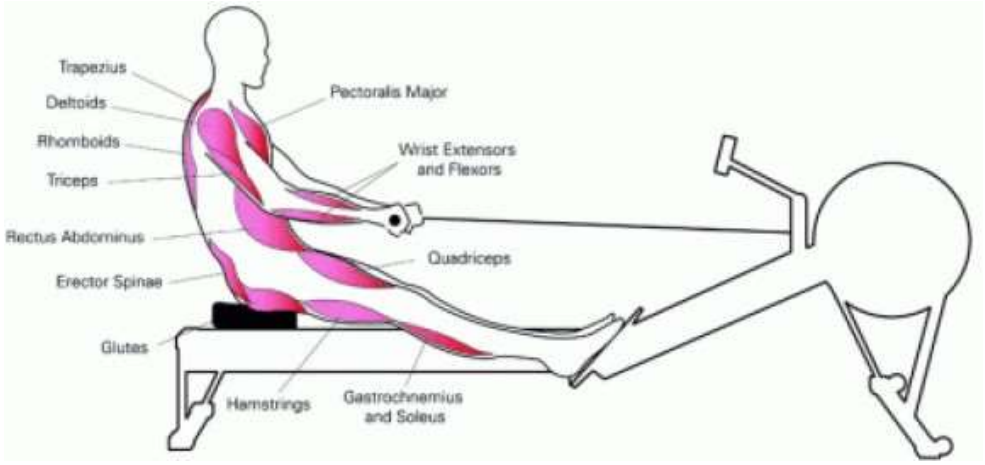


Image: Besides the postural muscles many fascial (movement) muscle groups are active during rowing. The fascial muscle groups lie at the heart of the origin of the movement trajectories. One movement trajectory will come to live out of a complex assembly of muscle movements. So every movement trajectory carries at least one translation level. The fact that movement trajectories are translations makes that even the most simple motoric movement (MM) needs to be studied as a complex (sub-)system.

In the second example we return to rowing. The action trajectory is simple. In Olympic races that is a 2000 meter straight line from A to B visualized out of the very first part of the boat. The transition point from the perspective of the action trajectory is situated on the outside of the blade of the oar where the push against the water is created. By pushing the water in the opposite direction an action trajectory in the other direction becomes possible. This principle is the same in every Motoric Movement Action *moving A-B*[73]. Because boats possess a set intermediary constellation the rowing oar can't be or can hardly be manipulated freely. So the transition point out of the perspective of, the movement trajectories from, the motoric movement (MM) must be situated in the point where the outside of the palm of the hand touches the outside of the handle of the oar.
As always the movement trajectories of the motoric movement (MM) have no direct relationship with the action trajectory of the movement action (MA). The push off(-trajectory) of the blade against the water has a direct, negative, relationship with the action trajectory. The movement trajectories just make that push off possible. The various trajectories don't share anything.

Within every stroke the little toes and the blades of the oars, and everything in between, are moving from the very first beginning to the very last moment in the Motoric Rowing Action.

I will limit myself to the motoric movements (MM) of rowing which every layman will also be able to notice. Let's define one stroke as one Motoric *Rowing* Action. A rower makes a movement trajectory by pushing the legs against the foot plate. After this leg action it is obvious that a rower also creates

[73] Zie hoofdstuk soorten motorische bewegingshandelingen

another movement trajectory by pulling the oar with an action of the arms. Those are the two most important movement trajectories in rowing. The movement trajectories have the same direction. It is obvious that neither one is executing the main action. The main action is created by the resultant of those two movement trajectories. This fact defines the biomechanical main action in rowing. The movement idea is namely that the movement trajectory of the leg action must give a boost to the movement trajectory of the arm action. One can compare this *push-in-push* principle with a swimmer who pushes of a starting block where the block will move and give a push in the direction of the water during the start.

Irrespective to the transfer of energy one can notice again that the whole body needed to become a unity to execute one stroke. Just like in the posting task not only the fascial muscles have set relationships but also the postural muscles. From the little toes of your feet to the outside of the blades of the oars and everything in between is active from the beginning to the end. Just like in the posting task all motoric movements (MM) have to create one unity. As one unit they have to focus at the action trajectory. Because in the end the action trajectory has to fulfil the task. Although the action trajectory cannot be executed without the motoric movement (MM) the explanatory model of the Motoric Movement Action is always reasoning towards the action trajectory. The explanatory model therefor wants to appoint the becoming of the body to one unity as *one* happening towards *one* action trajectory. The explanatory model wants to observe it as *one* eruption of energy. Although it is possible that a certain time frame is involved. This shapes the underlying idea of the *unity technique model* or the *unity model* within the motoric movement (MM). So explanations within the explanatory model of the Motoric Movement Action of how a technique model works or how the transfer of energy is regulated will have to comply with the unity model. However this doesn't exclude the existence of a kinetic chain model. It is possible to maintain that explanation for certain parts of the motoric movement (MM). Somewhere and somehow energy will have to be transferred.

3. The kinetic chain model

I will appoint in this paragraph the kinetic chain model which is used a lot in tennis. It is also used in throwing sports. The transfer of energy in ordinary daily Motoric Movement Actions is hardly explained. One assumes that it is obvious what happens or that it doesn't matter. I suppose that if it is able to serve tennis that it probably can be used in simple Motoric Movement Actions as well. Within biomechanical research the kinetic chain model is still the leading explanatory model.

"Ball Velocity and Tennis Serve Kinematics

In tennis, the serve is a sequence of motions referred to as a 'kinetic chain' that begins with the lower limb action and is followed by the trunk and the upper limb. Fleisig et al. (9) have shown that tennis players produce a rapid sequence of segment rotations (Table 1). The order of maximal angular velocities is trunk tilt (280°/s), upper torso longitudinal rotation (870°/s), pelvis rotation (440°/s), elbow extension (1510°/s), wrist flexion (1950°/s), and shoulder internal rotation (2420°/s).(9) These joint and segmental rotation contributions to racket velocity in the serve are of great interest in the literature.(10,11,12,13) The major contributors to the mean linear velocity of the racquet at impact are internal rotation of the shoulder, flexion of the hand, horizontal flexion and abduction of the shoulder and trunk flexion (see Table 2)."[74]

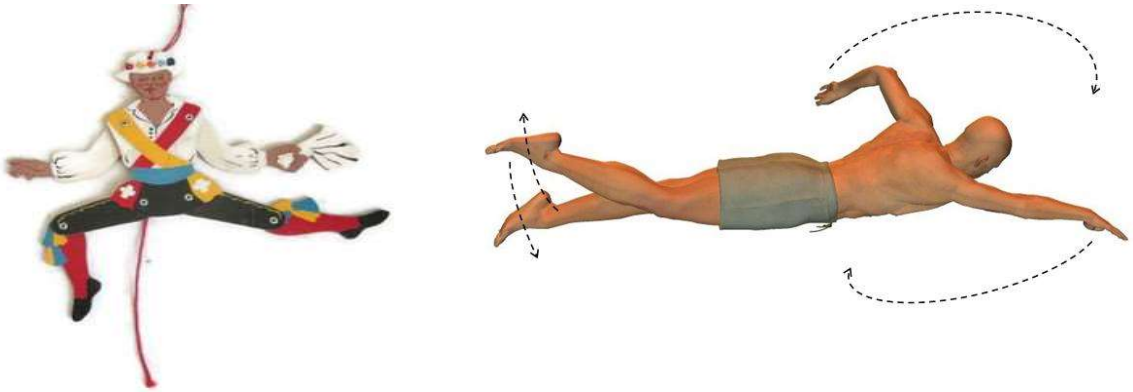
"Kinetic chain

[74] Caroline Martin, J Med Sci Tennis 2014;19(2): Tennis Serve Biomechanics in Relation to Ball Velocity and Upper Limb Joint Injuries; http://www.caromartin-tennis.com/wp-content/uploads/2015/05/martin.pdf

There are generally two segment coordination strategies used in tennis (table 11).). In strokes where power is required (such as the service and groundstrokes), a number of body segments must be coordinated in such a way that a high racquet speed is generated at impact. Where precision is needed, the number of segments is reduced and segments operate more as a unit (such as the volley at the net), although the drive volley now challenges this general principle.
Efficient function, with maximal performance and minimal risk of injury, requires optimum activation of all the links in the kinetic chain designed for power.[12] Injury is often associated with alterations in the flow of energy across segments, such that if one segment is removed from the chain, then there is an increased reliance on the others to accommodate this loss, which may lead to tissue overload." [75]

The kinetic chain model mainly explains movements and transfer of energy in a linear way. In the article belonging to the second quote *the three orthogonal axes* are appointed. However they are never specified to specific movement trajectories. The current biomechanical research determines which parts are actively linked and how those parts work, in itself, independently. That's all. It is assumed apparently that it then automatically will work together according to the kinetic chain.

Besides this deficiency parts of the explanation of the kinetic chain model are not correct. Movements don't need *Ground Reaction Force*. Astronauts are able to play the drums as long as they have energy (CO/BP). In space the arms and legs can be pushed of the torso endlessly without any GRF. Only in the execution of the Motoric Movement Action *moving A-B*, in which the whole body is involved, an astronaut needs to gain an *outer reaction force*[76]. Swimmers also float as a consequence of the water and are able to push off the legs and arms, as long as there is energy, endlessly. The action trajectory in swimming is created by pushing the water backwards. By pushing against *the ground*. The negative resultant of that push creates an action trajectory in the other direction. This is characteristic for every Motoric Movement Action *moving A-B*. However the movement trajectories have nothing to do with that push against the ground. They arise because the arms and legs are rigidly fixed to the torso.



