

'The Work of a Wandering Mind'

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The teacher is stood, alongside the school inspector, who is holding on firmly to her clip board and pencil. The two women are looking out of the window at a group of children gathered together in and around the sand pit. Some are pouring water, some are digging in the sand whilst others are standing back, quietly watching. One little boy is slowly turning over some of the big rocks nearby, looking underneath each one before replacing it gently. A few moments later and he sits down in the pit, gradually reaches out his fingers and burrows them deep into the sand. He rests in this pose for a few minutes, quietly absorbing the sights and sounds of the busy garden, his eyes soft and dreaming.

Inspector: "When you look out of the window, what do you see?"

Teacher: "I see children playing...why, what do you see?"

Inspector: "I see children *coasting*."

Teacher: What do mean by the word 'coasting'?"

Inspector: "Well, I'm looking at a child in the garden who has already learnt that insects are found under stones and nothing is being done to move him onto the next learning goal. He isn't being *moved forward* in his learning....he is simply... 'coasting.'"

This true account of events illustrates a child enjoying a freedom that is commonplace in the Steiner Kindergarten. The experienced and dedicated teacher is secure in her view that as long as the strong rhythmical structure of Steiner kindergarten is present, through sitting undisturbed in a day dream...or **Mind Wandering**, the child will reap significant developmental benefits. She has personally observed over time the healthy growth, progression and development of children through this approach and witnessed the blossoming of many dreamy young individuals into creative, confident and academically successful adults. For her, this child, albeit unknowingly, is 'moving *himself* forward', simply by experiencing the world through his senses and allowing his mind to wander; there is no need for adult intervention in these moments. Indeed, interaction with another would abruptly halt the optimal 'dream state' (**Spontaneous Thought/ Mind Wandering**) that she is looking to support as a Steiner kindergarten practitioner (**1, 2**) and a developmental opportunity will be wasted. Waite and Rees (2014; 4) (**3**) refer to the "cultural lightness of adult involvement" in the Steiner Kindergarten during children's playing and dreaming, highlighting it as an intentional feature of a model that rotates structure and freedom.

The inspector on the other hand, has clearly communicated her anxiety at the unfamiliar scene in front of her. The child is not explicitly provided with any 'learning goals', nor is he, in her eyes, being 'progressed' in his learning by the teacher. Such an approach, most commonly employed in mainstream preschool classrooms, might involve for example, questioning the child about which type of insects he has found, how many he could count or what colour they were; questions

designed, as the inspector herself indicates, to elicit more 'goal-directed learning'and indeed, in neuroscientific terms, more '**Goal-Directed**' thinking. In line with some research perspectives, she perhaps sees Mind Wandering as being a "state of decoupled attention" **(4)** and somewhat unhelpful for "attending to" and "integrating" (*ibid*) information presented in his external environment. These are absolutely true aspects of Mind Wandering, but it is also a good deal more than this... as we will see shortly.

The problem faced by the teacher here is a common one for Steiner educators. The task of briefly explaining in philosophical terms why Mind Wandering is actively encouraged in the young child is not an easy one. It would be advantageous for us as a movement to develop concise and accessible answers to questions like these that inevitably will continue to meet us in years to come.

It may be that the field of neuroscience can support us to do this. I hope to throw a little light here on an area of brain research that could help us to prepare an accessible answer to the question of Mind Wandering in the kindergarten and its potential value.

I will explore in the following pages what the brain itself might be doing whilst a person is Mind Wandering. More specifically, I will consider the function of the particular network of neurons that activate during Spontaneous Thought processes; **The Default Mode Network**. Please bear in mind as you read, the following two points:

1. I will generally refer to Mind Wandering in this article more broadly, in terms of its overall 'family' or 'category' of thinking; **Spontaneous Thought**.
2. The information provided in the first three sections relates to research conducted on adults, due to a sparsity of studies available on children. Section 4 describes what is known about children's Spontaneous Thought and also illustrates how the research on adults is still likely to be relevant to our argument.

1. What is Spontaneous Thought and where is it found in the brain?

Spontaneous Thought can be defined as "a mental state or series of mental states that rises relatively freely due to an absence of **constraints** on the contents..." **(5)**.

The Default Mode Network is the neural network most commonly associated with Spontaneous Thought and includes (amongst others) the following brain regions; the medial pre-frontal cortex, the precuneus **(6)**, lateral parietal and temporal cortices **(7)**, the cingulate cortex **(8)** and the hippocampal formation.

The Default Mode Network activates "by default" at times when the person is not focused on a task and gives rise to Mind Wandering. Neurologist Marcus Raichle discovered this network unexpectedly through fMRI*, as he witnessed a consistent pattern of increased activity in certain brain regions during rest than were shown during the many different 'goal-oriented' tasks in his experiment **(9)**. The Default Mode Network was historically thought to entirely 'switch off' during all goal-oriented tasks, however recent studies have found that it does activate in some cases, such as with autobiographical or social working memory tasks **(10)**.

