Who cares about mathematics?

On the ritual fabrication of mathematical knowledge

Sverker Lundin, 2013-05-05

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Abstract

This article starts with a critique of the notion that modern mathematics education teach children and youth useful knowledge. I argue that mathematics education not only works poorly, but that recently won insights in the fields of (1) sociology and history of science and technology, (2) anthropology of everyday life and (3) epistemology suggest that it *cannot* work in its present form. The main question is thus: What does it do? A tentative answer is constructed with the help of the anthropologists Bruno Latour and Roy Rappaport, the psychoanalytically inspired philosopher Robert Pfaller, the sociologist Paul Dowling and the theologian and historian Ivan Illich. In the second part of the article I analyze the *form* of mathematics education, and show that it fits with a certain definition of ritual. The third part describes a number of *messages* that mathematics education transmits by means of this form. Shortly, these messages, transmitted by education, say that *mathematics* is a powerful presence in the world and that *mathematical knowledge* is something that all people need, but have only in varying degrees. In the fourth part I introduce concepts from Marxist critique of ideology and psychoanalysis, to show how these messages work. People do not generally "believe" in them. Mathematics education instead have ideological effects by means a complex process of identification and disidentification. I show that mathematics education results in a *demand to love mathematics*, and that a number of peculiar features of mathematics education can be understood as attempts to *evade* this demand. The typical stance towards mathematics in modern society is thus to *want* not to care about mathematics, but succeeding only partly in the endeavor. The question is then: Who cares about mathematics? In the last section I argue that mathematics education should not be understood as oppressive nor as emancipating, but as a particularly modern *form of antagonism.*

1. Introduction

Functionalism and the standard critique

In modern society, the education system is generally taken to serve the purpose, more or less well, of providing the citizenry with useful knowledge. This view of education is sometimes called “functionalistic”, because it assumes that there are certain kinds of knowledge that are particularly useful and that the education system fills the function – more or less well – of teaching such knowledge (Lave 1997).

Useful knowledge is supposed to be produced by science, and it is therefore in particular *scientific knowledge* that stands at the center of the education system. Mathematical knowledge is perhaps the primary example of such knowledge.

While the functionalistic view of education is part of modern common sense, it is not all that easy to understand the underlying idea. For once, it is important to not confuse knowledge, in this model, with *information*. It is easy to see the value of information, about life and the world, being collected by science and provided to students through education. However, information is not knowledge. Nor should knowledge be confused with *technique*. Most people adhering to the functionalistic view would consider it crucial to sharply distinguish between knowledge and technique. On the other end of the spectrum, it must also be noted that knowledge is not the same as *wisdom* – a term seldom used in connection to modern education.

Knowledge is multi-purpose. Informally, one might say that it stands between two other central notion in modern discourse on education: *understanding* and *competence*. Understanding stands for the ability to make sense of something. Competence stands for the ability of doing something useful. Both are contained in the concept of knowledge.

The underlying idea seems to be that that science provides *kinds* for knowledge. At least this seems to be the case in regard to mathematics education. Given the general concept of knowledge, mathematics constitutes a delimitation, a form. It is this form that is provided by science. Given this form, it makes sense to see education as “filling it”, for each particular student. This “filling” would then amount to what is commonly called *learning*.

Adherents of a functionalistic understanding of education might find this metaphor, of “form” and “filling”, unfit for making sense of learning. A reason for this could be that it lies close to another metaphor, that is often criticized, namely that of “transmission”, or of seeing the mind of the student as consisting of “boxes”, that are to be “filled” in school. This is not how modern education is supposed to function.

In *Metaphern der Pädagogik: metaphorische Konzepte von Schule, schulischem Lernen in pädagogischen Texten von Comenius bis zur Gegenwart*, the German historian of education, Alexandra Guski (2007), collects and compares the many metaphors for learning that has been employed since the 17th century. She concludes that there is a rather constant set of metaphors that are preferred in modern education, namely of: growth, development, building, elevation and travel. Characteristic of these metaphors is that they envision learning as gradual processes where the learner, at least to some extent, plays an active role.

My metaphor of form and filling can be reconciled with any of these metaphors, if it is recognized that learning as growth, for instance, is necessarily restrained by the subject matter that is learned. If it is mathematics that is learned, it is of course mathematical knowledge that must grow. For this metaphor, it makes sense to see mathematics as, for instance, a particular kind of tree, say a birch. In the same way as birch has particular properties, different from other kinds of tree, mathematics bring particular properties to mathematical knowledge that makes it different from other kinds of knowledge. The “filling” can in this metaphor be envisioned as a comparison, between the tree of the student, and a sort of model tree, provided by science.

I draw here on the philosopher Ian Hacking and his analysis of “kinds” in *The Social Construction of What* (1999). Hacking distinguished between *natural kinds*, such as for instance (supposedly) birch, sun and electron, and on the other hand *constructed kinds* such as mobile phones and democracy. In this terminology, most proponents of mathematics education would probably consider mathematics to be of the natural variety, but that does not really matter. The important thing is that it is considered to be a kind, that can lend particular properties to knowledge. In the case of mathematics, the kind lends knowledge good properties that makes it particularly useful, both for understanding, and as competence.

The Standard critique 1 – Smith, 1900

This view of the relationship between science and education opens up for a certain type of critique. When the properties of particular kinds of knowledge are taken to derive from science, it is close at hand to compare these properties with those of the *actual* knowledge that students acquire in school. Such comparisons usually turn out very unfavorably for education. Typically, the knowledge that students acquire seems to be substantially less useful than the kind, provided by science, suggests that it should be. Since the properties of the kind are taken for granted as given, in this comparison, the inevitable conclusion is that something is wrong with education. Sticking to the metaphor of growth, it is something wrong with the garden

In a recent article I analyzed an extreme form of such critique in terms of what I then called “the standard critique” (Lundin 2012a). I provided numerous examples of such critique in that article (see also Lundin 2008, 24–34). As a further illustration, listen from the introduction to David Eugene Smith’s *The Teaching of Elementary Mathematics* published at the turn of the 19th century:

> Arithmetic is universally taught in schools, but almost invariably as the art of mechanical computation only. The true significance and the symbolism of the processes employed are concealed from pupil and teacher alike. […]
>
> The subtlety, delicacy, and accuracy of mathematical processes have the highest educational value, both direct and indirect. To treat them as mechanical routine, not susceptible of explanation or illumination from a higher point of view, is to destroy in large measure the value of mathematics as an educational instrument, and to aid in arresting the mental development of the pupil. (Smith 1902, ix)

We see here how problems of *education* (”mechanical computation […] arresting the mental development of the pupil”) are contrasted with a supposedly powerful potential residing in *mathematics* (”subtlety, delicacy, and accuracy […] have the highest educational value”). This quote is typical for the standard critique, in that it takes education to actually pervert the properties of mathematics, almost into their opposites.