Images: (left): A jumping jack *in space*. The arms and legs are linked to the body by split pins. That makes it possible that the arms and legs can be pushed of the torso endlessly. (right) A swimmer *in space*. If a swimmer really would be in space he wouldn't be able to move an inch but he would be capable of pushing his limbs of his torso endlessly. Those pushes would also be able to provide a letter with the necessary energy to execute a posting task.

Limbs are able to push of the torso mainly because of inertia and the rigidity, the unity, of the rest of the body. Conform this idea the sole lower arm is able to push of the upper arm as well. And the same can be said about the hand-lower arm and the fingers-hand relationship.

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[75] http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2577481/ Biomechanics and tennis; B. Elliott
[76] See chapter 5.5 – The Motoric Movement Action *flying*

The unity model within the explanatory model of the Motoric Movement Action wants to emphasize in here that these actions are only possible if the rest of the body forms a constant rigid base from the beginning to the end of the Motoric Movement Action. This creates another difference with the linearity of the kinetic chain model. That model implies that once the energy is transferred by a link it is able *to leave the premises* before the whole action is completed.
The unity model is not only concerned about what moves but also what not moves. In which it is also very important which movement trajectories dominate in what way and which movement trajectories are motion-dependent. The kinetic chain model doesn't explain all that.

By the way it is very important that there is biomechanical research which tells us what links are involved and in what way they move. But one should never use this research as the full explanation of how technique models work. It should be considered as the beginning of the research within the unity model and not the end. However biomechanical research suggests that the outcome is the end story. Among other things that takes care of the fact that at least 99% of the tennis population regards the service out of one technique model. And that led to the fact that I was wrong footed for years in my own participating research. I just copied the prevailing findings of the current biomechanical research. It was all presented in such a way that I even never developed a thought about the idea of considering anything in a critical way. It was presented in such a way that all the findings naturally belonged to *the* service. One service. That went on till the time that I couldn't bring together two things within the tennis service for at least a year. It was a real shock to notice that the two characteristics, which I wanted to deduce to the movement source, belonged to two totally different technique models. I remembered that the shock mainly comprised the fact that there was more than one technique model. And not the contents of the technique models. Finally that led to three technique models[77] in the service. The elite model (Raonic, Karlovic, Isner etc.) differs from the most common service model as the *Fosbury flop* differs from the *straddle* technique in the high jump. They are both totally different models with a fundamental difference in the movement idea. However the outer characteristics are so alike that bio mechanists never noticed the difference. For commercial reasons I will not share precise details in here. In "Watch The Ball Trajectory!" I do however reveal that the torso action in the elite model is motion-dependent on the arm and racket action. In the most common *normal* model the rotation of the torso is part of the biomechanical main action and is certainly not motion-dependent.
The different technique models also have consequences for the massive stats which always accompany most biomechanical research. The different models host completely different characteristics on the outside of the body. So if you consider all services being the same and put all the data on one big pile the data become more unreliable. Still the biomechanical research showed a gross motoric way where to begin with my quest in tennis. It presented, like the perceptual perception of a latent action trajectory in the Motoric Movement Action, a precise image of what was happening globally.

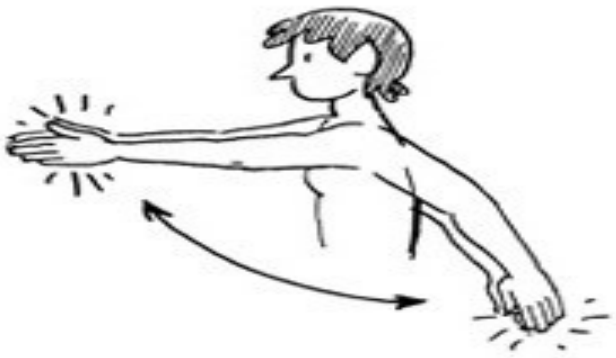
4. Timing and the motoric movement (MM)

An important part of the motoric movement (MM) revolves around the possibility of estimating the timeframe of a movement trajectory and in particular a biomechanical main action. This knowledge is needed a lot in for example tennis. With every movement trajectory we possess knowledge about the global time frame involved. That is also part of the cognitive basis. However action trajectories we mainly guide with actual perception but movement trajectories we are able to perceive that in a proprioceptive way.

If we clap in our hands behind our back then the task can be imagined. From the palms of our hands we have to create perceptual perceptions of two latent action trajectories which will meet behind our back in opposite directions. The action trajectories have to come to a complete standstill because of

[77] Zie "Kijk Naar De Balbaan!"

that frontal confrontation and by doing so a clapping sound is produced. We are not able to see the whole action trajectory with actual vision. However we are able to time the clapping because the latent perceptual image of the action trajectories can be adjusted in a proprioceptive way. This is only possible if the action trajectory beholds two of our own body parts. Because we are able to *feel*, from both sides, in which phase the motoric movements (MM) have progressed in the action trajectory. Both movement trajectories are created out of our own body and therefor can be adjusted in a proprioceptive way. That is why we are able to execute this Motoric Movement Action in the dark and are unable to perform a *high-five* with a neighbour in the dark. The only reason why we are able to trace a mosquito during the night is because he fortunately/unfortunately reveals his flight by the high pitch sound he produces. By localising the sound a perceptual perception of a latent action trajectory can be visualized from the palm of the hand to the head of the mosquito.



Because movement trajectories also connect a number of set places P in a linear way we implicitly form a certain time set in all motoric movements (MM). In many daily Motoric Movement Actions that doesn't play a relevant role. However in sports, like tennis, the timing of the motoric movement (MM) fulfils an essential role. The power tennis of today requires that a lot of energy is transferred to the ball. Therefor the racket needs to be moved away from the perceptual intersection point of the incoming ball trajectory and the outgoing ball trajectory first. Subsequently the racket, or more accurate the front outside of the sweet spot of the racket head, needs to return to the contact point in a set way and under the influence of the biomechanical main action. That action requires precise information of the global time frame that is involved. This is essential because not only the motoric movement (MM) needs to be timed but the movement action (MA) needs to be timed as well.
Because the movement action (MA) leads the motoric movement (MM) the timing of the action trajectory has to lead the timing of the movement trajectories. The precise global predictions provide the exact leeway which those moments of timing need. The precise global prediction of the time scale of the action trajectory will be actually adjusted during the actual movement action. The motoric movements (MM) will be able to cover those fluctuations of the expected time and the actual time frame involved in a proprioceptive way.


PEANUTS
featuring
"Good ol' Charlie Brown"
by Schulz
PUFF PUFF
THIS IS HARD ON US LUNGS
IF I START COMPLAINING, YOU'RE ALL IN TROUBLE
SHUT UP, HEART!
WHY DO WE FEET HAVE TO DO ALL THE WORK?
HOW ABOUT TOES? YOU THINK IT'S EASY BEING A TOE?
YOU GUYS ARE ALWAYS COMPLAINING.. WE EARS CAN HEAR YOU WAY UP HERE!
BESIDES, IT'S US LEGS WHO REALLY DO THE RUNNING..
ALL I KNOW IS, RUNNING IS HARD ON THE BACK... BACKS SHOULD BE HOME IN BED..
HOW ABOUT NOSES? I HATE JOKES ABOUT RUNNING NOSES!
LIPS ARE MADE FOR KISSING, NOT RUNNING...WE NEED MORE KISSING...
I'M HUNGRY!
HA! I KNEW THE STOMACH WOULD START COMPLAINING PRETTY SOON! WE ARMS NEVER COMPLAIN
THAT'S A LAUGH! IF IT ISN'T BURSITIS, IT'S TENNIS ELBOW! WE STILL SAY IT'S WE FEET WHO DO ALL THE WORK...
YOU THINK IT'S EASY BEING A FINGER?
HA! JUST TRY BEING AN ELBOW SOMETIME!
HOW CAN THE LONG-DISTANCE RUNNER EVER GET LONELY?

Chapter 8 – Motoric Learning

1. Introduction
2. Optimisation of the Motoric Movement Action
3. Motoric learning within the explanatory model versus the current daily practice

In this chapter I will focus on motoric learning. Motoric learning doesn't add anything substantive to the Motoric Movement Action and therefor shouldn't be in this book. I will however discuss it for a number of reasons.
First of all the Motoric Movement Action is the central theme within motoric learning. How we learn motorically is a central part of our existence. Within the world of science it occupies a substantial place. It forms a link in a lot of disciplines in which there is still a lot of unclarity and no uniform language. The explanatory model of the Motoric Movement Action will change that drastically. That is why it is important to translate the model towards motoric learning processes properly.
Besides that it gives me the opportunity to review the essences of the Motoric Movement Action once more but now from the perspective of how the Motoric Movement Action needs to be transferred in lessons in the most effective and efficient way. The explanatory model provides the most optimal motoric learning model automatically.
The last reason is the fact that I will always remain to be a teacher. I had to write these books because it crossed my path but they were not my goals in life. I will never become a writer. It is my ultimate goal to teach motoric skills in the best way possible.

