Educating far from Equilibrium: Chaos Philosophy and the Quest for Complexity in Education

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It would be futile, John Dewey argued in 1902, to think that we have to choose between child-centered, progressive education and traditional, subject-matter-oriented approaches. Calling for adaptivity, he stressed that we need the act of balancing the one with the other. The tendency in current educational policy to lean in favor of traditional, disciplinary modes of control appears to lose sight of this need. The aim of this paper is to reconnect to the task of maintaining a balance between educational freedom and structure, using a variety of theoretical resources such as complexity science, and the philosophies of Deleuze and Guattari, Schiller, and Nietzsche. Based on these resources, the authors also discuss Steiner Waldorf education as an example of how educational practice may approach, and integrate the significance of chaos in the form of a "virtual pedagogy".

Introduction

One hundred years ago, John Dewey (1902/1956) commented on what he perceived as the two major directions of educational thought. The first, what he referred to as "old education", had its orientation towards subject-matter, reproduction of human knowledge and tradition, while the other, "new education", was child-centered, dependent on motivation, and aimed at self-realization. For Dewey, these were complementary modes of operation through which the individual would alternate as the demands of his learning process prompted him to do so. Taken as complete educational ideals in themselves, however, they would be absurd. Unfortunately, this is exactly what Dewey observed: the formation of contradictory systems of truth serving no educational purpose at all, except as platforms for political contestation. Dewey found it hard to stomach. "Old education", unbalanced by disregard for the individual's own motivation, would have no chance of success without employing strategies of control, coercion, and discipline; "new education", on the other hand, when in disregard of the need for structure and tutoring, would only lead to confusion, lack of direction, closing in on "anything-goes inventionalism" (Osberg & Biesta, 2008, p. 316).

Certainly, Dewey must have had high hopes that a century of educational research, reflection, and practice would have brought humanity closer to a point of reconciliation between these polar opposites of educational thought. However, a closer look at contemporary educational reforms leaves ample opportunity to doubt that much has changed. Global trends in educational policy, as leading researchers have noted (Apple, 2004, 2005; Ball, 2003, 2006; Benveniste, 2006; Goodson, 2010), lean considerably in favor of standardized knowledge assessment and accountability on all levels of educational performance – individual as well as systemic. By and large, such policy implementations stand in close rapport with disciplinary power as theorized by Foucault (1977/1995) – forging control and examination procedures with panoptic surveillance mechanisms, and coercion where necessary (Larsson, Löfdahl & Pérez Prieto, 2010; Perryman, 2006; Webb, Briscoe & Mussman, 2009). It is, according to Apple (2004, 2005), a trend that fuses neo-liberal ideals of marketization and competitivity with neo-conservative idealizations of a glorious educational past; it is, in many aspects, "old education" that has yet to become new.

In recent studies, such disciplinary policies have been discussed in the light of complexity theory as well (Osberg & Biesta, 2010). From this perspective, standardized assessment and strictly implemented curriculum control (indeed formal learning in general) may be regarded as powerful tools for *complexity reduction,* reducing the unpredictability of human learning and the degrees of freedom in educational systems. While this approach may have its rightful but limited application in education (Dewey certainly thought so), complexity reduction may also have drawbacks that become apparent if we consider aspects of human experience and learning that resist quantitative mapping – aspects that have *intensive* qualities, to speak with Deleuze and Guattari (1988). Reaching for such intensive qualities is, it could be argued, nonetheless important in the educational context; and unfortunately, this need cannot be satisfactorily addressed by strict adherence to disciplinary regimes alone. It becomes a task for philosophers of education to ask the counter question of discipline: how to *increase* complexity in educational systems, when ethical or aesthetical imperatives invite us. This task demands that we suspend a trivial understanding of order in terms of top-down policy action, and persevere into investigations regarding the possibility of a "creative order" that emerges from the learning process itself, and learn how to work with, rather than against, influences that might described as chaotic (cf. Aviram, 2006; Cvetek, 2008; Davis & Sumara, 2005; Morrison, 2008; Semetsky, 2005, 2008).

Of course, this is a philosophical problem that predates Dewey. Allowing ourselves to place the issue in a wider frame of discussion, we may come to recognize that it touches upon a dichotomy of a much older datum in human culture – the polar opposites of Chaos and Order. The question of arriving at a proper balance between these forces has truly been a reoccurring theme in ancient times, the Renaissance, as well as modern literature (Hayles, 1990). For instance, it was addressed by Friedrich Nietzsche (1909/1923) in his discussions on Greek tragedy's two major artistic attitudes, or drives – the *Dionysian* and the *Apollonian*. The first, being the more 'chaotic' as it leads towards transgression of limits and dissolution of boundaries, he named after the Greek god Dionysus, while the second, the more orderly principle of distinction and individuality, was named after the god Apollo. Finding a balanced dynamic between Apollo, "the glorious divine image of the principium individuationis" (p. 25) and Dionysus, "the blissful ecstasy which rises from the innermost depths of man [sic] [and] of nature, at this same collapse of the principium individuationis" (pp. 25-26), was for Nietzsche the key to true creativeness (cf. Cox, 2009; Fitzsimons, 2007; Schacht, 1995).