The functionalistic model of the relationship between science and education sketched above might have seemed somewhat far-fetched, perhaps even tending to the metaphysical. Is it really necessary, one might ask, to talk about “kinds” to understand modern education? I take the abundant presence of the standard critique, in the history as well as in present day discourse of mathematics education, to testify to this necessity.

As the anthropologist Jean Lave points out, the separation of modern education into “subjects” is founded on “widely shared assumptions about the cognitive basis of continuity of activity across settings” (1997, 4). Each subject provides a particular *kind* of knowledge. Lave describes these kinds of knowledge as “coherent islands whose boundaries and internal structure exists, putatively independently of individuals” (1993, 43). The idea is that “subject knowledge”, for instance mathematical knowledge, will constitute a tool (of many) that the successful student will bring with her, from school to life after school. In this metaphoricity, science is taken to have *designed* the tool. The task of education can then be understood in terms of the construction, or fabrication, of a *real instance* of the tool, for each individual student to use.

The point of departure for the standard critique is a strong faith in the scientific “design” of mathematical knowledge, its mathematicity lending it very fine properties. These properties are taken as invariant and stable, certainly beyond questioning. They constitute the ideal with which real instances are compared. As they do not compare well, the machinery of fabrication is put into question.

<u>The Standard Critique 2 – Popkewitz, 2010</u>

Most instances of the standard critique are somewhat hyperbolic, mainly serving the function of lending extra force to suggestions of how to do things better. The quotation from Smith (1902) above belongs to this category. Here is a present-day example:

> As a teacher, you will have the awesome responsibility of helping *all* of your students construct the disposition and knowledge needed to live successfully in a complex and rapidly changing world. To meet the challenges of the twenty-first century, students will especially need *mathematical power* […].
>
> Unfortunately, the mathematics curriculum, the instructional practices and assessment methods that you might be accustomed to […] are generally not effective in promoting children’s mathematical power. (Baroody and Coslick 1998, vii)

However, the functionalistic understanding of education and the type of critique it facilitates can also be found in much more sophisticated accounts. For instance, Tom Popkewitz (2010) recently talked about the “processes of translation that produce school subjects” and conclude that they “never merely replicate the original”. Even though one of his main points is that school subjects are “acts of creation”, he nonetheless, throughout the article, gives priority to science as that which education ultimately should take as its point of departure. He writes that:

> Pedagogy is a practice that converts the practices of mathematics, for example, into concepts related to the psychology of the child and learning, systematizing particular strategies about what is recognized and enacted as classroom experiences.

Popkewitz here claims that practice of schooling is a “converted” versions of the practices of mathematics. Thus, what students do in school is conceived of as modeled on what scientists do at the university. The argument fits the form of the standard critique because it derives strength from difference. Thus, educational psychology functions as a wedge, in Popkewitz account, separating the activities of schooling and science. Education is even further removed from science in its ambition to “use” the subjects to promote values such as democracy and civic virtue, instead of having subject understanding as its prime focus. Therefore,

> In the instance of teaching school subjects, the rules and standards of conduct taught in the name of school subjects […] have little relation to the disciplinary norms of participation, truth, and recognition of academic fields assigned through the naming of school subjects, whether it is mathematics, physics, or history.

Despite the fact that Popkewitz provides a sophisticated analysis, both of science and mathematics, drawing on work in the field of science studies (eg. Latour 1999; Knorr-Cetina 1999), and of education, he nonetheless reaches a conclusion very similar to that of the standard critique, namely that education needs to be reformed, and that such reform should take science as its point of departure.

Problems with the functionalistic understanding of mathematics education

From the perspective of a functionalistic understanding of mathematics education, the analysis that will be presented in what follows may seem to be off topic. I say almost nothing about how the citizenry of modern societies are to be provided with the mathematical knowledge that they, according to this perspective, obviously need. From this perspective, mathematical knowledge seems to be a necessity. An analysis that does not take this need into account must thus, from this perspective, seem to be irrelevant if not irresponsible.

One way, of several, to characterize modern mathematics education is to say that it is founded on four interdependent assumptions. Firstly, that mathematics is an abstract power driving development in science and technology; secondly that access to this power is necessary for successful participation in modern professional and everyday life; thirdly, that this power can be present as a resource in people, independently of time and space, as well as situation and social context; fourthly, that this presence can be established through activities separated and different from those where the power is to have its effects.

The present state of research in the relevant fields present serious challenges to all of these four assumptions.

The sociology and history of science…

Anthropology of everyday life…

Epistemology…

The sociology and history of education…

Because of this, I take it as background knowledge that mathematics education, in the form suggested by the standard critique, *cannot* work (see also Lundin 2008; Lundin 2012a; Lundin 2012b; Dowling 1998; Walkerdine 1988). There is simply no such thing in the world as that mathematical knowledge or competence that it tries to bestow on its pupils. There is no kind of knowledge, constituting the design of a tool, that can be used as a blueprint for teaching, understood as a process of building.

I will thus not be concerned in this article with the "failure" of mathematics education. Putting it sharply, from my point of view this would amount to something like analyzing a rain-dance with the tools of meteorology. Instead, my question is how mathematics education *can seem to make sense* and *why it is actually practiced and supported*, despite the visibility of both its dysfunctionality and its great costs – in terms of time, suffering and of course, money.

Theoretical resources

I will here briefly present five scholars, the works of which constitute my main theoretical resources.

<u>Paul Dowling</u>

The English sociologist Paul Dowling (1998) demonstrates how a series of mathematics education textbooks "mythologize" everyday life, by describing it as if mathematical knowledge was needed for it to handled properly. Dowling calls this *the myth of participation*. It is the myth that mathematics "participates" in the activities of everyday life. Dowling also talks about a corresponding *myth of reference*. He found that it was propagated mainly by another variant of the textbook series that he analyses, written for the more able pupils. This myth suggests that knowledge of mathematics is in fact, in some sense, knowledge about reality. A central concern for Dowling is self-referentiality. He argues that mathematics education claims to refer to reality and science, while it in fact only refers to an imagery of its own construction.