2. Functions of The Default Mode Network

The Default Mode Network has been rather magnificently described as ‘the neurological basis of the Self’ **(11)**. The reason for this is that it encompasses autobiographical information such as recollection of memories, self-referencing and reflections on one’s own emotional state (*ibid*). Importantly it has also been associated with the development of theory of mind*, empathic understanding, moral reasoning, social evaluations and categorisation, past recall of events, imagination of future events, episodic memory* and story comprehension (*ibid*). Clearly all aspects of vital significance to the development of a healthy human being. How many of these processes children engage in during their Mind Wandering is not fully known yet by neuroscientists however, as studies on Spontaneous Thought and the Default Mode Network in children are very sparse, hardly a surprising fact if one considers the significant practical and ethical problems potentially involved with fMRI scanning on young children.

3. How Does Mind Wandering Differ from Other Thought Forms?

Canadian neuroscientist Kalina Christoff (2016) **(5)** refers to Mind Wandering as a member of the Spontaneous Thought ‘family’ and places it on a scale between night time Dreaming and Creative Thinking. She suggests that thoughts can be categorised in terms of how much ‘**constraint**’ is exerted over them. Deliberate control processes, issued by the **Central Executive Network***, serve to constrain both the content and flow of different mental states by steering and subduing their spontaneity (Fox & Christoff, 2013) **(9)**.

Constraint can come in two forms:

1. **Deliberate**. Related to the Central Executive Network and cognitive control **(12)**; e.g consciously bringing one’s own attention back to the focus of a boring lecture.
2. **Automatic**. Unrelated to cognitive control; e.g being preoccupied with a particular emotional concern or being drawn back to the sound of a nearby annoying buzzing fly.

Levels of Constraint on Different Modes of Thought

- **Goal-Directed Thought**: Under the highest constraint. *This is the type of thinking required for the goal-directed learning that the Inspector in our opening observation is looking for.*
- **Creative Thought**: Fewer constraints than Goal Directed Thought but more than Mind Wandering, usually serving a specific goal and involving deliberate processes such as selection, evaluation and possible revision of creative solutions **(13)**.

- **Mind Wandering:** Fewer constraints than Goal Directed Thought and Creative Thought, but more than Dreaming, which can be viewed as an intensified form of Mind Wandering (9). *This is the type of thought the Steiner Kindergarten teacher wishes to encourage in order to support the child to build the foundations for future creative thought.*
- **Rumination and Obsessive Thought:** Highest level of *automatic* constraint - “mind wandering gone awry” (5; p.719).
- **Dreaming:** Least constraints of all (except in lucid dreaming). The lack of cognitive control in dreaming is the reason our dreams are often implausible and bizarre in nature (9).

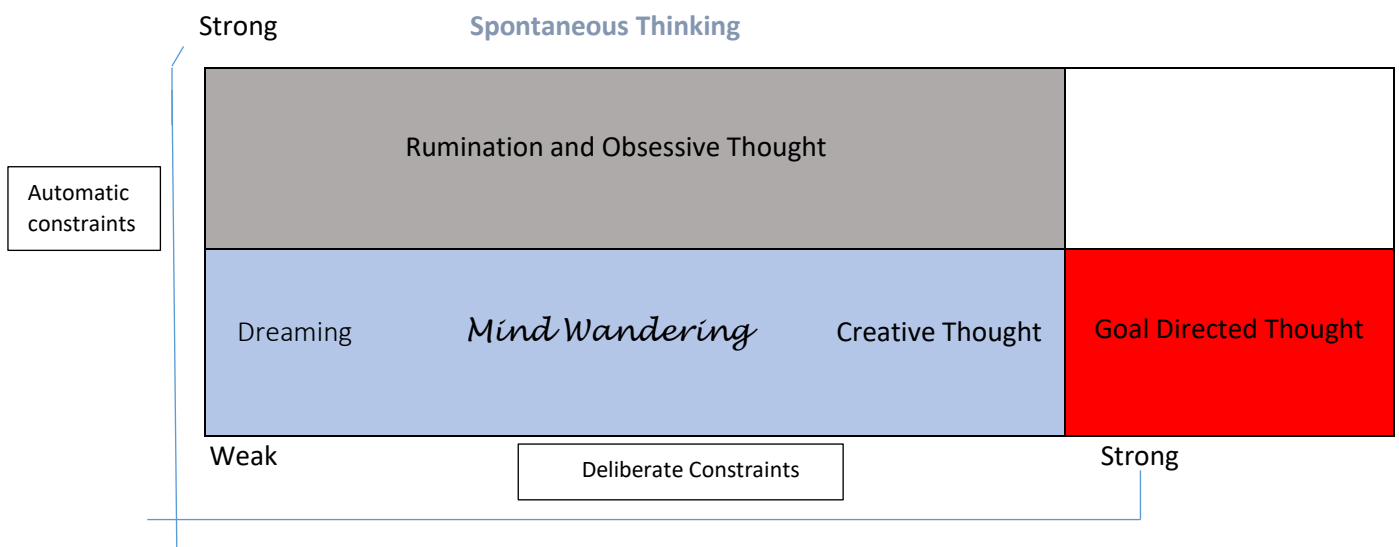


Figure 1: Types and Levels of Constraint Exerted on Different Modes of Thought. Christoff et al. (2016; 719)

4. The Development of Spontaneous Thought and the Default Mode Network in Children

Neuropsychologist Aldrich Chan (2016) (14) provides a useful assimilation from psychology and neuroscience of what is currently known about the development of Spontaneous Thought and the Default Mode Network in childhood.