Posing a similar problem one century before Nietzsche, German philosopher Friedrich von Schiller argued that human development depends on the successful negotiation between contradictory forces of existence; in fact, there is "no other way to develop the manifold aptitudes of man [sic] than to bring them in opposition with one

another" (Schiller, 1795/2001, Letter VI). In his *Aesthetic Letters*, he identified these oppositions as the force of matter and the senses on the one hand, and the force of form and reason on the other. The force of matter, or the *will* to material existence, is what Schiller calls *Stofftrieb,* the sensuous instinct. Its domain is *physis,* the physical/natural world, the manifest and the manifold, tending towards change and diversification. On the other hand, *Formtrieb,* the force or will to form, is the will to become one, to preserve identity in time. It is the ascent into abstraction, the search for a rule to govern, and to connect the things particular (Schiller, 1795/2001). For Schiller, these forces could indeed be harmonized in the medium position between sensibility and reason that is the *aesthetic condition.*

In more recent times, we find that the philosophy of Gilles Deleuze and Félix Guattari (1988) seems to close in on the same theme as well, by discussing the mechanisms of *stratification* (leading towards solidification, stabilization, and manifestation on the *strata* of physical existence) and *destratification* (leading towards disintegration, towards a *plane of consistency,* or *plane of immanence*, where all things are in constant flow). In the nomadic philosophy of Deleuze and Guattari, we also find the all-pervading ambition to recognize change, process and unpredictability, *rhizomatic* growth, as a necessary countermeasure to balance and suspend overly rigid structures, and stratifications (cf. Gough, 2006; Semetsky, 2003, 2005).

The dichotomy is not discussed exclusively in the domain of philosophy. During the 1960's and 1970's, it was to become highly actualized in natural science as well. In the transdisciplinary research fields of *complexity science* and *chaos theory*, devoted to the study of nonlinearity and chaos in simulated as well as natural systems, it is sometimes said that *complexity* is a phenomenon prospering on the borders between order and chaos (Byrne, 1998; Hayles, 1990; Lloyd & Pagels, 1988). According to some researchers, the skill of maintaining such border states between predictability and unpredictability, stability and instability – states *far from equilibrium* (Prigogine & Stengers, 1985) – may in fact be a key characteristic for life on earth. Chris Langton, computer scientist and pioneer researcher in the fields of dynamical systems and artificial intelligence, argues that the precursors of terrestrial life had no choice but to gain control over such dynamical states. They had to learn how "to maintain themselves on these extended transients in the face of fluctuating environmental parameters, and to steer a delicate course between too much order and too much chaos, the Scylla and Charybdis of dynamical systems" (1990, p. 35).

In Nietzsche, Schiller, Deleuze and Guattari, and in complexity theory as well, we recognize heterogeneous, but occasionally overlapping, conceptualizations and variations of dealing with the (apparently) polar opposites of Chaos and Order. From these sources, we take the preliminary advice that achieving complexity and advancing creativity often involves the skilful negotiation of opposing forces. In this article, we will attempt to take up their lessons to a quest for complexity in education as well. Making an attempt to probe the "border states" between order and chaos, matter and form, as they have been charted by complexity theorists and philosophers such as Deleuze and Guattari and Friedrich von Schiller, we aim at a discussion of how such theories can assist the integration of chaotic and virtual dimensions in pedagogy and educational practice.

Understanding chaos and the virtual

Approaching the concept of chaos is, as we might well expect, not always a straightforward issue. It has, as Lorenz (1995) and Hayles (1990) point out, certainly meant different things in different contexts, different times, and to different people. In early Western tradition, as expressed by Hesiod, "chaos was associated with the unformed, the unthought, the unfilled, the unordered" (Hayles, 1990, p. 19). However,

Plato's concept of the *chôra* may be taken as a more sophisticated conception of chaos that, according to Bulhof (1995), is comparable to the *shunyata* (void) of Buddhism, which is not "empty" in a literal sense but rather the *formless receptacle of all forms*. Chaos, in this interpretation, "… is not the absence of order but rather the fullness of plethora that… is the condition both for any model or activity and for the undoing and transformation of such models or activities" (Grosz, 2008, pp. 26-27). In this respect *chôra*, *shunyata* and *chaos* – in the sense of the unordered receptacle of all orders – are related notions. We will come back to this conception of chaos below.[1]