The analysis presented in this article is intended to complement that of Dowling by bringing into view the role the textbooks that he has analyzed plays as part of what I will call the *form* of mathematics education. I want to complement Dowling's analysis of myths, with an account of their corresponding ritual. I have already tried to take some steps towards a better understanding of the meaning-producing effects of the practices of mathematics education (Lundin 2008; Lundin 2012a; Lundin 2012b). This article is a continuation of that work.

<u>Roy Rappaport</u>

My primary theoretical resource in this article is the American anthropologist Roy Rappaport, and the ideas he presented in his *Ritual Theory in the Making of Humanity* (1999). In the next section I will present his definition of the ritual *form* and show that it fits with the organization of modern mathematics education. The specificity of his definition allows for a detailed understanding of the mechanisms of its meaning production. The produced meaning is then analyzed in terms of two different kinds of *messages* which are transmitted mainly be means of *enactments of meaning*, that is: the messages of mathematics education are transmitted by means of people participating in mathematics education acting almost as if they were performing a play, *demonstrating* the properties of mathematics and mathematical knowledge. My analysis in this first part of the article will focus on the difference between on the one hand *ritual as productive* of meaning, and on the other hand, *the meaning* thus produced. I will bring out this difference by first describing what I will call the fabrication of grades – that is, the range of mechanism within the education system by which grades in mathematics are established as an exact and reliable measure of relative strength. I will then contrast this machinery, established by convention, with its message about what it is and what it does.

Bruno Latour

[Introduction to Latour here]

Robert Pfaller

In section 4 I raise the level of abstraction somewhat, with a consideration of how the meaning produced by ritual is *related to*, by performers and outside observers. I here introduce the work of the German philosopher Robert Pfaller. Following in this section the argument of (Lundin 2012a) I introduce the notions of seeing-through, faith and the impetus for reform. They derive a somewhat new significance against the background of Rappaports ritual theory. The basic idea is that the meaning produced by mathematics education is reflected back on its performers (and others) as a kind of obligation – an obligation to *desire* in a way that follows the logic established by its ritual form. The point of the argument is that the activity of mathematics education can be understood as an attempt to satisfy this demand for *seeming* to desire mathematics; it is a play to the gallery, with the twist that there is nobody there to watch. We are, basically, fooling ourselves with mathematics education, into believing that we care about mathematics. It is a public show that we have set up (to the misfortune for children and youth), so that we can relax and think whatever we like as soon as we leave schooling behind.

Ivan Illich

My approach here builds on the work of the philosopher, historian and critic of modernity, Ivan Illich. While Illich is mostly remembered for the radicality of his position, he in fact presents a historically founded and theoretically sophisticated – if brief – analysis of modern schooling (Illich 1972; Illich and Cayley 2005). He suggests that modern schooling is a ritual and that it thus is productive of meaning. This meaning circularly makes schooling itself seem necessary. The main mechanism for this to happen is the establishment of a certain idea of knowledge, namely as a *scarce resource* that can only be produced by the particular activities taking place within the education system. According to Illich, we moderns are schooled into believing that we have the experience of formal education to thank for that which we know. Illich thought that this amounted to a confusion of process and product. A necessary first step towards the establishment of more fruitful activities of education would thus be the unmaking of this confusion. Illich knew much about church history, and when he talked about deschooling he thought about the relationship between church and state. He saw the education system as the church of modernity. Compulsory schooling thus corresponds to compulsory church attendance and in short: an obligatory relation. Illich was a Christian, but he insisted on Christianity being a *possibility* that must be chosen freely. He thought that the same holds for science. According to Illich, education must be a possibility. When it is made into an obligation it becomes, as he said, *perverted* (Illich and Cayley 2005). The deschooling of society would amount to a disconnection between state and school, as we have previously disconnected in modern societies the state from the church.

2. The ritual form

First I follow Rappaport in defining what a ritual looks like and show that it fits well with mathematics education. I then provide a rather detailed description, in the style of Bruno Latour, of certain features of mathematics education that result in an exact and stable, one-dimensional *order* among pupils. The manner in which this order is fabricated will play a central role in the argument of the following sections.

Definitions

1. An order established by "others"

The first defining feature of the ritual form is that participants follow a course of action to some extent established by others than themselves. Rappaport expresses this as follows:

> [t]he performers of rituals do not specify all the acts and utterances constituting their own performances. They follow, more or less punctiliously, orders established or taken to have been established, by others. (32)

This description fits well with schooling in general and mathematics education in particular. That pupils are not free to do what they want in the classroom is clear – but one should remember that this to large extent also holds for teachers. Together, pupils and teachers ”perform” mathematics education, and despite local variations, a modern observer would have no problem identifying this performace *as* a performance of mathematics education. There are pre-established roles that teachers and pupils assume, structured by the classroom, teaching material, curricula, assessments, by teacher training and, of course, by the teacher – informally and probably most often unconsiously – adopting patterns of action from the teachers they had when they were pupils. Pupils are schooled into taking this activity of schooling for granted, and if they become teachers they pass it on to the next generation. Of course the practice of schooling changes! The point is not that it is stable in time (see below), but that mathematics education, at a particular time and place, is performed in a particular way; that those doing it has no choice but to accept this way of doing it.

Neither pupils nor teachers are *allowed* to depart very much from these preestablished patterns of action. It is well known that standardized assessment, beyond the control of the teacher, effectively restricts the space of possible teaching activities; national education systems also often employ inspections to prevent unwarrented deviation. To this can be added the stabilizing effects of parents, if not the pupils themselves, who ”knows” what mathematics education is supposed to look like. If the teacher deviates to much from what is taken to be a ”good” or ”standard” performance of mathematics education at a particular time and place, this will lead to sanctions from a range of different directions and, ultimately, to preclusion from teaching.

The point is that mathematics education is something you enter into as a whole, where what you say, what you do and the circumstance in which this takes place fits snuggly together. You cannot pick and choose the pieces that you like: either you accept it as it is, or you have to reject it wholesale. And alas, as a pupil you have to accept it, wether you like it or not.