If you Google the words *motoric learning* or *motoric skill learning* than you find a lot of information about the phases a pupil must pass will he be able to perform a certain motoric skill. Besides that you will be offered some information about scientific research that answers the question how optimisation within the motoric learning process can be achieved. Still the amounts of information being offered suggests that in motoric learning processes we mainly look at the side of the pupil out of the idea that the study material is perfect or almost perfect. The description of the demands for the motoric learning process out of the explanatory model of the Motoric Movement Action however doesn't emphasize the role of the students at all. The motoric learning processes related to the explanatory model rather wants to emphasize the role of the teacher and leave the students out of it. Future teachers will have to take care of an actual, steady progressing, motoric learning process. With my books all the secrets concerning the Motoric Movement Action are revealed and in this chapter you find a full and complete list of what you have to develop. So if a teacher presents his specific expertise according to these demands a pupil will learn *automatically*. There is no other possibility. A teacher is only forced to do a lot more than he did before. I estimate that the work load for tennis teachers will at least be doubled or tripled. A tennis teacher was able to hide behind a bit hazy, arty depiction of the task in tennis for a long time. He could fool around, even in a malicious way, and was still able to point at the student. *The player is lazy* or *he doesn't have "the gift".* That will never be possible again. From now on tennis teachers will have to work really very, very hard. The explanatory model of the Motoric Movement Action releases tennis from the artistic label. The model shows that teaching tennis is just a plain craft in which a teacher has to control a lot in an artisanal way. So if you Google *motoric learning* or *motoric skill learning* in the near future I hope you will receive a lot of information about the phases a teacher will have to pass to take care of the fact that actual motoric learning processes will be reinforced.

Of course teachers must be able to give proper feedback, motivate etc. as well. But mainly they will have to comply with the demands of the explanatory model of the Motoric Movement Action. Teachers with the best intentions towards students but who only want to tell their own story are useless. The fact that they are of good will doesn't make them a good teacher. That is just a prerequisite in teaching. From now on a teacher is forced to produce students who have the right notion of the Motoric Movement Action.

1. Introduction

The explanatory model of the Motoric Movement Action is crystal clear about fulfilling one task. With movements we are able to control we need to move an (movement) action object, our body or a body part which we do not control. The Motoric Movement Action contains the word movement twice. It is the combination of the motoric movement (MM) and the movement action (MA). The first is about the movements we are able to control. The movements of the (movement) action object we are not able to control. The movements of this (movement) action object only belong to that object and so they don't belong to us. That sounds very odd but that is the way our perception processes behold this all.

The two different movements are the only two parts of the Motoric Movement Action and they need each other to achieve one successful task. However they are and will remain two completely separated phenomena. Therefor the motoric movement (MM) is glued inextricably to the movement action (MA) but completely on the outside. In a formula this can be visualized as MMA = MM x (MA). The formula clearly shows that connection and also that the movement action (MA) is the leading factor within the Motoric Movement Action.
Within the execution of one task the motoric movement (MM) hosts many movement trajectories while only one action trajectory within the movement action (MA) will become manifest.

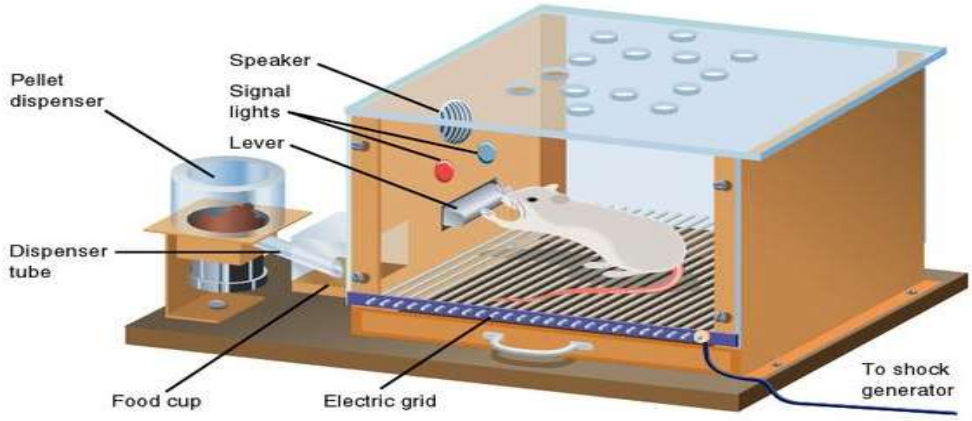


Image: Test setup *Skinner-box*

The formula also shows clearly that within one Motoric Movement Action one form of an action trajectory and one form of a movement model is needed. Otherwise humans and primates are not capable of doing anything. I remember one time that I had a huge conflict with my mechanical key card belonging to my hotel room door. That happened approximately twenty years ago. You had to open the door in a certain way and I wasn't able to do it. I was fighting with the lock for at least fifteen minutes creating hilarity among the bystanders. That is why I remember the moment so well. Fortunately the digital locks nowadays are much simpler. For clarification I was able to put the card into the lock. That was a simple Motoric Movement Action. But then you had to move the door handle in a certain way

after the *clicking* sound of the card insertion. Till this day I have no clue about the action trajectory involved in there. The movement trajectories wouldn't have been the limiting factor.

The hotel door finally opened just as the consequence of a process of *trial and error.* And that is also how it works with animals. Skinner proved that animals are able to learn motoric skills by conditioning. It takes a while but after a period of trial and error an animal cognitively knows which action trajectory leads to a reward and which action trajectory leads to punishment. Even complicated tasks in which several action trajectories need to be linked (scripts) can be learned in that way. When a test animal will receive punishment because he exceeds a certain time frame while executing a Motoric Movement Action then this animal is able to learn to create the shortest action trajectory in the shortest time. The time frame involved is then the expression of how efficient and effective the movement trajectories (technique) are executed.

Chimpanzees[78] already know the action trajectory cognitively when they want to obtain fruits high up in a tree or honey in a tree stump. As well as they know that the normal Motoric Movement Action *grabbing/taking/touching* can't be executed out of a normal position with just the arm. The arm (the index finger) is respectively too short or too broad. In the situation where honey is involved one needs to look for a (motoric) movement object which is able to execute the specific action trajectory to the honey. Ergo is so long and small that it fits into the hole and is able to bridge the gap to the honey. In the situation of the fruits high up in the tree one is able to find a solution in either lengthening the arm with a long stick or in bringing the whole body closer to the fruits with a ladder (tree trunk, crate etc.). So the solution in this last task can be found in two really different Motoric Movement Actions.
The usage of a stick requires understanding of a completely different action trajectory and completely different movement trajectories from another movement model. The action trajectory of the stick is from the end of the stick towards the hanging fruits. The complexity of the movement trajectories increases with a factor because of the usage of the (motoric) movement object which can be manipulated freely. With a ladder the whole body is moved as a part of the Motoric Movement Action *moving A-B*[79] and the *normal* Motoric Movement Action *grabbing/taking/touching* is executed. The bridging of the horizontal *nothing* which is characteristic for a lot of Motoric Movement Actions is now complemented with an extra special action trajectory in the form of a ladder which bridges the *nothing* vertically.

This is what humans do as well. We decide to reach for that high stored sauce pan with the soup ladle or we use a kitchen ladder. Two completely different solutions to fulfil one task. In which two different action trajectories and two different movement models are involved. We choose out of the cognitive basis, out of all the possibilities known to us, that option which is most suitable to us out of the tactical *grabbing/taking* action. The tactics involved will then choose one of all the possible action trajectories and will exclude all others during the actual *grabbing/taking* action.

[78] http://biolinguistic.yolasite.com/ape-primitive-man-and-child.php
[79] See chapter 4.3

So if one wants to be as creative as possible a person needs to possess many options for action trajectories. Along with this fact it is essential that one obtains insights of the fluctuations of the success rates within one action trajectory. If one learns to pour liquids at varying distances than one should also learn cognitively how much of the liquid will be wasted. In the very unlikely case that one has to pour gasoline from a distance, because we also forgot the funnel, into a car at a remote place under windy conditions then one is able to make an estimation of how much gasoline will finally fulfil the task. The Motoric Movement Action *throwing* under which the Motoric Movement Action *pouring* resides is typically an example of an action where the success rate can be influenced easily. That is why we throw (letter posting, pouring) from such distances that the success rate is high.

These examples show that we cognitively need to know at least one action trajectory and one movement model. When more options occur we choose the most efficient and effective one. It also enables us to combine options. Rational processes in primates make that possible. Therefor it is important to possess a huge reservoir of action trajectories. Especially in sports like tennis, chess, sailing etc.. So in rowing matches one doesn't need it that much. The simple straight action trajectory in there can in no way be compared with most ball sports or board game sports. Still I don't exclude that some cognitive knowledge must be obtained in rowing concerning the action trajectory. With strong winds the boat maybe has to make a certain angle relative to the wind and the water. It is also possible that the inclination angle of the boat (*planing*) as a whole effects the Motoric Movement Action *rowing*. Because if one transfers within the water sports from rowing to sailing the action trajectories are seemingly simple as well. Close hauled sailing is familiar with simple *straight* zig zag action trajectories and running downwind hosts just one *straight* action trajectory. These simple action trajectories however don't mean that a sailor, just like a rower, doesn't have to know a lot about the action trajectories involved. The contrary is true. The cognitive basis in sailing must be as huge as the cognitive basis in chess, tennis or soccer. The weather conditions, the environment, the opponents etc. provide a very complex matrix of latent action trajectories in sailing.

Image: A chimpanzee combines a ladder *and* a stick. In that same way we are capable of reaching the high stored sauce pan with a soup ladle *and* a kitchen ladder.