During the Renaissance, the meaning of the word chaos was rather that of "a lack of differentiation, a gaping void, a confused mass" (Hayles, p. 20) – an interpretation that would find its extension later in the 20th century. Research in physics, and thermodynamics, had by then popularized the concepts of thermal energy. For instance the second law of thermodynamics states that all forms of energy (electric, chemical, etc.) eventually dissipate into heat – the least usable form of energy. Ultimately, this law implies that the universe drifts towards ever increasing levels of *entropy* (roughly translatable to "disorder"); in other words, all things sooner or later end up in a thermodynamic equilibrium – the infamous heat death of the Universe. In this respect, chaos turns out to be the antagonist to order, the enemy of progress and usefulness (Hayles, 1990), in contrast to chaos in the sense of *chôra*, which is rather a precondition of all order.

In the 1960s, the tables were about to turn again, as computer technology enabled scientists to experiment with nonlinear systems of differential equations. Pioneers such as Lorenz (meteorology); Feigenbaum (mathematics) and Mandelbrot (mathematics and geometry) noted that such models were capable of highly unpredictable behavior; and that there in fact were characteristic, deterministic *patterns* behind the system's transition towards chaotic behavior, and "natural" fluctuations, so that periods of chaos often were succeeded by new intervals of order (Hirsch, Smale & Devaney, 2004; Lorenz, 1995; Mainzer, 2005; Mandelbrot, 1982; Peitgen & Richter, 1986). As many other researchers would notice, these characteristics made nonlinear models into excellent tools for modeling complex processes occurring in nature, for instance, in the hands of 1977 Nobel Prize winner Ilya Prigogine, who focused on "the spontaneous emergence of self-organization from chaos; … on the dissipative structures that arise in systems far from equilibrium, where entropy production is high" (Hayles, 1990, p. 9).

The idea of chaos as the necessary precursor to order rather than its absolute adversary is a theme that runs in philosophical discussions as well, for instance in Deleuze and Guattari (1988). Touching upon the themes of chaos and order in a way that is highly compatible with complexity science, they introduce the concept of *the plane of consistency*, which offers a valuable resource for understanding the creative aspects of chaos.[2] Like many other concepts from Deleuze and Guattari, this one possesses quite an elusive character. It is described as a plane of immanence, of multidimensionality, as a *prima materia* out of which matter is born, where language and signification take their beginnings, or rather, where the thing and its representation become one. It is where opposites mingle, flow together; it is the field of the pre-physical, the unformed, and the unorganized. Deleuze and Guattari explain that:

> … if we consider the plane of consistency we note that the most disparate of things and signs move upon it: a semiotic fragment rubs shoulders with a chemical interaction, an electron crashes into a language…. The plane of consistency is the abolition of all metaphor; all that consists is Real…. Hence, the plane of consistency knows nothing of

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[1] See also Heidegger (1979, p. 337), who derives *chôra* from *chaô*, the source of our word for chaos.
[2] As De Landa (2002, pp. 29-38) points out, some of their central concepts are in fact derivations or 'ontological interpretations' of concepts originating from nonlinear dynamics.

differences in level, orders of magnitude, or distances. It knows nothing of the difference between the artificial and the natural. (1988, p. 69)

Indeed, the plane of consistency does resemble a principle of Chaos – however, it is not Chaos in terms of the completely unordered: "there is no hint in all of this of a chaotic white night or an undifferentiated black night. There are rules, rules of 'plan(n)ing,' of diagramming" (p. 70). The plane of consistency does not work without logic; it has its own, according to which flows are constructed, and continuums of intensity are upheld.[3] It may also be regarded as a field of *virtuality* (Massumi, 1992). As such, it encloses and contains all the possible routes of development that an object *may* engage in, *have* engaged in, or *could have* engaged in, but perhaps did not.[4] In terms not very different from Bulhof's (1995) interpretation of Plato's *chôra* mentioned above, Massumi holds that:

> The virtual as a whole is the future-past of all actuality, the pool of potential from which universal history draws its choices and to which it returns the states it renounces. The virtual is not undifferentiated, it is *hyperdifferentiated*. If it is the void, it is a hypervoid in continual ferment. (1992, p. 66)

A concept of relevance for this discussion is that of *stratification* – the process through which the plane of consistency moves from virtuality to actuality – that is, where it assumes form, and becomes organized. According to Deleuze and Guattari (1988, p. 502), "stratification is like the creation of the world from chaos, a continual, renewed creation", and it pertains to "giving form to matters, of imprisoning intensities or locking singularities into systems of resonance and redundancy, of producing upon the body of the earth molecules large and small and organizing them into molar aggregates" (ibid.,p. 40).