2. Formal, puncilious and repetitive: special place, special schedule.

Secondly, rituals are formal and often repetitive. Rappaport writes:

> Behaviour in ritual tends to be punctilious and repetitive. […] Rituals are performed in specified contexts, that is, they are regularly repeated at times established by clock, calender, biological rhythm, ontogeny, physical condition, of defined social circumstance, and often they occur in special places as well. (33)

It should not be difficult to establish a high degree of correspondence also between this part of the definition and modern mathematics education. The activity of the pupils is carefully monitored by the teacher, and what pupils most often do is to solve problems (Lundin 2012a; Lave 1993). It does not matter at this point if these problems are provided by the teacher or if the pupils retrieve them from their textbooks. Pupils move from problem to problem and while the mathematical content, the level of difficulty and the connotations of the problems shift, the form of the problem solving activity remains the same. Pupils' solutions are compared with the ”right” answer, either by themselves or by the teacher. It all takes place in a special place, the school and the classroom. On a somewhat larger timescale this activity follows an explicit schedule, where the day is divided into lessons and breaks, the year into semesters and courses, comprising a smooth movement, interrupted only by particularly important tests deciding who has to get off and who can continue.

The first point here is that mathematics education is separated from the rest of society and that this allows it to follow its own logic and its own dynamics. The second point is that this logic and dynamic is particularly clear, if not even *clarifying*, because of its formality. In the world of mathematics education it is much more clear than in other parts of society, both what you are supposed to do, the criteria of evaluation of performance. Furthermore, constant supervision constantly serve to established to what extent each and every participant manages to comply with these criteria.

3. Invariance in space (more or less), stability in time

Thirdly, rituals are *more or less invariant in time and space*. Here ”more or less” fills a crucial function for the argument. On the one hand it should be clear that mathematics education in some respects is invariant in both time and space. This invariance is sustained by means of a host of mechanisms, such as the design of the classroom, standardized and mass-produced teaching materials, standardized assessments, centralized teacher training, curricula, centrally regulated inspections and so on. It should be noted that this invariance did not happen by chance. On the contrary it is the result of sustained efforts of centralization and standardization, primarily in the first half of the 20th century (cf. Porter 1995; Desrosières 1998). Furthermore, the education system does not just lie there, holding together: The homogeneity and stability of the education systems is the result of continuous work on standardization and prevention of deviation.

On the other hand mathematics education contains a certain measure of variation. Rappaport argues that it is characteristic of rituals that such variation is part of its regulated performance (36). In the case of mathematics education such variation emerges primarily as a result of pupils varying ability to produce satisfactory solutions to the problems they are faced with in the classroom. The ritual is invariant in that all pupils are *faced* with (similar) problems. Variation emerges in the answers. One could say that the ritual results in a sort of clarification. If pupils outside school have a range of vague similarities and difficulties, this is boiled down, by ritual, to *one* particular difference. The invariance of ritual practice makes it possible to exactly *measure* this difference in a way that allows for comparisons between pupils that preserve their validity through movement in time and space.

The interplay between invariance and variance will repeatedly come in to the argument at crucial junctures in what follows. Invariance is crucial for making mathematics education into reference point, a constant, reliable and seemingly natural background. Agains this formalized background, individuals stand out in sharp contrast through their formalized performance.

4. Performance

Furthermore, Rappaport writes:

> Liturgical orders are realized - made into res - only be being performed. (37)

The point here is to distinguish ritual from instructions and information found in books or manuals. Such may of course affect its reader – perhaps even many readers – but this is still something crucially different from a ritual actually being performed. The ”messages” that I will soon come to are messages of ritual as performed. While parts of these messages sometimes come to explicit expression within the ritual, their discursive content are not identical with that which is expressed by the form of the performance itself. In a way that cannot be easily compared with the effects of written text, the *power* of the messages produced by ritual depends on the number of people that takes part in its performance and the time, resources and effort that is invested in it. In a cultural comparative perspective, mathematics education is a massive ritual: everybody are obliged to participate, several days a week, most often for more than a decade.

5. Non-efficiency

Rappaport's fifth point concerns instrumentality, and he says that rituals are, in some sense, formal rather than effective. Rappaport does not provide any concise definition of this point. Instead he discusses the complex and in many ways problematic relationship in between the field of anthropology to the ”non-functioning” of ritual. Early anthropologists (working around the turn of the 19th century) did not hesitate to ascribe to what they called ”magical thinking” to the ”primitive” people and cultures that they studied (cf. Latour 1993, 102). Characteristic for this magical thinking was, according to the anthropology of that time, an erroneous conception of the efficacy of ritual. For instance, the belief might have been imputed to the performers of a rain dance, that this dance actually had the capicity to produce rain. In the course of the 20th century, anthropologists increasingly came to realize that performers of ritual to not generally entertain such beliefs – at least not in any unambigous sense. While there are of course crucial differences between ”primitive” and ”modern” cultures and societies, anthropologists of today (such as Rappaport) do not generally hold that the presence of belief in the occult efficacy of ritual as a very good way of making the distinction.

Nonetheless, in so far as ritals are performed, and an observer can easily see that the ritual does not in fact have the effects that are purportedly aimed at, and if the performers do not even themselves believe in such efficacy, the question is of course: why is the ritual performed at all? Rappaport holds that the relationship between ritual performance, its proclaimed goals, its actual effects and the ”beliefs” of performers, is a complicated matter.

In the case of mathematics education, the complicated relationship between performance, efficacy and belief come to expression in the contradiction between the two messages of the ”standard critique”. Mathematics education seems to carry a promise to deliver modern society from some of its most frustrating evils: incompetence, incomprehension, low self-esteem, segregation, unemployement, poverty and the like. From the very historical start of mathematics education, its proponents have tried to gain control over this delivery. They have tried to understand what mathematics education should look like for its aimed at effects to materialize. And while they have not succeeded in gaining such control, they have neither been very open to revise their fundamental assumptions concerning mathematics education on the basis of experience. Quite to the contrary they have been possessed by one particular vision of it, the vision expressed in the standard critique: In the face of failure they time after time come to the conclusion that their predecessors have not been able to arrange for a proper performance of mathematics education. They never question the very possibility of this type of activity actually having the great effects sought for.

In fact, the relationship between the proclaimed goals of mathematics education and its actual results is thorougly unclear, in a similar way as the relationship between a rain-dance and the event of rain. And do we moderns believe that mathematics education work? Well, not in general, no. That is why we insist on the necessity of reform. It is exactly this complicated relationship between proclaimed goals, actual results and belief that Rappaport refers to in his definition of this aspect of the form of ritual.