Chan (2016; 13) reports that during infancy and up to 2 years old, a “stable and continuous sense of self, capable of introspection” is absent. Over time, the brain develops in accordance with its social environment and through this process, a sense of self arises. This viewpoint converges with Rochat (2003) (15), who contends that self-recognition occurs at about 2 years old, and Siegler’s (1998) (16) estimation of when explicit memory begins.

Whilst theory of mind is thought to surface between 3 and 5 years old **(17)**, self-concept is not identified until the child is between 7 and 8 **(18)**, alongside a wider range of self and social capacities. All such processes, as they mature, Chan suggests, are embedded in the Default Mode Network and stabilization of this network seems to occur between 9 and 12 years old, which is also reflected in Default Mode Network functioning studies **(19; 20)**. In a very recent paper, Chaddock-Heyman et al (2018) **(21)** report evidence to show that children (7-9 years) with more integrated and interconnected 'resting state' brain networks, particularly in the Default Mode Network, achieve higher academic performance scores.

Fair et al (2008; 4028) **(20)** found that default regions of the brain, though only "sparsely functionally connected" at age 7-9 years, over time, integrate into a "cohesive, interconnected network". What is very interesting, and critical to our argument for the value of Mind Wandering in the Kindergarten, is that even young children have been found to be carrying out many self-reflective activities later associated with the Default Mode Network, for example episodic memory, mentalizing* and theory of mind **(22; 23; 24; 25; 26)**; this is *despite* their Default Mode Network still being structurally immature **(27)**. Fair suggests that such functions will improve with age and structural Default Mode Network maturity.

Furthermore, importantly, Honey et al (2007) **(28)** are just one voice to state that partially through spontaneous activity itself, integration and consolidation of the Default Mode Network (and other brain networks) is *likely* to occur, in the same way that Hebbian learning takes place (*see Hebb, 1949) **(29)**. If further evidence of Honey's suggestion is found in the future, our scientific argument for the benefits of Mind Wandering in the kindergarten will be greatly strengthened.

Finally, whilst visualizing the Default Mode Network stabilizing and maturing in the lower/middle-school age child, I am caused to reflect momentarily on Steiner's vivid description (Steiner, 1975; 20) **(30)** of the astral body being drawn inwards to the physical body between 7th and 14th year, "following "the lines and directions of the nerve fibres from without inwards", "laying a firm hold upon all the organs" and "uniting itself chemically" with the organism... and I am struck, once again, by his remarkable insight and vision.

Conclusion

We have taken a short but exciting journey here and looked through the lens of neuroscience into the highly significant role that Spontaneous Thought and the Default Mode Network (together with the Central Executive Network) appear to play in the life, development and learning of the human being.

The Steiner early years teacher sees herself merely as a 'witness' or 'facilitator' to the child's natural processes of 'being and becoming' (Waite and Rees, 2011) **(3)**; processes that arise through the carefully designed kindergarten structure of rhythm, routine and ritual, in which Imaginative Play and Mind Wandering are free to exist. If we take into account the research-based evidence outlined here on the neuroscientific value of Spontaneous Thought, I think we can confidently say, that the child who turns over the stones and sits in the sand uninterrupted for a moment, does not have to

be concerned about where his next learning goal is coming from, for his own mind already has that covered.....and so much more. It is extremely busy in these precious moments of day dream, busy with remembering, with reflecting and with imagining....it is fully engaged trying to understand the world, others and perhaps most profoundly, its Self. At such times of apparent 'absence', the child's mind is, in fact, laying down vital foundations for its future: *this* is the value of the day dream. The only problem that child's mind has, in this extraordinary, cram-packed and attention-demanding era, is finding an undisturbed space and time in which it is free to simply wander.

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Definitions:

Episodic Memory: Detailed memories relating to specific events in time.

Theory of Mind: Imagining the thoughts and feelings of others.

Functional Magnetic Resonance Imaging (fMRI): A brain scan that measures changes in brain activity by detecting increased blood flow and therefore increased neuronal activity.

Central Executive Network: The brain's neural network responsible for higher level cognitive functions, particularly attentional control and working memory.

Mentalizing: Understanding the mental state of others and ourselves.

Hebbian Learning: When synaptic connections between neurons are strengthened by the two neurons each side of a synapse having highly correlated outputs, i.e '*Neurons that Fire Together Wire Together*', Hebb (1939).

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