On the other hand, we have the opposite process of *destratification*. While stratification tends towards further consolidation and organization into molar aggregates, destratification amounts to dissolution and destabilization of unity. It may also be interpreted as a reopening onto virtuality, an expansion from the actual state of things, into the sphere of what *might* be actualized. Therefore, destratification tends towards the plane of consistency; and as Deleuze and Guattari (1988) frequently remind us, this always carries an element of danger and unpredictability. It may be a line of flight away from what is predictable, and well known; to follow it is to embrace renewal and to readjust to the molecular process that lies beneath a molar aggregate – the "continual ferment" that makes the foundation for every well defined structure (Massumi, 1992).

Chaos, then, can be understood in at least two different ways: 1) as an undifferentiated disorder like that of entropy or the thermal equilibrium of the heat death of the universe; and 2) as a state or condition of hyperdifferentiated order in analogy with the Deleuze-Guattarian concept of the plane of consistency. This hyperdifferentiated hypervoid (which is the understanding of chaos we aim at when using the term in the following discussions) is a superposition of an indefinite number of orders. It is, however not even in this second sense quite the same as complexity. Complexity, in our interpretation, still involves the precarious keeping of a sensitive balance – unfolding as a history of dynamic interaction between processes of stratification, where structures are consolidated, and actualized, and destratification, the relativization of structure without which no further self-organization can occur.

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[3] The term 'intensity' refers to that which cannot be divided without changing in nature; see p. 483.

[4] A reader familiar with dynamical systems might possibly recognize this as *phase space* – a mathematical space that describes a system's change over time, according to a given set of parameters (cf. Hirsch, Smale & Devaney, 2004).

Before moving on, we want to make clear that this understanding of complexity – as a negotiation between 'chaotic' and 'ordering' influences should not be taken as support for a dualistic model of 'Chaos versus Order'. Rather than considering chaos and order as distinct domains with distinct properties, we prefer to consider them as complementary, and this is exactly what the Deleuze-Guattarian concepts of stratification/destratification may help us accomplish. If destratification is the movement or tendency towards the chaotic – into smooth space – stratification is what enables the orderly segments of *striated space* (Deleuze & Guattari, 1988). But as we are reminded by Deleuze and Guattari (1988, p. 474), "smooth space is constantly being translated, transversed into a striated space; striated space is constantly being reversed, returned to a smooth space". Thus, there is never a question of mutual exclusion or even contradiction on the level of ontology. This is the understanding that we wish to build the rest of our investigation upon.

We will argue that in the context of education, on the level of individuals engaged in processes of learning, complexity cannot be a question of following one of these directions exclusively. Complexity cannot thrive on a continual increase in order and organization unless we *also* approach chaos in the second sense discussed above – in the form of a *virtual* dimension of the object or subject to be studied. Attempting to grasp how this dimension may be reached, actualized and experienced, we turn once again to the *Aesthetic Letters* of Friedrich von Schiller.

Virtual pedagogy in Friedrich Schiller and Rudolf Steiner

As we noted in the introduction, in his *Aesthetic Letters*, Schiller (1795/2001) placed the human subject at a threshold between two distinct forces. These are two forces that the human being must recognize and pledge allegiance to, as he belongs to them in equal degree. Doubly determined, we must be matter as well as form. We cannot take sides. To engage in *Stoff* alone would be to embrace chaos and to lose form; to identify with *Form* is to become an abstraction, and to turn lifeless, removed from the pulse of nature. How is the human being to stand her ground? This is where destiny compels us; this is our existential double bind – but it is also where our freedom lies. At the point of balance, says Schiller, *Stofftrieb* and *Formtrieb* hold each other in sway, and the human self can find its liberty. Satisfying them both, he will satisfy himself; and this he will do in the domain of the *aesthetic*. Here, a third instinct or power is at play – the *Spieltrieb*.

> The reason, on transcendental grounds, makes the following demand: There shall be a communion between the formal impulse and the material impulse – that is, there shall be a play instinct – because it is only the unity of reality with the form, of the accidental with the necessary, of the passive state with freedom, that the conception of humanity is completed. Reason is obliged to make this demand, because her nature impels her to completeness and to the removal of all bounds; while every exclusive activity of one or the other impulse leaves human nature incomplete and places a limit in it. (Letter XV)

The character of *Spiel* is the will to play, the will to create, also the will to beauty. When creating, through art or music, we may be able to unite matter and form, to tend towards beauty; but it must be playful. For it is only in play, according to Schiller, that the human is really human; only here can (s)he labour without strain, rejoice and revere at the same time. Therefore, the domain of *Spiel*, of play, is really the only ground for developing the human being in a harmonious manner – the platform from where she can proceed to

completeness, avoiding the perils of having to owe the prosperity of one faculty to the disadvantage of another.[5]