The fabrication of a strength-relation

The act of solving a puzzle

My basic unit of analysis here is the situation in which one single pupil works on one single problem. Following the terminology of Thomas Kuhn (1962), I will call the problems worked on in mathematics education *puzzles*. Kuhn refers to them as “that special category of problems that can serve to test ingenuity or skill in solution” (p. 36). The outcome of the puzzle can be “anticipated, often in detail so great that what remains to be known is itself uninteresting”, but far from making puzzle-solving uninteresting, as any puzzle-solver knows, this may very well have the opposite effect of enticing fascination and devotion. In so far as “the way to achieve that outcome” (ibid.) is on the one hand unknown, but on the other hand seemingly within reach, this solution can function exactly as a lure, attracting the researcher (in the case of Kuhn), or pupil (here), to pursue it (cf. Lundin 2010).

School is in several ways set up for puzzle-solving. It is separated from the goings on of social practical life; the pupil ideally sits *still*, *silently,* when encountering the puzzle, with a *zeroed mind*; there is *time* for this particular kind of work. The puzzle is found, presented, in a way encountered, as a natural part of the school environment; it is supposedly self-contained and explicitly posed as “a question from nowhere” (paraphrasing Ernst Nagel), having exactly one solution, supposedly within the reach of the abilities of the pupil, calling upon the pupil to respond.

It is tempting to see this situation as particularly suited for *abstract* work, perhaps related to a *rational* world of mathematics. I think that is a mistake. The activity taking place in this setting is no more “abstract” or “rational” than activities taking place anywhere else. As Valerie Walkerdine notes, school work takes place in a *specific* set of practices (1988, 187), it is a specific kind of work. Characteristic is rather its *separation* from other practices in society, and the relative lack of physical movement in the school setting, as work is usually performed *sitting* (with minimal access to technological resources, cf. Hutchins 1996)). It is also tempting to see it as *neutral* in relation to the rest of society – equally open to *any* kind of learning, as suited for the production of *objective* knowledge. This is also a mistake. Insofar as it is seen as abstract, rational, neutral and objective this should rather be interpreted as an the consequence of a successful imposition of an imagery of schooling produced by schooling itself, where the highly specific features of its setting is universalized and seen as, in principle, no setting at all. Again, the analysis of Kuhn is useful. What I suggest is that a particular *paradigm* of modern schooling is taken for granted, and that this taken-for-grantedness makes its specificity invisible for its participants and (modern society) observers (Kuhn 1962; see also the analysis of "skhole" in Bourdieu 2000, 10).

In this setting, the pupil encounters a puzzle, works on it, and suggests a solution. Disregarding here a variety of other possibilities, I will stick to what is most common, namely that this suggestion is put, by the pupil herself, as what I will call a *response-mark* on a piece of paper.

Moving on now to what happens after the production of this response, it is necessary to distinguish between two typical possibilities: puzzle-solving as training and puzzle-solving as assessment.

When puzzles are solved for the purpose of training, the response-mark may be compared, by the pupil herself (or a teacher), with a response-mark established as the *ideal response* for this particular puzzle. Characteristic for the training setting is that the comparison between the pupil's response-mark and the ideal is taken note of only informally. It may result in a written *result-mark*, but then nothing further is done with it.

When, in contrast, puzzles are solved for the purpose of assessment, the comparison between student response and ideal response is always performed by an expert – a teacher, sometimes with the aid of assessment criteria specifically designed for the puzzle at hand. Possibly aided by such criteria, the teacher performs a *judgment* of the pupil's *result* on this particular puzzle. This result is put in what I will call an *archive*, for the student, where such results are accumulated.

It is important to note the *materiality* of this process. It connects clearly to what Rappaport writes about ritual:

> [In rituals] incorporeal qualities, in their nature only vageuly metrical and certainly not numerable, are given a form that is not only material but clearly metrical, like number of pigs, coppers, and copper plaques.
>
> […] in instances in which claims are made concerning valued states or qualities themselves devoid of essential physical properties (e.g. prestige, worth, valor, "bigness") the sign must be substantial (e.g. thirty-two pigs given away) if it is to be credited. If the sign for such qualities were not substantial it might be discounted as mere words: vaporous, boastful, "hot air." (Rappaport 1999, 86, 56)

Mathematical knowledge is exactly such an "incorporeal" quality that is translated, through the performance of ritual, into material and metrical form – as marks on pappers, supposedly the result of a measurement against mathematics itself, the teacher only functioning as an insignificant mediating link.

Of crucial importance is that in both training and assessment, the response of the pupil is inconsequential on the level of practice. Whether the comparison with the ideal response takes place immediately, or with some delay, the puzzle-solving activity ends with a “zeroing” of the mind, a clearing of the particularities of the puzzle, the pupil remaining in the school setting, continuing the activity of puzzle-solving. This activity will of course at some point end, but it will (typically) do so independently of the responses produced by individual pupils. Firstly, it should be noted how this inconsequentiality of responses contributes to the specificity of the puzzle-solving activity, making it thoroughly different from most other practices in which choices have immediate practical consequences.

Secondly, this makes *reacting* to the result a purely subjective and individual matter. In an extreme case it may happen that no comparison with the ideal response is even made – since this comparison fills no practical function for the school work. In a less extreme case, the pupil may note the discrepancy between her response and the ideal only in passing. The point is that, while the comparison makes it possible for the pupil to try to *adapt* to the puzzle-solving activity, by trying to understand why her solution did not correspond to the ideal, this is thoroughly optional. In fact, since the ability to produce appropriate responses will have crucial consequences only much later, I think that the ability to anticipate this, and thus to take this activity *seriously*, even though it is structured as if the responses were of no importance, is crucial for adaption to take place. Thus, adaption (i.e. “learning”) is highly dependent on an understanding of the importance of taking it seriously, in face of the fact that the message of the activity – in the sense of Rappaport – on a smaller time scale, because of the practical inconsequentiality of how you response to the puzzles, is that there is no reason to take the activity of puzzle-solving seriously.

It should be noted that the “work” performed in the puzzle solving is “formal” in exactly the sense suggested in the fifth part of the definition of ritual. It is suggested by the form of the puzzles that this work is a kind of acting *on* and *in* reality. But this work does not have the effects suggested by its significations. As “real” problem solving, school work is utterly inefficient.