So as a minimum we need at least one action trajectory and one movement model to execute one Motoric Movement Action. And we need as many action trajectories and movement models if we want to be creative as maximal as possible. So in tennis a player needs to possess a lot of cognitive knowledge about ball trajectories. The action trajectories in tennis. Besides that it would be fantastic if you could execute all these action trajectories with lots of different techniques. It would be very nice if within one stroke, for example the forehand, you were able to hit it with all kinds of grips or if you would be able to hit a forehand with the right and with the left arm. Like some professional soccer players are capable to shoot evenly with both legs. Unfortunately for mere mortals that is only possible in a very limited way. One is able to gain almost all knowledge about ball trajectories but in technique models

humans find their limitations in relation to the execution of a Motoric Movement Action. That is why we have to choose for the most superior technique model. I will come back to that point later.

We don't learn to hoola hoop[80]. There are no hoola hoop schools. You will have very little chance of getting good instruction[81] if your parents are circus artists or if you visit a circus school. Because the instruction probably will not comply to the demands of the explanatory model of the Motoric Movement Action. You have a greater chance of being wrong footed with information which will do you more harm than good. The way of trial and error which we all just follow at the schoolyard will probably have the highest success rate. Of course that success rate will be influenced by talent but it would mainly depend on coincidence.
According to the explanatory model of the Motoric Movement Action optimal hoola hoop instruction would have to focus on five key areas.

1. *The learning of the action trajectory within the context of the movement action (MA). Hoola hooping just requires a simple action trajectory. But also in here a cognitive basis must be created which the tactical movement action must be able to use as a blueprint. If one wants to hoola hoop at any location, with any hoop, under all weather conditions and with all body parts then one needs to know a lot about the fluctuations within all those aspects. The tactical movement action will then assess all this abstract information to the actual conditions where one is supposed to hoola hoop.*
2. *The learning of the most superior hoola hoop movement (technique) model in which the relevant movement trajectories and their mutual relationships are explained. The learning of other technique models might be useful. It could be a part of a learning progression and besides that the models could work as references for each other. The superior model will get more embedded in that way and the cognitive basis of abstractions will be enlarged which will make it possible that a performer will be able to improvise maximally when environment factors change.*

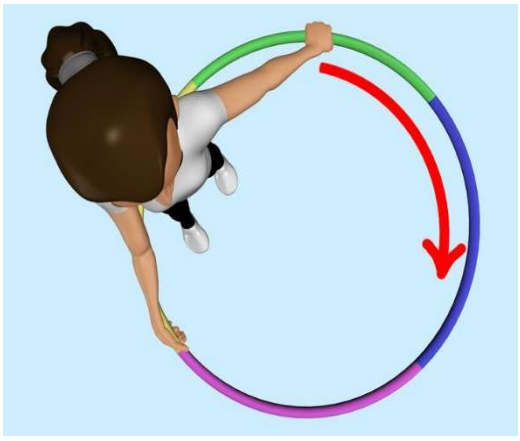


Image: The action trajectory

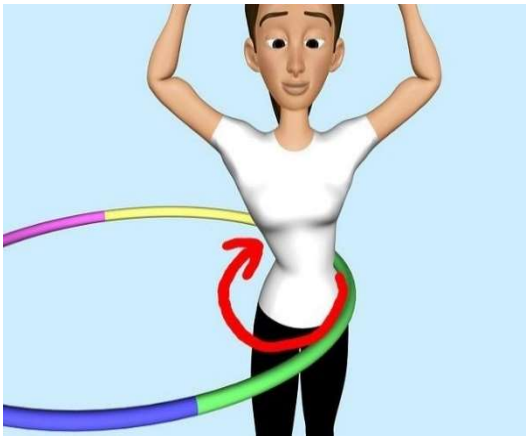


Image: The movement trajectory

3. *To learn everything about the focus involved. The primary focus must be pointed at the action trajectory. The secondary focus must be pointed on the transition point of the movement trajectories towards the action trajectory. The transition point is situated in all points where the hoop touches the body. These two foci have to be executed at the same time. So a student has to develop one total focus image which combines these two foci.*

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[80] The Motoric Movement Action *hoola hooping* follows the Motoric Movement Actions *gymnastics* and *free diving*. The execution of the action trajectory is the whole task. I am not aware of hoola hoop matches where the quality of the movement trajectories are judged as well.
[81] https://www.youtube.com/watch?v=JXObsv_ubJI ; Are you able to discover the instruction about the action trajectory, the movement trajectories, the biomechanical main action, the focus etc. in this video clip?

4. *The special fitness you need for hoola hooping. I can't add anything new in here.*
5. *The last phase in motoric learning is concerned about the fact that the general rational information must be executed by one unique (subjective) body. In this phase one must already be able to hoola hoop but one is unaware of the fact how efficient or effective the Motoric Movement Action is executed. In case of mediocre hooping a maximum might be reached already and conversely what already looks very good could maybe be executed much and much better. The ratio has to know a lot but only the unique body is able to execute it. And every body constellation of every subject is different. So in this phase one has to give the body the opportunity to let it find the most optimal way. The ratio and the body are both independent entities*[82]*. Teachers but especially students need to respect this non-rational process. Besides that teachers need to intensively look for exercises to guide this process actively. They could start with students hoola hooping and let them turn at the same time or let them move otherwise in a room. I will not mention other examples. That is up to hoola hoop experts.*

2. Optimisation of the Motoric Movement Action

So with a known action trajectory and a movement model we are able to execute a Motoric Movement Action. But that doesn't say anything about the efficiency or the effectiveness of that Motoric Movement Action. In most common daily Motoric Movement Actions we don't really care. In a letter posting task, in switching on the light or tying shoe laces we never question if we do it effectively. Most of the time we learn one way to do it and we sustain that all our lives. If it complies with the demands of the task and if we are able to execute it easily then we think it is fine as well. That is very logical.

"Skilled performance is characterized by high levels of movement effectiveness and efficiency (e.g., Guthrie, 1952). That is, a high skill level is associated with accuracy, consistency, and reliability in achieving the movement goal (i.e., effectiveness), as well as fluent and economical movement executions and automaticity, as evidenced by the investment of relatively little physical and mental effort (i.e., efficiency)."[83]

Of course within sports that is a whole different story. Questions about efficiency or the effectiveness are being posed continuously. A fraction of profit towards the efficiency or the effectiveness will provide a fraction of profit in the execution of the whole Motoric Movement Action.
In this paragraph I will appoint the demands for motoric learning as if we were desiring to execute all Motoric Movement Actions like it was top-class sport.

The explanatory model of the Motoric Movement Action clearly shows how the execution of a Motoric Movement Action has to be optimised. To reach that goal all parts, all complex (sub-)systems, of the Motoric Movement Action need to be optimised. The formulas of the Motoric Movement Action show these parts clearly. MMA = MM x (MA) and MM = (IC) x (BP) x (BM).

Five key areas can be appointed:
a. The movement action (MA)
b. The motoric movement (MM)
c. The focus.
d. The body processes (BP) or the fitness (CO).
e. The individual conditions (IC).

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[82] *Snoopy*
[83] Wulf, G.; Attentional focus and motor learning: a review of 15 year

a. The movement action (MA)

The primary goal in lessons is to explain the total model of the specific Motoric Movement Action. Besides this general explanation the movement action (MA) should be explained thoroughly. It must become clear that out of the cognitive basis and the tactical movement action a player needs to come to a perceptual perception of one latent action trajectory and how that action trajectory has to be executed during the actual movement action. The essence of the movement action (MA) is the action trajectory. Students must be able to visualize out of the right perspective how the body, a body part or an (movement) action object fulfils the task in a Motoric Movement Action. Out of *top-down* perception processes a student needs to learn how to visualize a precise picture of the global shape of an action trajectory and to actually adjust this precise global perception out of *bottom-up* perception processes. A student needs to possess a lot of cognitive knowledge about action trajectories. Important facts like inflexion points, intersection points etc. needs to be known. Besides very concrete information it is important to provide as much abstracted information as possible. This must open the opportunity that a student will be able to improvise maximally when things change in the last moment.
If it is possible students need to learn a range of action trajectory shapes. Even if one action trajectory is clearly superior. The action trajectories will function then as a reference for each other. It widens the cognitive basis and the superior action trajectory is embedded better in the whole field of possibilities. And besides that as a teacher you never know which sublime steps a student is going to make with the seemingly inferior action trajectories[84]. In this process it is more efficient to offer reference action trajectories which can be used independently as well. But sometimes you cannot escape the fact that a learning progression contains action trajectories which can't be used in the actual Motoric Movement Action.

In comparison to the motoric movement (MM) a student will be able to learn everything about the movement action (MA). It can never be the limiting factor. In chess, soccer, tennis, sailing etc. not all latent action trajectories can be mastered cognitively but a player is able to proceed a long way if he masters all knowledge in *reference* action trajectories.