Perhaps we ought not to be surprised, should this extraordinary point of balance, this *aesthetic condition*, display some extraordinary characteristics. It is, to begin with, ideally an utterly useless state, in the sense of not producing any tangible results such as improvements of a person's character:

> We must therefore do justice to those who pronounce the beautiful, and the disposition in which it places the mind, as entirely indifferent and unprofitable, in relation to knowledge and feeling. They are perfectly right; for it is certain that beauty gives no separate, single result, either for the understanding or for the will; it does not carry out a single intellectual or moral object; it discovers no truth, does not help us to fulfil a single duty, and, in one word, is equally unfit to found the character or to clear the head. (Schiller, 1795/2001, Letter XXI)

If anything, the aesthetic condition removes us from deliberations and considerations of improvement and profit, to the point that we are in fact "nothing in the æsthetic state, if attention is given to the single result, and not to the whole faculty" (Schiller, 1795/2001, Letter XXI). Freedom comes with wholeness, and in order to attain this wholeness, any one-sidedness that we may have acquired, such as the "one-sided compulsion of nature in feeling" or "the exclusive legislation of the reason in thinking," must be rebalanced, for humanity to be "restored to him by the æsthetic life." "All other exercises", Schiller continues, "give to the mind some special aptitude, but for that very reason give it some definite limits" (Letter XXI). This also means that we have a criterion for recognizing whether or not a work of art is truly aesthetic: if it is, it will not jeopardize human freedom by charging the mind with some special inclination. On the other hand, if "after an enjoyment of this kind we find ourselves specially impelled to a particular mode of feeling or action, and unfit for other modes, this serves as an infallible proof that we have not experienced any pure æsthetic effect" (Letter XXI).

The domain of *Spiel* opens up, it seems, a very interesting place – it is an *aesthetic* void. Removed from demands of result and performance, it is also a creative void. With Deleuze and Guattari (1988), we may recognize it as a field of virtuality, of creative potential opening up as human nature refrains from an all-too-rigid stratification. Finding this potential amounts to reaching a *plateau* that is sustained on the basis of desire "with desire defined as a process of production without reference to any exterior agency" (1988, p. 154). For Schiller, it is a zone of free creation, in fact "unprofitable, in relation to knowledge and feeling" (Letter XXI), a possibility arising only on the basis of play.

Realizing that Schiller thinks of the aesthetic condition as unprofitable in relation to knowledge, it might seem paradoxical to approach the concept from a viewpoint of pedagogy and education in the first place. But this holds true only as long as we approach the aesthetic condition with expectations of an explicit "learning outcome." It aims, primarily, at the restoration of man's wholeness and his "freedom to be what he ought to be" (Letter XXI) and to the same extent, it primarily concerns what Biesta (2010, p. 21) refers to as the "subjectification" dimension of education, that is, the development of individuality and autonomous thinking. This it performs through the "removal of all bounds" (Schiller, 1795/2001, Letter XV), reaching for a potential that is empty, yet full at the same time, "in as far as we attend to the absence of all limits and the sum of powers which are commonly active in it" (Letter XXII). Accordingly, Schiller takes the liberty to assure us that the aesthetic condition is "most productive in relation to knowledge and morality", since "a state of mind which comprises the whole of

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[5] This holistic ideal of creating a balance between the faculties of human nature, such as intellect and feeling, is of course one that Schiller shares with the mainstream of German Romanticism; with Neo-humanists such as Humboldt, and their notion of *Bildung* (cf. Beiser, 2003).

humanity in itself must of necessity include in itself also – necessarily and potentially – every separate expression of it" (Letter XXII).

Therefore, the potential of the aesthetic condition certainly may contribute positively to the "socialization" and "qualification" dimensions of education as well – and here we agree with Biesta (2010) that such cross-over effects in fact *cannot* be avoided. But as we access the virtuality of the aesthetic state we need to accept its property of being an "abstract machine" (Deleuze & Guattari, 1988) working close to chaos. As such, its output is unpredictable. In practice, this would (for instance) mean that any pedagogy that wants to work in the aesthetic state must avoid locking in on *Stofftrieb* or *Formtrieb* exclusively. Instead, it must allow for the faculties of reason and sensuality to alternate in their own rhythm before giving priority to one over the other. Refraining from conceptualizing the object of study in advance, prematurely inscribing it in a system of signification, we also allow ourselves to be immersed in the process of getting to know the object on as many levels – *strata*, in the vocabulary of Deleuze and Guattari – as possible.