Puzzle-solving repeated in time

For an individual student, this procedure of puzzle-solving – as training or assessment – is *repeated*. Following the lead of Kuhn I will call this sequence of instantiations of the procedure described above *normal school-work* (as in “normal science”). It consists mainly of puzzle-solving of the training-variety, with shorter sequences of assessment puzzles-solving, the results of which are put into the student’s archive. In this chronological perspective, what the student works with is a *sequence* of puzzles. This sequence is not exactly homogeneous, but rather *homogeneously changing*, in that the puzzles become increasingly difficult to solve. It thus poses an expectation of increasing ability on behalf of the pupil, an expectation of adaption. Of crucial importance is that the setting remains stable, throughout this process of training, assessment and (possible) adaptation. Again it is worth noting how the performance of the pupil do not in any substantial respect influence the characteristics of activity. Another way to put this is to say that the impact of the *judgment* of the pupil is restricted to the production of responses to the sequence of puzzles; this is the only way through which the individuality of the pupil becomes known. One may take not here also of the importance of *invariance* of the judgment of the teacher(s) throughout the process of normal school work to ensure comparability and addibitility of the results put in the archive.

Puzzle-solving repeated in the collective

Puzzle solving is not only repeated in time, for an individual pupil, but also with in a what I will call a *cohort* of pupils. In mathematics education, comparability is not only aimed for between results produced by a single individual pupil at different times, but also between the results of different pupils on the same puzzle. In general, this is achieved by all pupils working on a relatively homogeneous *set* of sequences of puzzles in a setting that is invariant in space; important is of course also the invariance of the judgment of teachers.

Normalization

While a host of mechanisms work towards achieving stability and invariance in all these regards, one that is of particular importance is what in Sweden is called a "national test", which has the function of what I will call *normalization*: A particular set of puzzles are distributed to all pupils in a cohort who work on them simultaneously. To raise the level of comparability of the results on these puzzles, the teachers are often provided by unusually extensive aids for assessment. The results are then collected and compared with each other. For each puzzle, the relative frequency of correct answers in the cohort is established. This frequency is used as an exact measure of the value of a correct answer to the puzzle in question. The *normalization* then consists in the ascription to each particular pupil, the value resulting from the addition of the values of the correct answers produced by the pupil. This value is then put in the archive, together with the other results.

Abstraction

I will call *abstraction* the process by which results in the archive, through the judgment of the teacher, is summarized. This occurs in several steps: results on individual puzzles are summarized as *scores* on tests, comprising a sequence of puzzles; test scores are summarized as *course-grades*, which are summarized as a (final) *grade* in mathematics. In this process, the shifting particular contents of the many puzzles solved is disregarded, as well as of course the particularities of the puzzle-solving work. Again, by a host of mechanisms, in particular that of *normalization*, this process of abstraction is made stable and invariant. Through the process of abstraction, a set of results residing in the archive of the student is replaced by an assessment, from then on *representing* their worth or strength in comparison with all other pupils in mathematics education.

Trials of strength

What is the point of all this? The process of normal school work is, at a few points, interrupted by *crucial* situations, crossroads where it is to be determined if and where the school work is to continue. In the Swedish education system we have mainly to such crucial situations; the step from primary to secondary education and the step from secondary education to the university. At these critical junctures the pupils in a particular cohort are compared to each other in what can be called a *trial of strength*, represented by what is in their respective archives – often, as the result of abstraction occurring soon before such events, in terms of a set of grades. Mathematics education here fills the humble function of being one of these grades, but in many cases a grade given particular importance by the rules of the trial. Mathematics education provides information about the extent to which pupils have become "an expert puzzle-solver" (Kuhn 1962, 36).

What is decided in these crucial situations is basically what kind of normal school work that each pupil is to pursue in the future, with the possibility that the school work for some *ends*. Trials of strength thus decide on the one hand where the normal school work of each pupil will take place and what it will consist in, and on the other, for how long the pupil is allowed to remain within the education system. The point is that, the end-points of education constitute what might be called an *interface* to other parts of society, in particular work life. Often in terms of an *exam*, which is a further step of abstraction after grades, you may get from the education system a key, fitting with the locks of a particular profession.

The conventional nature of mathematics education

It should be clear that these trials of strength are thoroughly *conventional*, they are deliberately *arranged* or *constructed.* They derive their importance from two directions: on the one side from the work of puzzle-solving, judgment, normalization and abstraction and on the other from their *impact* on the future lives of the pupils.

An important aspect here is that both of these sides are continuously *performed*. They can be seen as a kind of *work*. This performance, this work, takes place in a sort of shadow, however. We on some level of course "know" that this happens. We know that something goes on here that we know very little about. I think here, for examples of the processes of normalization and abstraction: the description above does probably not come as a surprise, describing something unknown. However, these processes are not exactly "known" either. They do not have any public presence.

They are in this regard similar to the sewage systems of any western city. This is an example used by Žižek to illustrate the point that I am trying to get through here. As we flush the toilet we of course understand that its contents go somewhere. But as it goes out of sight, it goes out of the "symbolic", out of meaning, out of our world. Another useful examples is that of meat production. As we buy our eggs or bacon, we of course in a sense "know" that something has happened here, before, even recently, involving animals we never see. But this knowledge is constantly in the background, never conscious. If it is for some reason *made* present, this can be quite disturbing. We may then effectuate coping strategies, until it recedes to the background again.

In contrast to sewage systems and meat production, this performance that takes place in the background, is *represented*. Thus it is present in the public, but *as* something quite different from what I have described above. The reason why the above description constitutes a necessary part of my argument is that its public representation only "works", can only grasp, to the extent that this backside remains in a state of "oblivion", in a way "hidden". What I want to point out is how this hidden part, not only *exists*, but needs constant attendance. This backside is a *constructed machinery*, involving conventions, discipline, measures of sanction and correction, standardization, mass-production of things, technologies of information, transportation and coordination – and so on. It is something that *we* – we moderns – constantly *perform*, in the same way as we produce meat and keep the sewage system functioning.

I will now turn to how this performance is, in a way, publicly (re)presented.

3. The ritual message

I start with going through some of Rappaport's terminology and ideas concerning *how* the ritual form results in the transmission of messages. I then show how this reasoning applies to mathematics education.

