# The therapeutic function of metric space

A mental image refers to something other than itself but is at the same time a thing in its own right. In this article the duality of mental images is used to develop a method that relieves the subject from bothersome, disordered thoughts, thoughts that are evoked by the mental image of certain events. The two main concepts involved, semantic reference and metric space, are expounded. Examples demonstrate the application of the method. From the theory, presented as a logical argument, the procedure is derived that must eliminate the bothersome disordered thoughts of the subject.
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The goal of this article is to present a method to free a subject from bothersome, disordered thoughts, evoked by the mental image of an event or a series of events. A mental image of such an event can generate a cloud of thoughts such as statements, assertions, analyses, arguments, associations, and fragments of all these structures.

Our experience has demonstrated that to free the subject of bothersome disordered thoughts the *distance* between the position of the subject and the position of the mental image, i.e., the image of the thought-provoking event, is of decisive importance. From this we developed our approach of treating the mental image as a metric space: a collection of points with distances between them as the defining property.

The concept of distance belongs to topology, a branch of mathematics. An example is the work of Kurt Lewin. In his *Principles of Topological Psychology*, Kurt Lewin (1936) introduces the use of topological concepts in psychology.

## Application of the method: Example 1

To illustrate the essentials of the method the following example is presented.

### THE HUMILIATION

A woman vividly remembers a scene in which she was humiliated by her husband in the presence of her children. Repeated fragments of descriptive sentences, chaotic clusters of defensive and attacking thoughts, explanations, and emotional comments occupy her mind. The feeling of humiliation is always in the background. Sometimes she imagines the frightened faces of her children and the expression on the face of her husband. She often re-experiences the scene and then the shadow of humiliation falls upon her again. When asked to describe the scene from a position outside the scene, as if describing a photograph, she is still gravely focussed. But when her psychologist instructs her to move, rotate, and rescale the mental image of the scene, a smile blossoms on her face. After finishing the session she reports a deeply tired but relaxed feeling and an 'empty head'. She can still recall the scene with her husband but the image evokes a neutral 'objective' attitude.

The session described above contains important features of the method presented in this paper. First of all, *repeated fragments of descriptive sentences*, are signs of the subject's involuntary

and disorganised thinking. Very often, discussions with the subject, analyses, or diagnostic activities to straighten things out increase the jumble.

The vivid mental image of *the scene in which she was humiliated* is the starting point of the session. The occurrence of such a salient event corresponding with disordered thoughts is not always directly evident. Often the jumble of the subject's thoughts must be explored to find the event or series of events provoking the bothersome thoughts.

The concept of distance is introduced in the first step of the geometrisation phase of our method (see below). The subject is instructed to position herself outside the image. The next instruction is to apply operations on the mental image such as *translation, rotation, and rescaling*. Translation and rotation do not change distances within the figure, rescaling does.
Before the treatment the experienced event coloured her way of looking at the world, afterwards it was an object in her world.

## Application of the method: Example 2

THE KNIFE

*1. Re-experiencing the drama*

A man, John, aged 45 years, born on the lee shore, confused in thinking and behaving, asks for help in taming his busy and overworked head. The instructor asks him to select an image that often comes to his mind, an image that bothers him a lot. He is not asked to explain his choice. John recalls the following event.
In their small kitchen Sarah, his then wife, and John stand opposite each other. She screams and accuses him while swaying with a large knife. He is defending himself in tone and argument. Then he sees the knife coming, right at his chest. With his right hand he catches the blade that she withdraws at the same moment.
Years later, the very moment of the fast approaching blade still occupies his mind and embitters his mood.

*2. Facing things*

John is requested to construct an image of the moment the knife blade is approaching. Then he has to position himself in that image as a participant and place the image at a distance of two à three metres in front of him, so he is an observer. The image appears to be three-dimensional. There is not a clear distinction or distance between John in the image and John as observer of the image; he is tempted to merge both positions. In order to separate the positions he is instructed to be aware of the physical support his seat is giving him.