How, then, is it possible to attain to the more practical aspects of such a *virtual pedagogy?* We propose that some clues may be found in the educational philosophy and methods of Steiner Waldorf education. As is fairly well known, Rudolf Steiner inaugurated Steiner Waldorf education almost a century ago in Stuttgart, Germany. It is perhaps less well known that he also recommended all teachers to carry an exemplar of Schiller's *Letters* in their pockets and read it every now and then for inspiration. He must have seen some relevance of Schiller's ideas about aesthetics and human development for teachers and teaching. In a small publication describing the pedagogical ideas of a Swedish Steiner Waldorf-oriented school we get a first impression of how this pedagogy incorporates chaos into the teaching activities, and also how the formal and sensuous instincts are both stimulated:

> We never succeed as long as we cling to our conceptions of how things should proceed in school. But we succeed if we expect happy and peaceful work out of the children's own inner laws, out of will itself. That is what we trust when we do our outmost not to press the world of consciousness on the children, but cautiously meet this consciousness-world, as if tempting life to unite with the sharp edge of thought and warm it, make it pliable and human. (Ahlbom, Hogervorst, Kanbjer & Löwlie, 1978, p. 56, our translation)

In a mini-study of the same school, based on interviews with some of its teachers, Göransson (2010) makes the actual practice of the school a bit more clear. One teacher is quoted as saying:

> … there is one thing I have learnt over the years that if I come into the classroom and say [claps her hands] "right let's start!" it is like absurd in their world – what do you mean "start"? We have already started we are fully in it. If I think their thing is not good enough, so to speak, so that I want them to start maths because time is so and so and we only have this much time, then it may be very hard to make them feel this joy. Because it is the joy I want, I don't want them to obey me or do what we are supposed to do but they should have the joy to do what we should do. And if I enter and start playing with them and direct the play a bit so that it is not only – well so that it is actually an exercise also and yet play then when I say, "now it is maths" then all of them come. (p. 7, our translation)

In these quotes one senses a strong commitment to the creative forces inherent in play. In order to face and appreciate these forces, the teacher must not be afraid of chaos in any sense of the term. She must be able to hold herself in the middle between order/form/structure/purpose and disorder/chaos/unpredictability. Hence, she must not cling to conceptions of what *should* happen in school. The teacher does not oppose disorder by demands for order; she lures, guides or invites chaos into structures of form, into formative structures. This reflects the Steiner Waldorf ideal of not forcing adult "world orders" (in all possible senses) into children's life earlier than necessary. In

Schiller's terms, we take this to mean that the work of the *formal* impulse, such as the formation of concepts, cannot be allowed to override the *sensuous* impulse until the senses have grasped the material to be learned. We see this procedure at work in Steiner Waldorf science education as well, where the study of natural phenomena always begins with thorough observations, not with theory; since it is held that:

> Attentive dwelling on the observations of the senses enhances the potential of immediate experience to break through the armour of preformed conceptions or ready-made thoughts…. This approach is a good exercise in the discipline of allowing phenomena to speak for themselves, rather than imposing a network of pre-established concepts on them. (Dahlin, 2009, p. 551)

We can see that this ideal translates well in a Deleuze-Guattarian ontology as well. Beginning with sensual observations, we have an opportunity to seize the object's characteristics on more "molecular" levels – paying attention to "micro-perceptions" (Daignault, 2008; Deleuze & Guattari, 1988) – before a "molar" concept is formed and the object finds its localization within a network of significations. However, it is clear that this virtual thought space cannot unfold unless keen attention is maintained during the time of observation. Although self-control and self-discipline are necessary for this, it is not a static condition where the forces of *Form* and *Stoff* cancel each other out; rather, it is a dynamic play where the balance is continuously tipped in favour of one or the other, without any of them gaining the upper hand for longer than a moment.

There are other elements in Steiner Waldorf education that display similar intense qualities. For instance, these qualities manifest in the way alphabet recognition is introduced to children. Steiner education finds it appropriate to make this transition with caution, recognizing that learning the alphabet represents a transition from oral to written language that has a parallel in the transition from a purely oral life, bound to the present moment and personal speech, to a textual and abstract culture which has lost much of these qualities (Ong, 1982).[6] Thus, when teaching the alphabet, each letter is shown to grow out of a living form; for instance, an S may be seen to come out of the neck of (a picture of) a swan. Interestingly, this compares to the way the Irish monks – in some sense inheritors of the oral Druid culture in writing for instance *The Book of Kells* let the letters grow forth out of animal forms and even let these forms turn into accompanying stories that run beside the text itself (cf. Eco, 1989). This seems a nice illustration of how several planes of comprehension are allowed to interrelate, and also, how order grows out of chaos but chaos is never overcome or reduced.[7] Order does not replace chaos but bows to it in reverential recognition of its source.[8]

However, Steiner is not all alone in his ideas about pedagogy for young children. Egan (1988, 1990) describes a pedagogy for the primary level that has many parallels with Steiner's recommendations. According to Egan, oral culture has special tools of thinking, or *bonnes à penser* as he calls them. These should be used in teaching, since children actually live in an oral culture before they have learnt to read. Following Egan, we should try to mitigate the losses that occur in the transition from oral to written culture. Early forms of teaching should therefore be poetic and mythical, and based on storytelling in order to preserve the oral *bonnes à penser*: rhythms, rhymes, metaphors, and stories. Just as rational thinking does not *replace* mythical thinking but develops as a

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[6] Traditionally oral cultures have often been suspicious about reading and writing (Ong, 1982). According to Steiner (2002), the old Druid culture for instance regarded reading and writing as unhealthy in that it caused brooding and introverted states of mind.