Definitions

Rappaport's idea is that ritual, because of its particular form – from the "micro" level of puncilious and repetitive action to the "macro" level of invariance in time and space – endows reality with meaning. It makes certain ways of talking, thinking and feeling about it come naturally and it makes it seem obvious that there are things in the world – things important to ritual practice – that exist and have certain properties, even though these things may often not be "material" in any ordinary sense of the word. Rappaport talks about this in terms of *messages*.

<u>**The canonical and the self-referential messages**</u>

Rappaport distinguishes in his theory between to kinds of messages: *canonical* and *self-referential*. The canonical message is transmitted by the invariant aspects of ritual and refers to the universal and general. In mathematics education, the canonical message refers to the properties of mathematics and of mathematical knowledge. It says *what* these things are. The self-referential message is transmitted by variations in ritual performance and refers to the participants. In mathematics education the self-referential messages says *how much* mathematical knowledge each of the participants have.

<u>**Enactments of meaning**</u>

These messages are not primarily transmitted explicitly. The main mechanism by which performance generates messages is by means of what Rappaport calls *enactment of meaning.* Such acts take place *as if:* the world was in a certain way, the performers had certain properties, and as if the performers stood in a certain relationship to the world. Put shortly, the ritual presupposes an *order* of the world. By taking part in the performance of ritual, Rappaport writes, the performers *indicate* – to themselves and others – that they *accept* this order. Their performance bring this presupposed order into being. At the same time, by actively taking part in it, *showing* the properties of this world, they become *fused* with it: "In conforming to the orders that their performances bring into being, and that come alive in their performance, performers become indistinguishable from those orders, parts of them", Rappaport writes, and he calls this act of conformance or acceptance "Ritual's first fundamental office" (Rappaport 1999, 119,117).

What I will show in what follows is thus how the act of accepting mathematics education, bring into being, not only a conception of the world in which mathematics exist with a certain set of properties, but also a specific relationship between those participating in education and this world. Far from education transmitting, transforming or distorting an "object" received from science, mathematics education is here concieved of as productive of this very imagery of reception, transmission and transformation.

<u>**Sacred postulates**</u>

While enactment is the main mechanism for the transmission of the mechanism of mathematics education, it needs to be noted that mathematics education also contains "postulations", that is: explicit statements of what the ritual is supposed to mean. I think here of a rather limited core of statements in the discourse of mathematics education that have features that makes them fit with Rappaport's concept of *sacred postulates*. I think here of statements asserting the high educational value of mathematics, the value of *activity and creativity* for learning; the value of *the teacher*; that you *cannot start early enough* with mathematics; the value of *realism*; and their negative counterparts: the evils of mechanism, rote learning and memorization. This way of talking about mathematics education derive from the early 19th century German states and in a recent article I named it the ”standard critique” of mathematics education (Lundin 2008; cf. Lundin 2012b).

The point here is that the truth of these statements cannot in any straight forward way be checked; they refer circularly to the properties of mathematics education. The historian of education, Jürgen Oelkers, has noted that in so far as there seem to be a mismatch between reality and these statements, in education, this is always interpreted to the detriment of reality. If for example, it is claimed that mathematics makes children happy, and it turns of that mathematics education more generally makes them frustrated, this mismatch is not taken to indicate a need to revise the conception of mathematics. Rather, it is taken to indicate the ”fallen” state of reality; it is reality that needs ”revision”! In fact, the religious connotation of this expression is exactly to the point, as this way of talking about mathematics education emerged as mathematics became part of a particular kind of Christian world view (Oelkers 1996, 15; Oelkers, Osterwalder, and Tenorth 2003, 50 et passim).

Rappaport writes about sacred postulates that ”they are generally devoid, or close to devoid, of material significata. They are, therefore, invulnerable to falsification by reference to evidence naturally available in this world” (280). That this hold for statements asserting the value of mathematics education for democracy, self-confidence and economic growth should be clear, but I contend that it holds more generally also for modern educational theory: their key terms, *learning* and *knowledge,* are ”non-material” (280); there is no clear way of establishing their presence or non-presence, in particular not outside the performance of ritual. Thus, as is typical for sacred postulates, rather than just describing, as they are uttered as part of the performance of ritual they *bring into being* that which they refer to. The idea of Rappaport's analysis is that these postulates derive *unquestionableness* from the unquestionableness of the ritual, in that the acceptance of ritual amounts to an acceptance of the truth of the sacred postulates.

Summing up, acting *as if* and *postulation*, both contribute to the transmission of the messages of mathematics education. The form of performance is most fundamental. Explicit postulation helps, so to speak, make clear what this performance is meant to mean.

The messages of mathematics education

The act of solving a puzzle

I will again take the act of solving a puzzle is my basic unit of analysis. In school, this act is taken to be “doing mathematics”. More exactly, it is *supposed* to be “doing mathematics”. When ritual is not performed properly, it may be claimed that what has taken place was not “doing mathematics” but mere manipulation of marks on a piece of paper; mere, empty, computation.

A first message of this act is that mathematics is something that you can in fact “do”, and that it is “done” by this act of puzzle-solving. The act *links* the pupil/performer, the setting of school work and the incorporeal object of mathematics. At the same time it brings this non-material object into being.

This analysis would pertain to simple puzzles such as “7-3=”. More often than not, the puzzles also bring in elements referring to reality, making them more or less “realistic”. Dowling’s *The Sociology of Mathematics Education* is to a large extent devoted to a detailed analysis of *how* school mathematics refers to the outside world (Dowling 1998). Rappaport too develops his own account of how this referencing works. Since his material contains many rituals not involving written text, it is more focused on the referencing function of things and acts (Rappaport 1999, 58–68 et passim). I will come back to the fundamental problematic later. Here it will suffice just to note *that* puzzle-solving becomes *linked*, not only to mathematics, but also, when the puzzles are “realistic” to the outside world.

In a similar way as computations may not “be” mathematics is performed carelessly, the act of solving puzzles involving elements referring to reality may be claimed to be failures, in that the supposed link between the puzzle-solving activity and reality fails to obtain. It is then “mere computation”, pertaining only to the then and there of the school setting – utterly pointless.

When successful, this act brings mathematics into being through *learning*, which is the non-material process ideally taking place as a counterpart to the visible performance of the pupil. When this happens, a “whole” is established, that links the pupil at the same time to mathematics and to reality.