Teachers will now have the task to master multitudes of knowledge above the knowledge of a student. Besides the fact that they should know all action trajectories in all game situations at several levels they also must be able to transfer this knowledge from universal, to player specific to opponent specific. And in doing so they have the lifelong task to look for those learning progressions which will transfer the cognitive knowledge in the fastest way.

b. The motoric movement (MM)

The primary goal in lessons is to explain the total model of the specific Motoric Movement Action. Besides this general explanation the motoric movement (MM) should be explained thoroughly. A student needs to know that the technique in broad sense is everything what doesn't belong to the movement action (MA) and that technique in the strict sense stands for the body movements (BM). Those body movements (BM) are the subject of this section. A student needs to know that many movement trajectories as part of the unity model contribute to the motoric movement (MM). The essence of the unity model is situated in the fact that the Motoric Movement Action let the motoric movement (MM) work, as one complete unit, towards that one action trajectory of the movement action (MA). That one action trajectory demands the leading role continuously. So it is logical to pull *the happening* of the motoric movement (MM) towards the movement action (MA) and to appoint it also as one complete event. The name unity model is derived from this idea but also because the whole body needs to become one whole in every Motoric Movement Action if we want to be able to repeat the technique, the technique model or the movement model. This thought can also be maintained in all our daily actions.

[84] See for example "Watch The Ball Trajectory!" chapter 10.4.c – The banana shot of Rafael Nadal

When we post a letter, make a sandwich, switch the light on etc. we let the body become to the exact same unit over and over again and we probably will continue to do that all of our lives.

If one task of one Motoric Movement Action can be fulfilled with only one set constellation of movement trajectories then there is only one technique, technique model or movement model. If we are able to determine more set constellations within one Motoric Movement Action in which the body functions as one unit we are able to speak about more technique models. If we want to optimise the motoric movement (MM) the student needs to learn the most superior model. Superior models provide superior results. When models are comparable a teacher needs to investigate thoroughly which model will suit a specific player best. In for example tennis the one and two handed backhand are still considered comparable techniques.
Although at first, like with the movement action (MA), one is able to teach a lot of things implicitly in the long term one cannot avoid to teach explicit knowledge about the technique models. Especially in the education of elite players. The student and the body of the student will absorb it naturally as information that belongs to the Motoric Movement Action. The truth will never withhold a body of the student from flow.

Coaches need to know everything about technique models. They need to have knowledge about the evolution process of the technique models and must be able to appoint the transitions of all the phases in there clearly. They need to stay open towards developments because unlike the movement action (MA) the evolution of the motoric movement (MM) will never be finished. The body/mankind will always find new adaptations. There will always show up somebody who turns the straddle technique into a Fosbury flop like in the high jump.

Images: The high jump; Straddle technique (left) and the Fosbury flop (right)

His whole career a coach will have to find inspiration concerning the evolution of technique models in 1. science, 2. elite players and 3. the tendencies of the bodies of their own players. They need to develop a sense for when a new technique is knocking at the door and not to suppress it. I have seen beginner adults and children with tendencies of strokes from Nadal and Federer. The next year those tendencies were gone completely and were replaced with model strokes. So first of all coaches need to open up to the fact that there might be more technique models[85] and secondly that it is an evolutionary process. I think that the major part of the coaches will struggle enormously with these demands. A top coach will have to develop a more scientific, a more objectivised attitude.

c. The focus

[85] Within tennis all strokes are still considered to be one and undivided.

The explanatory model of the Motoric Movement Action is very clear about the focus[86]. A student needs to learn to primarily focus on the action trajectory because this line is fulfilling the task of the Motoric Movement Action. Besides this primary focus a second one is needed. A student needs to learn to point the secondary focus on the biomechanical main action of the motoric movement (MM) towards the transition point of the action trajectory. In that way the essence of the motoric movement (MM) will be linked to the essence of the movement action (MA) also in relationship to the focus.
It is possible to train them separately but when the whole Motoric Movement Action must be executed they can't stay separated. Because they must be executed at the same time and for mere mortals it is not possible to really visualize two complete separate images. A student needs to learn to combine the separate foci to one image. The focus image. This is clearly a complex image which must be trained thoroughly. Focus has a set link with consistency. Consistency in for example the tennis service becomes possible if one just simply reproduces the image of the moment of contact in a good service. The moment one hits the ball one is able to create a static, still image of the arm and racket constellation. This one image is very important but it is not enough. Students have to visualize that arm and racket constellation out of the whole biomechanical main action of the motoric movement (MM) and the ball must be viewed upon as a part of the Initial Phase of the ball trajectory. A latent ball trajectory which the perceptual perception already constructed and reduced to an initial beginning from where the whole ball trajectory will appear *automatically*. So for consistency in the service both foci are needed.
The distinction in primary focus and secondary focus becomes clear when a sudden gust of wind changes the position of the outgoing ball trajectory of the service drastically. The first and most important thing to do then is to adjust the shape of the Initial Phase from the new contact point. The action trajectory fulfils the task and not the biomechanical main action.

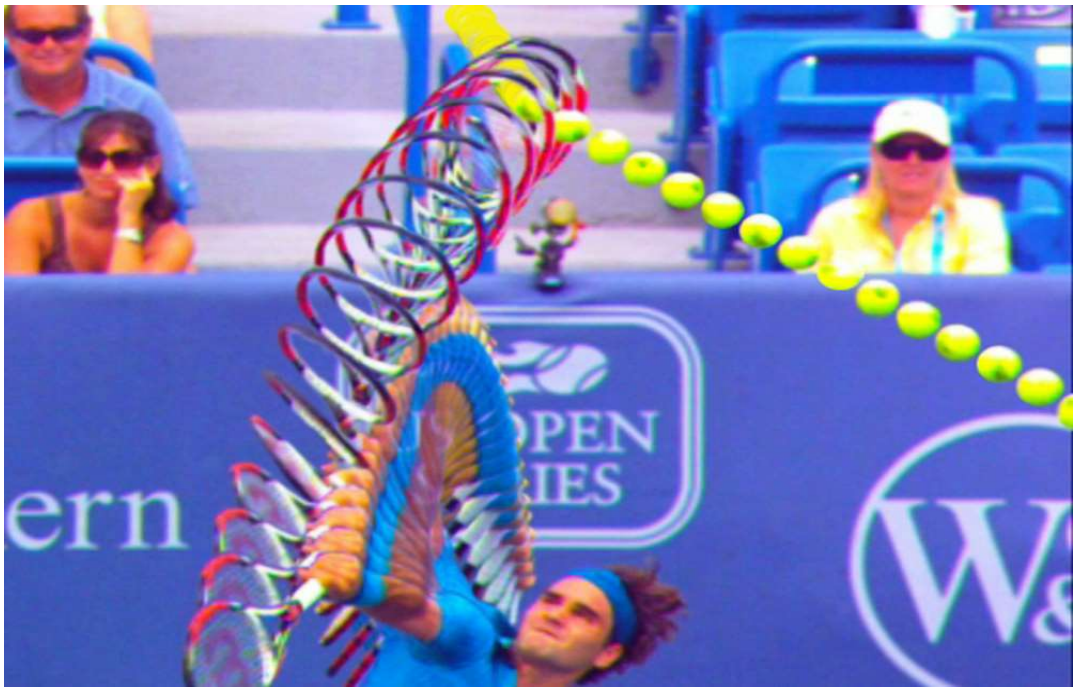

Image: Roger Federer is executing the Motoric Movement Action *serving*. The task is to create a *service* ball trajectory. The ball trajectory can only be executed by the ball. The motoric movement (MM) is only capable to activate movement trajectories which will hit the ball, during the transition point (TP), into the Initial Phase of its action trajectory. Perception processes are actively guiding the two actions. The visual perception is mainly occupied with future and actual positions P of the ball. The proprioceptive perception is mainly occupied with future and actual positions of the *sweetspot* of the racket head during the motoric movement (MM). In more complex motoric movements (MM) the latter will have to focus on the biomechanical main action in relationship to the transition point.

[86] See chapter 1.6

The current state of scientific research concerning focus is still a long way from the explanatory model. It is still observing one focus. Although it already unanimously reached the phase that an external focus is much more effective/efficient than an internal one[87]. In retrospect we are able to see now that the one focus as compared to the primary focus of the Motoric Movement Action stayed to close to the body. Research concerning focus has never appointed something that came close to an action trajectory. When we compare that one focus with the secondary focus of the Motoric Movement Action one is able to determine that it went too far from the body.

d. The body processes (BP)

Of course students need a specific fitness in the execution of specific Motoric Movement Actions. A specific condition (CO) of the body. Especially when a Motoric Movement Action has to be executed continuously and for a long time. A Motoric Movement Action will be optimised if parts of the body processes (BP) as a complex (sub-)system will be optimised. I will not discuss this substantively because I don't have to add something to it. The current state of scientific research seems to fulfil its task in relation to the explanatory model of the Motoric Movement Action.

e. The individual conditions (IC)

The last phase in the motoric learning process is much different than all previous phases. Unlike the first three phases in which knowledge is mainly transferred rationally this last phase is characterized by a fully irrational process. Motoric Movement Actions can be explained rationally but every body is unique with unique movement trajectories. And that exact same body is the sole executioner of the Motoric Movement Action. That is why the motoric learning process has to spend time and energy to that *subjective* translation process. The Motoric Movement Action must become one with the body. A coach needs to abide that process but especially the student needs to. The player must be convinced that his body, independent of any will or ratio, structures and supports as an independent entity. I will not discuss this in detail but I would like to mention three examples of this structuring process.

1. Most of you are familiar with strength training and the term super compensation. Strength training is provoking the body to produce more muscle mass in order to fulfil the same tasks more easily the next time. That is called compensation. If one chooses a certain optimum in the recovery phase to train again than the production of muscle mass is enlarged. That is called super compensation It is an obvious example of the body thinking along independently in optimising the task. The athlete doesn't have to make a conscious effort to help in these processes. The athlete only needs to give room to his body to fulfil that task. He needs to rest and eat good proteins. The body does the rest.