[7] It may objected that letting a letter grow out of an animal form is a poor illustration of "order out of chaos" since the animal form is not chaotic but is itself an ordered structure. However, in a relative sense, the animal form is more chaotic than the letter. Or rather, the real animal is a multiplicity of superimposed orders, whereas the letter is monolithic in its structure.

level *above* it, similarly, the teachings of school shall not replace the child's conception of the world but let it grow, expand and develop while remaining as much as possible in contact with its origins. Furthermore, Egan recommends the serious study of the playful logic displayed in jokes and in books like *Alice in Wonderland*. To take an example: "Lessons lessen from day to day, that's why they are called lessons", as Alice is told at one point. Studying such playful logic can make us aware of how meaning is constructed and how it can also be deconstructed, which is an important basis for logical thinking. It may also become a *bonnes à penser* for thinking "rhizomatically" – for letting thought become "a multiplicity, or a pack of connections and associations quite unlike the pure striated reason" (Semetsky, 2006, p. 74).

Conclusions

For Nietzsche, the relation between the artistic impulses of *Dionysus* and *Apollo* were, in the end, one of mutual interest rather than one of bitter opposition. It was in Apollo, "that measured limitation, that freedom from the wilder emotions, that philosophical calmness of the sculptor-god" (Nietzsche, 1909/1923, pp. 24-25) that the natural, unbound force of Dionysus could find its only equal and proper regulator; and it was only in unison that the two impulses could take the art of Greek tragedy to its highest state. We would like to argue that the same advice has validity for the art of pedagogy as well. If we want to navigate a complex course between "unguided learning and planned enculturation" (Osberg & Biesta, 2008) – the Scylla and Charybdis of educational systems – we need to work creatively with chaos as well as order.

We have suggested that Schiller's thoughts on play in the *aesthetic condition*, give some important clues in this direction. In Schiller and in Steiner's educational thought we find an invitation to involve the subject and the object into a process of mutual "reterritorialization" (Deleuze & Guattari, 1988; Semetsky, 2006), in other words, an invitation to let the study material connect and fuse with the student's everyday life experience – which is the very method that Dewey (1902/1956) recommended for balancing the demands of curriculum against the needs of the child. It is clear, though, that we cannot predict how the connections between subject and object, child and curriculum, will develop once we enter the rhizome. We cannot guarantee a result, cannot predict the time interval demanded for success, or on which *strata* the most significant learning may occur; whether it is on the level of signification, on the level of bodily sensation, or along emotional-affective lines of flight. This is similar to what Davis and Sumara (2005, p. 316) has reminded us about complexity, as it "cannot be scripted".

The responsibility of the educator in such a "space of emergence" (Osberg & Biesta, 2008, p. 325) is twofold. First, it involves the opening up onto virtuality. Being the intermediating agent between the child and the curriculum, the teacher has a unique opportunity to unfetter the rhizomatic potential already inherent in the situation – to allow him/herself (and the students as well) to work *with* this transformative potential rather than maintaining predictability at all costs. This, we argue, is the Dionysian element of a virtual pedagogy. It is potentially provocative; rather than "to ensure a desired end is reached with a minimum of fuss," it seeks "to complicate the scene, to unsettle the doings and understandings of those being educated" (Osberg & Biesta, 2008, p. 325). But that cannot be the end of it. Assuming responsibility in this context also calls for an Apollonian momentum; it calls for closure and the formation of molar concepts. Here, the teacher needs to assume co-responsibility not only for development on levels of qualification and socialization, but also (perhaps primarily) for effects on the level of what Biesta (2010) calls "subjectification" – i.e., a change in terms of the student's subjectivity and his way of being human. As Osberg and Biesta explain elsewhere:

> As educators we are responsible not only for the unsettlement (violating, opening) of the one called, but also for the particular one called (which is a closure). In other words we are responsible, at the same time, for the opening and closing of subjectivity. We are responsible for keeping the play in play. (2008, p. 326)

This attitude of responsibility should neither be read as a re-investment in traditional teacher authority or as a token of crypto-conservatism. It is a state of precaution that even Deleuze and Guattari – nomad philosophers par excellence – recommend before approaching the plane of consistency: "… if you blow apart the strata without taking precautions, then instead of drawing the plane you will be killed, plunged into a black hole, or even dragged toward catastrophe" (1988, p. 161). Accepting such responsibility does not mean that we put a hamper on the transformative potential of a virtual pedagogy. It does, however, invite us to acknowledge that 'going for chaos' may not be enough, that an even tougher challenge begins as we try out new forms of organization, order and subjectivity, in place of the previous ones. Neither in the context of educational philosophy nor in life philosophy can we simply "believe that a smooth space will suffice to save us" (Deleuze & Guattari, 1988, p. 500).