*3. Taking distance*

The moment John observes the image from a distance and shows no signs of mixing up semantic activities with the observer activity, he is instructed to change the three-dimensional picture into a two-dimensional one, like a photograph. He succeeds in doing so. Then he is asked to pay attention to details, to play with the image, and to turn it upside-down.

*4. Experiencing relief*

After his session, John reports that he can still remember the image. There is no mention of evoked emotions or semantic load. From then on the event is an isolated phenomenon that no longer disturbs his thinking, to his great relief. This is still the case a few months later.

The instructor uses the concept 'distance' in the sense of 'distance between the subject and the position in ambient space where the mental image is projected.' This type of distance also has a direction, **from** the subject **to** the position of the projected image. The other type of distance is the distance between points **within** the image. The 3-D to 2-D transformation can be regarded as an operation on distances within the mental image.

## A painting bottom-up: its surface

This paragraph and the next emphasise the duality of a mental image. The argument resembles the way Gibson (1978) writes about the duality of a picture. Imagine opening a catalogue with paintings of Malevich. You come upon the painting *Peasant Women at Church*. You cover the painting with a white sheet of paper. In the centre of the paper is a small hole so you can see only a small fragment of the painting. You observe this fragment but you refrain from description, and judgement; in fact you do not use any linguistic expression at all. Subsequently you relocate the small hole and you continue to observe the next small part of the painting. And so on. Sooner or later, the number of fragments observed is finite, you have observed all points of this surface. If you take away the white paper you know that you have before you a metric space.

Thanks to the distance property a metric space can be translated, rotated, rescaled, and deformed. Imagine an object made of very elastic material. Treating it as a metric space you may stretch this material over thousands of miles or press it into a

small cube: every change of form corresponds with a mathematical operation on a metric space. As long as you do not tear the material or do not pinch holes in it, very different forms can be created. All these different forms can be conceived as originating from one form. They are *topologically equivalent*.

A topological transformation or mapping of a metric space is a mapping one metric space onto another metric space. This mapping can be inverted. For instance, the form of a ball can be transformed into a cube, a rod, a mug, or the contours of a human being. The contours of a human being can be reverted to the form of a ball, and so on. Figure 1 shows four surfaces (bands) that are topologically equivalent and satisfy the axioms of a metric space; all transformations are two-dimensional.

**Figure 1.** Topologically equivalent surfaces

Introductions to topology: Henle, 1994; Mendelson, 1990; Searcóid, 2007

## A painting top-down: its reference

The painting of *Peasant Women at Church* impresses because it is full of meaning; meaning is all over the place, not only in the rectangle of the painting. This meaning cannot be constructed out of the collection of dots. The meaning of the painting 'jumps' out of the rectangle. In discussing this painting, or rather its meaning, analysing, interpreting, and describing are the *modi operandi*. These operations are top-down. One starts for instance with the remark 'What a devotion!', followed by a description of the orientation of the faces, the bodies, and the limbs of the persons depicted. Then one may notice that all visible hands are left hands, laid upon the heart, etcetera.

The search for meaning may result in a proliferation of interpretations and descriptions. This proliferation of interpretations and descriptions does not belong to the mental image of the painting; they are stimulated or evoked by that mental image.

## Mental image: its surface and reference

The entry on Imagination in the Stanford Encyclopaedia of Philosophy opens with the statement 'To imagine something is to form a particular sort of mental representation of that thing' (Gendler, 2011). The entry Mental Imagery in the same encyclopaedia opens with: Mental imagery (varieties of which are sometimes colloquially referred to as 'visualising,' 'seeing in the mind's eye,' 'hearing in the head,' 'imaging the feel of,' etc.) is *quasi-perceptual experience*; it resembles perceptual experience but occurs in the absence of appropriate external stimuli (Thomas, 2010). We will not engage in a discussion of the terms 'imagination' and 'imagery' but focus instead upon two faces of a mental image: surface and reference. The duality of mental images is used to develop a psychological method that relieves a person from a jumble of semantic expressions. One function of a mental image is in reference to something else; a mental image means something. This was called the top-down interpretation of the mental image. The other function of the mental image is being something, some thing, the bottom-up interpretation. If we cite Gibson (1978, p. 231): 'A picture is something in its own right and a display of information about something else.' This phrase implies subsequently, equating picture with mental image, that a mental image has two faces; it is a surface and a reference. Or might we say 'The one has a surface, the other has a face?'