2. One of the first research papers I read concerning this phenomenon and which intrigued me heavily was *Sleep and the Time Course of Motor Skill Learning* by M. Walker et al..

   "Growing evidence suggests that sleep plays an important role in the process of procedural learning. Most recently, sleep has been implicated in the continued development of motor-skill learning following initial acquisition. However, the temporal evolution of motor learning before and after sleep, the effects of different training regimens, and the long-term development of motor learning across multiple nights of sleep remain unknown. Here, we report data for subjects trained and retested on a sequential finger-tapping task across multiple days. The findings demonstrate firstly

[87] Wulf, G.; Attentional focus and motor learning: a review of 15 year

that following initial training, small practice-dependent improvements are possible before, but not following the large practice-independent gains that develop across a night of sleep. Secondly, doubling the quantity of initial training does not alter the amount of subsequent sleep-dependent learning that develops overnight. Thirdly, the amount of sleep-dependent learning does not correlate with the amount of practice-dependent learning achieved during training, suggesting the existence of two discrete motor-learning processes. Finally, whereas the majority of sleep-dependent motor-skill learning develops during the first night of sleep following training, additional nights of sleep still offer continued improvements."[88]

The research shows significant differences in effectivity of motoric learning after breaks with and without sleep. At the time I read this it really struck me. I thought it was a highly remarkable outcome. Motoric learning by doing nothing. The research sadly didn't come up with a conclusive scientific explanation.
My proposition about the technique (Motoric Movement) as a complex system with its many movement trajectories could form a part of that explanation. All new movement trajectories of a new technique must form complex relationships with all other movement trajectories. Whether new or old. The body has to combine it to one whole again. Like in the super compensation the body has a large independent role in this task. Why especially sleep is contributing more to this process is something I can't answer. However it shows me that a player doesn't need to have a rational willingness to achieve more effective movements.

3. As the last example I would like to mention the research papers of the German professor Wolfgang Schöllhorn. Schöllhorn is the advocate of what he calls differential learning. In exercises athletes must not try to reduce their variations in their movements until a sort of optimum is reached. Repetition exercises and technique training hold on strongly to this adage. Schöllhorn assumes that our locomotion system will learn by doing just the opposite of technique training and repetition exercises. He gives assignments to athletes to make all kinds of funny/strange moves before they actually perform their *real* technique. Schöllhorn leaves the original action trajectory unharmed. He just reinforces real different Motoric Movements. Within the current culture of sports this would be seen as extremely weird. But the results are remarkable positive. His view is supported by several sports scientists.

   "For numerous skills, it has been shown that many repetitions are needed in order to achieve perfection. For instance, the classic Crossman learning study (1959) of cigar-making indicated that even after 1 million repetitions of this skill, improvement was still possible, that is, a quicker time could be achieved. The common idea of learning is to repeat a particular movement as much as possible, accompanied with feedback from an expert. The desired outcome is based on an ideal movement pattern."

   "The Russian neuroscientist Bernstein (1967) noted that consecutive movements never repeat themselves exactly. He made cyclograms of rhythmic movements of an experienced smith who used his hammer on a stationary photographic plate. Bernstein discovered that every movement repetition was slightly different from the next. In other words, even in a relatively simple task such as hammering, the movements produced were never exactly the same (Bernstein, 1967). In sport, most tasks are complex with coaches and athletes repeating the desired movements a number of times in practice in order to improve the performance outcome. Ericsson (2005) described this as follows: "The crucial factor leading to continued improvement and attainment of expert performance is the engagement in special practice activities that allow performers to improve specific aspects of their performance with problem solving and through repetitions with feedback" (Ericsson, 2005, p 237). Underlying this definition is the assumption that there is an ideal way of performing a skill that applies to everybody. Second, any deviation from the required ideal performance is considered as an error (Schöllhorn et al., 2006).

[88] http://www.ncbi.nlm.nih.gov/pmc/articles/PMC202318/

Inspired by Bernstein's hammering example, Schöllhorn investigated whether elite athletes could produce precisely the same movement twice. He studied two elite discus throwers and concluded that during a one-year period, the athletes did not produce the same throw twice (Schöllhorn, 2000), revealing highly individual characteristics of movement (Schöllhorn & Bauer, 1998; Schöllhorn, Nigg, Stefanyshyn, & Liu, 2002). For instance, Schöllhorn and Bauer (1998) were able to identify individual throwing patterns in world class javelin throwers, even across several years of championship experience. Evidence for a larger variability of international throwing patterns in comparison to national throwing techniques led him to question the idea of a person independent ideal technique."

"Therefore, it is not logical to believe in one optimal motor pattern to which all learners should aspire. Based on these findings, Schöllhorn (1999) suggested a learning theory that opposes the repetition of movement based on an ideal movement pattern: differencial learning. Differencial learning utilizes the fluctuations in human motor behaviour to induce a self-organising process to the learner that takes advantage of individual movement and learning characteristics. Therefore, during the acquisition phase, the learner is confronted with a variety of exercises that extend the whole range of possible solutions for a specific task. In other words, an athlete should practice a particular skill in many different ways, and as a result, s/he will discover an individually specific optimal way for her/him to perform the particular skill."[89]

Wolfgang Schöllhorn's research completely corresponds with the *subjective* phase the explanatory model suggests. I will not go into detail any further. Motoric learning is just a side line of this book. Although I want to make two remarks.
The first remark is about Schöllhorn's *arranging process.* This process obviously will not be able to replace the four other crucial phases mentioned in this chapter. There is no room for or/or but it must be and/and. At the work floor you sometimes hear that differential learning can cause all the motoric learning. That will never work. If you would only emphasize the subjective phase it would really take a long time before you created for example a pro tennis player. If you look at effectiveness the other phases are contributing the highest percentages. However Schöllhorn's findings are crucial to optimise the effectivity of the subjective phase.
The second remark is about the fact that Schöllhorn never changes the action trajectories. He doesn't vary with the line of the task action. It is remarkable because other research consciously aims at changing these action trajectories. So nowadays at the tennis court you can see players serve from the most bizarre places. The goal is to guide the body in a *constraints led* way. Because this book reveals the essential differences between these two forms for the first time new scientific research has to appoint how they relate towards each other and how they relate towards *The Inner System*. Till now I don't have any thoughts about this.

3. Motoric learning within the explanatory model versus the current daily practice

In this chapter the demands towards motoric learning processes within the explanatory model of the Motoric Movement Action are appointed in a finalized and clear way. The model doesn't leave any loose ends in here as well. The formulas and descriptions of the complex (sub-)systems cover and contain all possibilities. There is nothing left to appoint within motoric learning.

[89] A new method to learn to start in speed skating: A differencial learning approach; G. Savelsbergh, W. Kamper, J. Rabius, J. de Koning and W. Schöllhorn; https://www.researchgate.net/publication/279544507_A_new_method_to_learn_to_start_in_speed_skating_A_differencial_learning_approach

It shows huge gaps with the current teaching practice. It would take much less time to appoint the similarities than to appoint the differences. The only similarity concerns the phase of the body processes (BP). In all other categories the current daily practice is situated very far from the explanatory model. So it is rather useless to address it extensively. You can take the aforementioned demands of the explanatory model and place them over your, former, teaching practice and notice the many and very obvious differences.

Now it becomes clear that we are able to determine in retrospect that the students were never the limiting factor. Because the Motoric Movement Action wasn't appointed yet one is able to see now that all teachers in the field of motoric learning, including me, actually didn't really know what they were doing. We did some small things right but the majority was wrong. I even dare to state that many teachers kept students from actual motoric learning.
Of course we cannot blame anyone for that because it wasn't that easy to find the right model. But in retrospect we can say that it wasn't good then and that we complained about students falsely. We did think that hitting towards each other in tennis was a simple and easy linear process. We were convinced that students just had to execute it without complaining a lot or having serious problems with it. Now it becomes clear that it is a very complex process. It wasn't something what you could learn in a couple of minutes. Teachers didn't realize that it took them several years to control it. That possibly they were talented. And how many things and what things were developed in that process.

Now with the explanatory model one is able to create an optimal learning environment. Even better if the motoric learning process complies with all aforementioned demands than flow will occur automatically. That is also the engagement of this chapter. Not the student is responsible for flow but the teacher is. From now on this will be motto in motoric learning processes. And teachers will really have to come along. A doctor can be very well respected now but the moment that cancer can be healed with method A and he persists in method B he becomes a quack. That doesn't mean that we have to condemn the naive cancer research of the early years. That research made the circle of increasing insights possible. We are only able to convict people who persevere in proven incorrect methods.

Appendix A – The Motoric Movement Action *walking* and *running*

1. The Motoric Movement Action *walking* and *running*
2. The movement action (MA) of the Motoric Movement Action *walking* and *running*
3. The motoric movement (MM) of the Motoric Movement Action *walking* and *running*
4. The manifestations of the Motoric Movement Action *running*
5. The matrix and the Motoric Movement Action *walking* and *running*
6. Foot racing

In this appendix I will address the Motoric Movement Action *walking* and *running* because it is an essential part of many Motoric Movement Actions and occurs a lot as an independent Motoric Movement Action.