Education is, after all, not only about acquiring knowledge, norms and skills, but also about "learning to live." That was Schiller's concern: that we learn to be free by learning to live in the dynamic tension between *Form* and *Stoff* – or, analogously, between Dionysus and Apollo, or in the "state far from equilibrium" where order is constantly reinvented in the face of changing conditions (cf. Prigogine & Stengers, 1985). Here it is worth noting that for Schiller, individual freedom and autonomous action is not based on Reason (as in the Enlightenment and liberal traditions), but on the undetermined and non-determining "aesthetic void", which leaves the human being completely to herself and does not give her any particular inclination in any direction (cf. Rittelmeyer, 2010, p. 98). The teacher, too, has to be able to live in this "void," this "aesthetic condition" in order to know when to assist the student in acts of opening and when to promote acts of closure; when to move further into the virtual and when to come back into the actual.

With that being said, we are in a better position to address the concept of order in relation to educational complexity. It is clear that we cannot do without order as such. At no point in the educational system do we benefit from a total immersion in the virtual side of things, or from a complete collapse of the "principium individuationis" (Nietzsche, 1909/1923, p. 25). We also require that the pendulum swings in the other direction. Whenever an individual student or a group of students needs to gather and focus different faculties of mind – in the aesthetic condition or elsewhere – self-discipline as a manifestation of the "Apollonian instinct" may be needed to stabilize the boundaries of exploration. This is, we argue, discipline at its finest, a most valid educational expression: as a mode of perseverance that helps us lock on to, and *unlock*, the different layers or strata that belong to a particular learning situation. Complexity can, no doubt, be found on many levels even in an apparently simple and straightforward system; and if discipline, as a mode of perseverance employed by the actors in this system, may prove helpful for securing the amount of time or space necessary to gain access to deeper levels of complexity, it has also proven its worth. But if we want to pursue this quest in correspondence with the lessons learned from complexity and chaos theories, we also need to remember that in a complex learning system, boundaries cannot remain fixed, the centre must be flexible, and order must be of the adaptive kind.

In retrospect, as we recall this article's initial point of departure in 'neo-disciplinary' educational policy, such lofty ideas may indeed sound like just another 'edutopia' for the 21st century (cf. Peters & Freeman-Moir, 2006). When trends in mainstream educational policy rather seem to encourage further segmentation in the form of better and more frequent testing procedures, output maximization, and state control (Green,

2006; Larsson, Löfdahl & Pérez Prieto, 2010), why should we spend our time approaching elegant notions such as Schiller's "aesthetic condition", or Deleuze and Guattaris concept of "smooth space"? Precisely because they provide a counter-measure – or 'anti-measure' – brought to bear on education's performativity culture (Ball, 2003). Precisely because finding a way to increase complexity, or a way to *realize* a complexity that is always at hand, does not always have to involve grand designs of revolution; it can also find realization in the small resistances, common negotiations and perspective changes that occur on a daily basis in our schools – and in our lives. It is on the basis of this understanding that we, in fact, may be warranted to encourage utopia as "an invitation to think, dream and consider possibilities in a cognitive context that is free from the usual constraints imposed by the now" (Peters & Freeman-Moir, 2006, p. 4). In other words, it is to approach the virtual.

In order to prepare for this undertaking, there are some things important for consideration. Should we refrain from rigid forms of stratification, and instead open up towards the virtual side of the educational process, we (as teachers and students) cannot rely exclusively on the authority of discipline. In order to open a horizon to the attainable, we may have to engage in interaction with Dionysus; we may have to achieve some relativization of the "principium individuationis". Once attained, the balance is not set; it is a state far from equilibrium, a matter of ongoing negotiation, a *plateau*. Striving towards this plateau was the task for Dewey in his time; it is our task too; and likely, it will be the task of future philosophers, teachers and researchers of education as well.

What better point of departure then, what better place to start, than in Schiller's domain of *Spiel*? Where can we lose just the right amount of weightiness needed for a fresh start if not in his aesthetic void, where creation is for the sake of creation, learning is for the sake of learning? Where can we succeed, if not in the realm of play? Of course, we have to remember, that sometimes play is dead serious.

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