The surface is the geometric face, the reference is the semantic face of a mental image. They are not deductible from each other. But it is possible to shift attention from one modus to the other. This attention shift forms the basis of our approach of treating a mental image as a metric space.

## The theory

We can now sketch the theoretical idea behind the method. A mental image can be considered from two points of view: the semantic and the topological point of view. From the semantic point of view, a mental image refers to something else and from the topological point of view the mental image is a thing in its own right. In accordance with the axioms of a metric space, the mental image can be considered a metric space. Reference and metric space are partners but the partners in this duality are incommensurate. There is no one-to-one correspondence between reference and metric space. The following argument summarises the theory:

## If

Premise 1: Mental image Mx functions (from the semantic point of view) as a *reference*.
Premise 2: Mental image Mx functions (from the topological point of view) as a *metric space*.
Premise 3: The reference function and the function

of metric space are incommensurate.
**Then** a transformation of the metric space has no corresponding transformation of the reference.

This conclusion implies that, if a mental image, conceived as metric space, is transformed into a topological equivalent space, the original referential meaning of the mental image becomes *indeterminate*.

An example. Suppose a subject has experienced some event (for instance, a deep humiliation). The subject has a mental image of that event. This mental image is associated with a set of descriptions, analyses, judgements, etcetera. The cognitive jumble of associations, obsessive, compulsive, or otherwise annoying, must be filtered away. A double manoeuvre must be made to reach that goal. The first manoeuvre is to revive the problem for the subject, followed by the manoeuvre to treat the mental image as a metric space. If the subject executes instructions to translate, rotate, rescale, and deform, then the reference function becomes indeterminate.

It is important to bear the following in mind. The method presented in this article is designed to erase disordered thoughts. This contrasts with methods that may create meaningfulness or make meaningfulness visible, for instance the *Life-line Interview Method* (Assink & Schroots, 2010). In applying this method, metric (life-line) aspects and semantic aspects (interview) collaborate with each other.

In order to erase the disordered thoughts (with respect to a certain event or events) in the method presented in this article, several functions are disabled, some explicitly, some consequently. Thinking, use of language, locomotion, movement of the limbs, all these functions are more or less restricted. Cognition is, as it were, disembodied (cf. Wilson & Foglia, 2011).

## Procedure

### General remarks

The procedure can be executed in variants. One variant follows a *protocol* that is phased strictly, including the time to spend on each item. Another variant is *en passant*: the functions of the different components are realised in a seemingly common conversation interspersed with tasks for the subject. A third variant is the application of the *principles* of the procedure in the long-term planning of a treatment. For the sake of simplicity we restrict ourselves to the problem that the subject was involved in an event, is exposed involuntarily to the memory of that event, and cannot find a necessary and satisfying meaning of his involvement in the event.
During the application of the method, the subject is not in control. In imageries the subject often has free rein to develop a given imagination (see for instance Sheik. 2003). In our case the instructor keeps a tight rein on the proceedings. The subject must fix the chosen image unless told otherwise. That is why the person who guides the subject is called an ‘instructor’. The instructor disables cognitive activities under the premise: if something is wrong with your cognition, you cannot solve that problem using the same cognition.