1. The Motoric Movement Action *walking* and *running*

The task within the independent Motoric *Walking* Action cannot be described in a uniform way. It depends on the original goal which was formulated out of an egocentric will.
Within foot racing it is easy. You finish when any point of the upper torso touches the first outer part of a imaginary vertical extended finish line. That point of the torso that touches the finish line will then become the transition point within the Motoric Movement Action *touching/grabbing/taking.* That particular point is then following the same Motoric Movement Action in which we have just have to *touch* the outside of a light switch with the small outside area of the index finger. The difference between these two Motoric Movement Actions however is the fact that we experience the touching of a light switch out of the action trajectory out of the perspective of the index finger and we don't do that in foot racing. The latter follows mainly the Motoric Movement Action *moving A-B*. In that task we know cognitively that the (movement) action object will come along automatically. In there the transition point out of the torso will only become evident if we approach the finish line.

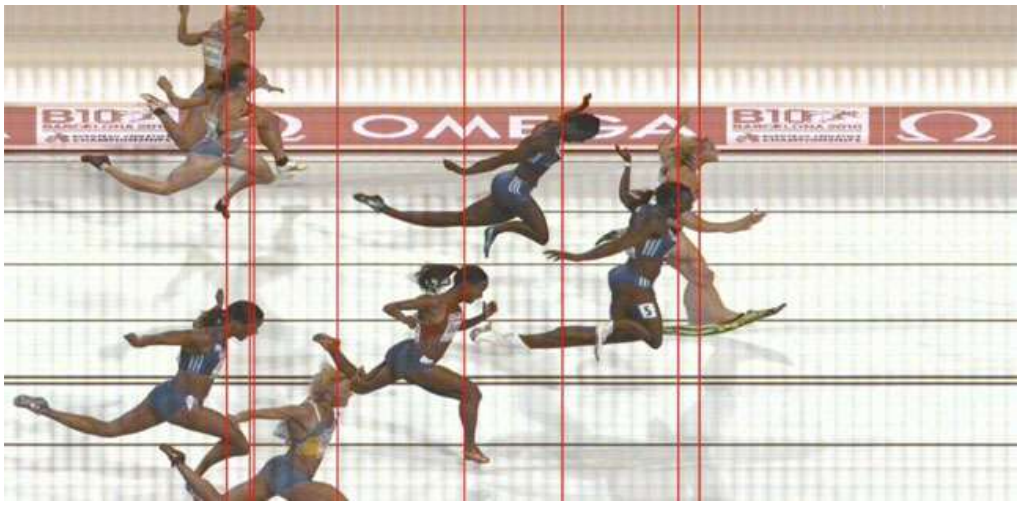

Image: An image of a photo finish camera. You finish when any point of the upper torso touches the outside of the imaginary vertical extended finish line.

In other Motoric *Walking* Actions it is harder to describe. It depends on what your answer is to the question why you want to go from A to B. If you go somewhere to teach then you mainly go to B to pass your *being*. If you are an extra in a movie then your silhouette is required in B. If you are a scout then mainly your eyes are wanted in B. So there is always a task and an (movement) action object but it is not always very clear. What becomes clear though is that the action trajectory remains to have no relations with the movement trajectories.
In case of the more vague tasks one can pose the question what can be meant with the transitioning of the *being* and where the transition point is situated then of that *being*. Within teaching one could imagine that the (movement) action object is my mouth because with that object I am going to explain things in B with the Motoric Movement Action *talking*. You can summon all kinds of philosophical images in there. More important however is to understand, that no matter what (movement) action object is involved in creating the action trajectory, that all other latent (movement) action objects come along with that same body. So for a teacher the presence of a body of a student can be wanted badly in a class room but he would rather have preferred it that the talking mouth or the tapping foot of that student were still at home.

In anticipation to the motoric movement (MM) I want to remark in here that we don't visualize an action trajectory out of the legs. Instinctively we situate an action trajectory higher in the body.

The Motoric *Walking* Action as a part of other Motoric Movement Actions can be appointed more easily. If we walk towards a mail box or if we make a sprint towards a tennis ball then at a micro level it is part of the Motoric Movement Action *moving A-B*. With the walking/running action the whole body is transferred in which the letter/racket comes along automatically.

2. The movement action (MA) of the Motoric Movement Action *walking* and *running*

Also in here the *walking* action hosts a cognitive basis, a tactical movement action and an actual movement action. The actual *walking* action follows the actual movement action of all Motoric Movement Actions *moving A-B*.
In walking we use general cognitive knowledge which we stored concerning this walking. We own a lot of that information. From approximately the last part of our first year in life we are training our *walking* operating system. People with a lot of walking experience own a lot of reference action trajectories. They have a lot of knowledge about inertia, shapes of inflexion points, timing etc.. If we are running with a certain speed we know that it takes a certain time to slow down. If we walk slowly forwards we are not able to walk backwards at any moment. With straight lines forwards and backwards we have less trouble than with lateral movements. Those sideward motions are not the favourite action trajectories for humans. The left-right lateral transitioning is what tennis players therefor need to train a lot. Besides this knowledge we know that our legs carry us in a certain harmony from A to B. We know that walking is the most efficient way but we do also know that we are able to transition to one leg (hopscotching), or to hopping and if it is really necessary to four (three?) limbs (creeping). The last example is an ancient manifestation of moving which is studied thoroughly by every human being in a certain era.

Street map knowledge is latent action trajectory knowledge and can be used as a tool to supplement the cognitive basis.

If we are at A and we want to go to B then we first design a tactical *walking* action. In the environment matrix there are uncountable latent *walking* trajectories. The tactical movement action has the goal to come to only one action trajectory which is actually going to be executed. The biggest deduction in the whole matrix takes place because we want to go from A to B specifically. That narrows down most

options. The latent trajectories which then remain are further assessed tactically. Efficiency and effectiveness are keywords in this process. We make all kinds of deliberations in choosing a latent action trajectory. This way is shorter but then I have to move over obstacles and it snows there. The other route is longer but free of obstacles and I don't get wet. Finally you have to come to one action trajectory. That is the fact in every Motoric Movement Action. You are not able to link the advantages of one route to the advantages of another route[90].

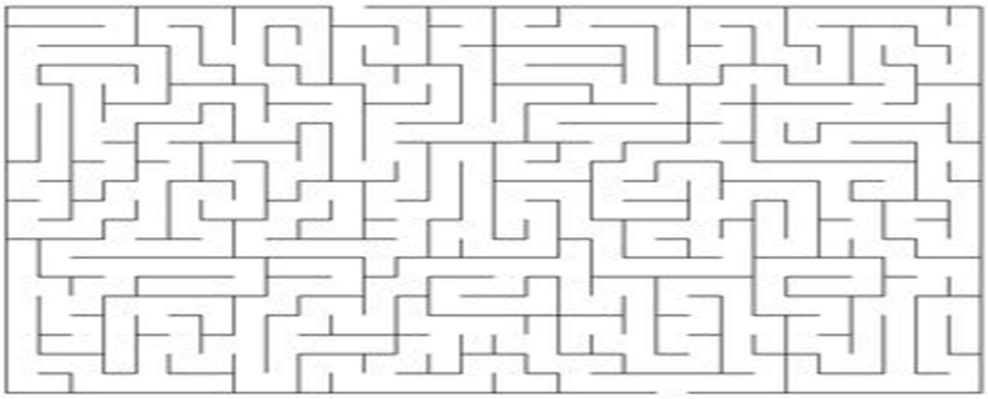

Image: When you walk in a maze it might be useful to consider each straight line to a square turn as one action trajectory of one Motoric Movement Action. And to use every *blind alley* result to enrich the cognitive basis and the tactical movement action in order to not use the same faulty action trajectory again.

If one latent action trajectory is selected then this action trajectory actually needs to be created. That happens during the actual *walking/running* action. The actual movement action beholds the choice for this one action trajectory as the only existing action trajectory in the world. A walker/runner first visualizes the whole action trajectory and then throws the whole body in the beginning of the whole latent action trajectory. The processing processes of the perception towards the dorsal and ventral stream accompany the process in an ongoing mutual relationship until the task is fulfilled completely. If the body deviates from the action trajectory a new latent image is created right away out of the cognitive basis and the tactical movement action. The actual movement action will accept this new picture as if it was always there and just keeps on executing.

3. The motoric movement (MM) of the Motoric Movement Action *walking* and *running*

I don't have to appoint movement models in relationship to walking into detail in here. If you watch a few video clips on YouTube you get a general idea[91] of how *walking* technique models work. For the explanation of the explanatory model it is only relevant that you see that several muscle groups are involved and that the movement trajectories have nothing to do with the action trajectory. The totality of movement trajectories, on the inside of the body, will finally make it possible that a transition point is created between the outside of that part of the sole that touches the floor and the part of the floor that is being touched by the sole of the shoe/foot. In the transition point a push off the ground is created which as a negative resultant has a direct relationship with the action trajectory. This negative resultant

[90] See chapter 10.5 of "Watch The Ball Trajectory!" – Dualism in ball trajectories

[91] For example.: https://www.youtube.com/watch?v=A_Zi0zakzBw Biomechanics of Running
https://www.youtube.com/watch?v=6ObNnCTV6MY Leg Muscles During Walking
https://www.youtube.com/watch?v=79yH4fCXv88 biomechanical analysis

is the characteristic of all Motoric Movement Actions *moving A-B*. A car, a bike, a boat, a swimmer etc. all have to push off in order to create an action trajectory in the opposite direction[92].