### Geometrisation

Imagine a subject suffering from recollections of an unbearable event; without end and conclusion she ruminates about the who and what and why of that event. In this recollection, distance and spatial position are implied by using expressions like: ‘he does not approach me’, ‘they shut me out’, ‘he expelled me’, ‘they close ranks against me’. The subject is asked to sketch a visual scene that summarises the different spatial positions of the participants. If the subject has completed this task, no spontaneous change of the image by the subject is allowed. Factual geometrical descriptions must be used. Such a transition from the linguistic to the geometric is called geometrisation. In order to advance geometrisation, the instructor induces in the subject a level of language that does not allow reflection upon properties and relations (Altena, 2004) and consists of assertions about the next task that should be performed by the subject (you now turn the image upside down; you concentrate upon details of the image until I say ’stop’). The subject complies with the assertions of the instructor.

## Re-experience and relief: Example 3

The instructor searches formulations in the language utterances of the subject that lend themselves for geometric expressions. He verifies if these expressions mirror something of the problem. The configuration is chosen that carries the most load. At that moment the subject is confronted with the situation he experienced as problematic. Therefore re-experience is part of the procedure.
If a geometric description of the problem is reached and re-experience manifest, then a crucial manoeuvre is made. The instructor tells the subject to imagine the chosen situation or event with himself included as a participant. When the subject carries out this instruction, he *in the here and now as a designer* designs his own presence in the event *there and then as an object*. This is accompanied with the instruction to move the mental image to a position at

a few metres in front of his position as designer. I.e., the subject 'looks' from a distance at a situation he participated in.
The position of the mental image is translated from somewhere in the neighbourhood of the subject, to a position unmistakably outside the subject, reason to label such a movement as *'exportation.'* This is the moment when re-experience should stop and relief begins. The situation or event the subject was involved in is changed into an image that is produced by the subject as an object or a thing. In this last phase the subject is instructed to emphasise the 'thingness' of the image. The subject must translate, rotate, rescale, and deform the image and, at the end of the procedure, focus upon meaningless details.

The following example illustrates the possibility that the mental image to be distilled is a copy of the subject. That could be the case when the subject is a problem for himself.

THE OBSESSION
A woman, 30 years old, got pregnant and gave birth to a child that died soon after his birth. When she told this to her employer he grinned unkindly and said: 'You shouldn't have got pregnant anyway!' Since that moment this remark and the pain it caused haunted her day and night. She hated herself for being so obsessed. The procedure chosen was as follows. 'You have a chair in front of you at a distance of about two metres. Place a copy of yourself in that chair; it is the copy moved by the obsession.' Tears filled her eyes and you could feel and see her pain when executing the command. Then the instructor instructed her to lift the metric space, which in the meantime had been installed in front of her, a few inches. 'You should now focus on the image in front of you (2 minutes). Rotate the image 45 degrees to the right (2 minutes).'
A light smile appeared upon her face. 'Now put the image upside down. Put the image back in the chair (2 minutes).' After the treatment she experienced less cognitive pressure, a burden was lifted from her shoulders.

Why was the situation in which her employer offended her not chosen? The answer is simple. Obviously she was offended and hurt by her employer. However, what bothered her most was her obsession: 'Why I am always thinking about it, day and night. Why didn't this stop when I had found a harsh answer in my fragmented imagined dialogues with my employer?' She understood the seriousness of the offence, but she did not understand the obsessive character of her inner dialogues. This point illustrates that it is confusion about the meaning of events that must be solved, not the events themselves. Therefore the mental image chosen was a copy of herself in front of her with the property of being obsessed.

## Expected effects

If a mental image, conceived as metric space, is transformed into a topological equivalent space, the original meaning of the mental image becomes indeterminate. The derived procedure is based upon this proposition. Therefore the experience after application of the method can be characterised with terms like: clear head, peaceful mind, relief, and neutral mood.

## Conclusion

Two incommensurate ways of mental imagination, one creating an image filled with meaning, the other creating a collection of points, can be brought together to free the subject from an undesirable mental state. The collection of points satisfies the axioms of a metric space, a topological object that can be translated, rotated, rescaled or deformed. The concept 'metric space' plays a decisive role in the transition from re-experience to relief of the mental problem. This demonstrates the value of topological concepts for psychological theory and therapy.

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