"Arm swing is a distinctive readily apparent characteristic of human walking and running. Our arms tend to swing out of phase with our legs, the right arm swinging forward with the left leg and vice versa. Although it has long been established that the arms do not swing as simple, unrestrained pendulums (Elftman, 1939; Fernandez Ballesteros et al., 1965; Jackson et al., 1978; Hinrichs, 1987; Ohsato, 1993; Webb et al., 1994; Gutnik et al., 2005), the extent to which the shoulder muscles actively drive the arms, and the effect of arm swing on stability and economy during walking and running are poorly understood.

Fernandez Ballesteros and colleagues showed that the shoulder muscles fire even when the arm is restrained during walking (Fernandez Ballesteros et al., 1965), suggesting that the neural control of arm swing may be controlled by a locomotor pattern generator, and is perhaps an evolutionary holdover from a quadrupedal past, a view supported by other workers (e.g. Gray, 1944; Jackson et al., 1978)."[93]

It is also important to notice that the whole body is involved in creating that push off the ground. Besides the moving arms the torso must remain rigid and form a unity conform the idea of the unity model. Even if one studies only one step within the Motoric Movement Action *walking/running* then every part of the body is moving from the beginning to the end of the action. That is logical because it is part of a Motoric Movement Action *moving A-B* with the whole body. All, and also the more static, body parts have dynamic relations with all other body parts in every phase of the action.
With the unity model as a basis one is able to create different technique models of all kinds of walking. In walking on your toes, walking on your heels, hopscotching or normal walking one is able to create a technique model which belongs to that form. Although there is no proof I think you will only find one technique model in all the aforementioned forms of walking. I believe that healthy people all use the same technique model although you are able to determine an uncountable number of different manifestations of all the different bodies.




4. The manifestations of the Motoric Movement Action *running*

So probably the technique model within the Motoric Movement Action *running* will be the same in every healthy human being. However the manifestation of the explanatory model of the Motoric

[92] Remember the important overlap with the Motoric Movement Action *flying*; chapter 5.5
[93] Control and function of arm swing in human walking and running; H. Pontzer, J. Holloway, D. Raichlen, D Lieberman; https://www.researchgate.net/publication/23963817_Control_and_function_of_arm_swing_in_human_walking_and_running

Movement Action *running* shows essential differences. And with that I don't mean all the personal manifestations of the motoric movement (MM) within the technique model. I mean that by not following the explanatory model big differences occur in the total execution of the Motoric Movement Action. One can notice three main forms of manifestations.

a. The first manifestation which can be noticed a lot among *Sunday*- runners and beginning competitive runners is the form where the action trajectory is created out of the motoric movement (MM). Those runners move out of the perspective of the legs or the leg action. This is equal to players in tennis who think that only hitting a ball is the main goal and not the creating of ball trajectories. You can notice very clearly that within these runners the body follows that leg action passively. The arm action which one is able to notice in there is the natural contra movement which the body induces and among other things has a balance function. The arm action in this form is motion-dependent on the leg action.

b. The second manifestation which can be seen a lot in advanced runners and elite runners is the form in which the action trajectory is still created out of the leg action but where the torso is leaning in the direction of the action trajectory. Not aware of the explanatory model, in the evolution process of running, one already has come to the point that the torso needs to lean forward. On the internet there is a lot of instruction which emphasizes this inclination angle as being very important. And it is very important. The only thing is that those people don't realize that this is the crucial part of running and that it must be the dominant leading factor. They only address it as just a part of the running technique. So the technique remains to be the leading factor in this manifestation. It is funny to notice that teachers who give this instruction[94] at first show a perfect action trajectory and after a few steps it all collapses and again comes down to the leg action. The disadvantage of this manifestation is that the inclination angle of the torso is pulled towards the straighter shape of the legs. This has a slowing down effect on the locomotion.

c. The third manifestation which one can hardly notice is the form which follows the explanatory model of the Motoric Movement Action. Just like within tennis only a few elite athletes have discovered the ultimate model. That means probably that they didn't find it rationally but that their bodies found it coincidentally. The elite model differs in the action trajectory and the focus. Within the Motoric Movement Action *running* the action trajectory needs to be created continuously out of the perspective of some part of the upper torso. As aforementioned we visualize an action trajectory out of an upper part of the body and not out of the legs. One can just start to create that action trajectory, like the YouTube instruction which is called under b., but it has to remain leading. It must also be the target of the primary focus. In this action one needs to create the feeling as if you continuously keep on pushing the body forward into the action trajectory. A very active pushing. So it is not a passive dropping of your upper torso after which the legs take over like in the second manifestation. The advantage of this active pushing is that the straighter legs will be pulled towards the inclination angle of the torso.
   Then it is essential that one needs to *follow* this primary leading torso action with *motion-dependent* leg action. You can visualize a leading trunk which floats through the air and where the legs will have to keep up or follow. Besides the push off function the legs also need to take care of the support function of the body. The biomechanical main action of the motoric movement (MM) remains important. The secondary focus must be pointed at the running technique towards the action trajectory. The primary focus and secondary focus will have to be combined to one focus image.

In the near future I hope that more runners are going to execute the Motoric Movement Action *running* out of the explanatory model (manifestation c). I hope it goes along with scientific research because I am convinced that significant differences will be discovered between the three manifestations.

[94] For example: https://www.youtube.com/watch?v=wCVSv7UxB2E ; after 0.52 sec.

5. The matrix and the Motoric Movement Action *walking* and *running*

If we are not able to execute a Motoric Movement Action when we stand still we first have to move the (movement) action object. The complexity of our perception will increase with a factor when we move. Walking in a kitchen without other people or any working machine will already change every matrix line every unit of time. That is why in a lot of actions we first move. Subsequently we come to a standstill and then execute the Motoric Movement Action. That is why in volleyball or tennis techniques are executed which after a running action let the student come to a, very brief, moment of standstill (*freeze*). This is directly related to the phenomenon of the dynamic balance.
Now you can see that in sports where you can't come to a standstill the complexity remains a lot higher. The matrix in there remains moving all the time. For example in soccer this moving matrix is one of the main limiting factors of game play within players. Until this moment that isn't recognized. It will have to become one of the main goals in training. The static *rondo* is still one of the leading exercises. It should be replaced by the dynamic *rondo*.

The perception of the matrix in walking/running hosts the same aspects as the standard example of the two trains in the theory of relativity. If an observer in train A thinks he sees a train B moving he can't be sure about which train is actually moving. The theory of relativity says that you can't make a statement about the moving but more important that it is not relevant to make such a statement. The importance is situated in the fact that they move *relative* to each other. The same happens in walking. Although we move ourselves in a kitchen the perception creates images of a moving kitchen. Our perception creates every time frame a static still image of all the matrix lines in the kitchen out of the perspective of our eyes. Even if we walk towards a cupboard in a straight line the perception experiences an approaching cupboard. In that way you can define a Motoric Movement Action *grabbing* of the cupboard handle also as a Motoric Movement Action *catching* of that same handle.

6. Foot races

The task in foot racing is finally to let one point of the outer part of the upper torso touch the first part of an imaginary lengthened vertical finish line. I will appoint the Game Idea in a few running events. The relay has been appointed in a previous part of this book.
However times are important for records in a final time is irrelevant. It only matters if you succeed in completing your action trajectory before your opponents do. From the perspective of the runner it is only important if his action trajectory stays in front of the action trajectory of other competitors.

a. Events with a set lane

In the 100, 200 and 400 meter events competitors are bound to their lane. An athlete is only able to influence other competitors when his latent action trajectory is compared to the latent parts of the others. The perceiving of the fact that a latent part of the action trajectory of an opponent is shorter than yours is capable of summoning a reaction to influence the relative difference into your favour. So there is a direct game dualism but one is not able to physically disturb the action trajectories of others. And so an athlete can't get *locked up* in the pack.
The matrix only holds that many action trajectories as there are lanes. As a standard an Olympic track now constitutes nine lanes. The matrix shows a homogenous shape because the action trajectories are separated nicely and keep the same distance due to the shape of the lanes. The actual matrix can be observed very well although the starting distances towards the curves of the track differ in length.

b. Events without a set lane

In other then 100, 200 and 400 meter events athletes assembly at a certain point. Then they share one lane to the end of that event and in principle share one latent action trajectory. The tactical *running* action is now extended with more tasks. Besides the fact that one also has to compare the latent action trajectories of all other athletes continuously the action trajectory is now physically influenced all the time as well. The advantages can be that your running is influenced less by the wind or that a runner in front of you can motivate you. There are a few disadvantages as well. Most runners are situated in the middle of the pack and are *locked up* in there. The action trajectory is blocked or at least it gives the feeling that the action trajectory is blocked. In that way you are limited in your action trajectory and passing opponents are able to cut your action trajectory. Although direct physical contact isn't allowed tactically you can't escape the fact that your motoric movements (MM) will be influenced by this kind of contact.
So the matrix is much less organized as compared to the events with set lanes because now everybody is allowed and will run everywhere. Besides that longer distances provoke more tactical races and multitudes of the number of athletes participate as compared to set lane events.

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La Linea[95]

[95] ***La Linea*** ("The Line") is an Italian animated series created by the Italian cartoonist Osvaldo Cavandoli. The cartoon features a man (known as "Mr. Linea") drawn as a single outline around his silhouette, walking on an infinite line of which he is a part. The character encounters obstacles and often turns to the cartoonist, represented as a live-action hand holding a white grease pencil, to draw him a solution, with various degrees of success. https://en.wikipedia.org/wiki/La_Linea_(TV_series)