In the case of realistic puzzles, the relationship between the school setting and the setting described in the puzzle, transmits a message of what Latour would call “action at a distance”, that is, that it is possible to actually solve the problem, whatever it may be, from within the school setting, not being actually there, but by being connected to it through mathematics – by mathematics being “the same” in both situations (cf. Latour 1987, 220ff).

The student writes down his answer to the puzzle as a mark at a piece of paper. This transmits the message that this written answer corresponds to actually solving the puzzle in the outside world. Thus, the end point of the puzzle-solving process – the *interesting* part, so to speak – consists in finding this solution, as a “thing”, that can be put on a piece of paper. What happens after this solution is found is thoroughly disregarded in mathematics education – transmitting the message of the insignificance of this kind of activity in the world outside schooling.

The answer is then compared to the ideal established by ritual. As this comparison takes place in school, the act of acceptance – of accepting this answer as the correct answer – implies an acceptance of mathematics being the appropriate *judge* of what constitutes a correct solution to the puzzle at hand. In the case of training, as the result may be disregarded or, in any event, without practical consequence, the further message is transmitted that the *puzzle*, is actually of no importance. In the case of assessment, as the result is archived, this adds to the message that the puzzle-solver, the pupil, is important in respect of her ability to produce the answer expected by ritual. But crucially, the result changes *nothing* as regards the puzzle. The puzzle is fixed – it ends with a question. The result is detached from the puzzle, produced in a completely separate setting. It has no *effect* on the situation that the puzzle describes. It is of no importance “out-there”. It is thin air, from the perspective of reality. Only from the perspective of mathematics education, does it have *weight*; *importance*. Thus, for the result to *count* as significant for the pupil, she needs to adopt the perspective and norms of mathematics education. And to do this is a matter of inner transformation; of a transformation of perspective, of frame, of desire.

Work on a sequence of puzzles

The *repetition* of the puzzle-solving act does not simply reinforce its intrinsic message – it adds several new dimensions. A first such new message is transmitted by the difference between what changes and what remains constant. Referring to the historian of theology, Amos Funkenstein, one can say that the homogeneity of the sequence consisting in it being always mathematics that is to be used to solve the puzzles, transmits a message of the "homogeneity of the universe" (Funkenstein 1986, 70). The world basically seems to consists of matter that can be manipulated mathematically; there are puzzles to be found everywhere, the solution of which always resides in "the same" mathematics.

Secondly, this message not only pertains to the properties of the world, but also to the tool that is used to solve the puzzles. This tool, mathematics, is "realized" simultaneously with the range of objects on which it operates. Mathematics is that which the pupil "does" when working on the puzzles; as it is always the same thing, getting its shape and meaning from the properties of the activity of puzzle solving. Thus, as is typical for ritual performance, the puzzle-solving realizes several entities at the same time, standing in a particular relationship to each other, an *order*. Firstly, the "world" of puzzles; secondly, the tool by which these puzzles can be solved.

Looking at the process from another perspective, focusing on the pupil, it transmits a message of his *life*. In so far as this "everyday life" takes place in school, it consist of puzzle-solving, an activity in which always one and the same "tool" of mathematics is right for the job; it is the magic wand that can be pointed to the puzzles lying around in the world, replacing them with their appropriate answer; life is thus becomes, in ritual performance, an *encounter* with this homogeneous world of puzzles; a life in which one is master in so far as one masters mathematics.

The importance here of stability in time is worth noting; not only the preestablished homogeneity of the sequence, but also of the setting for puzzle-solving, that remains the same as the pupil moved through the difference stages of schooling. The *form* of the performance remains constant, transmitting the message of the sameness, stability, and crucially, the *reliability* of mathematics, the point being that the extent to which you can expect to be able to solve the next puzzle becomes thoroughly *predictable*. This transmits the message of there being *something* that you "have" or "know" that is the cause of this predictable ability to master mathematics and through mathematics, the world.

Collective puzzle-solving

As puzzle solving is performed in the same way by all members of society, this very activity and its effects becomes a common point of reference. It becomes a *common experience*; possible to talk about. The invariance in space and stability in time ensures agreement as to the factuality of the matter, its presence, its givenness as part of the world.

Insofar as mathematics is taken to be the *cause* of mathematics education, and in so far as the presence of mathematics education is taken for granted, so is the presence of mathematics. This point may seem silly, but it is fundamental. Mathematics is an abstract concept, it is incorporeal, invisible. Found as a suggestion in a book, it can all to easily be put to the side as a fancy piece of metaphysics. Mathematics education, on the other hand, is an inevitable part of life, it is *real* – a fact – consisting not only of things, but of people, habits, places, ideas, desires, and the like. These are things we meet, more or less on an everyday basis. As we *interpret* all this as brought together *for the cause* of mathematics, we get, as a messages, that mathematics is part of reality. Furthermore, as mathematics education it not only taken to be inevitable, but in fact thoroughly unsurprisingly so, the same goes for mathematics: it is just taken to be an inevitable and unexceptional part of reality.

And why is it necessary to learn mathematics? Because of the structure of the world – the presence of puzzles that can only be solved by use of mathematics. Thus, of course, the presence of mathematics education does not only suggest the existence of mathematics but also of the world in which this mathematics is applicable. We thus have, in principle, three components: Firstly, the performers and their common experience; secondly, mathematics; thirdly, the world of puzzles. They are brought together as the experience is interpreted *as* an experience of *using mathematics to solve real-world problems*. This interpretation makes the performers part of the order of mathematics education.

Attending more closely to the form of mathematics education, we can "read", so to speak, what mathematics must be like. It must be something that it *take time to learn*; it must surely be *difficult*; the process of learning mathematics is of such complex nature that it *demands specialized expertise* to ensue; it needs to be learned in a setting (schools) specially designed for the purpose of learning – and so on.

As I will come back to later, the *thatness* of ritual messages has strong priority over any *whatness*. What I mean by this is that it is the *presence* of mathematics, as something that *needs* to be taken into account, that mathematics education creates agreement about. This agreement corresponds to the fact that it is obviously *something* that everybody in modern society has experience in school, and it is inevitable from our language practices that this experience "is" an experience of mathematics. But rather than creating agreement about *what* his thing "mathematics" is, it functions as a point of diffraction, where interpretations diverge.

One may think here of Benedict Andersons concept on an "imagined community" (2006). While Anderson talks about the common experience of reading the same newspaper, that bring a common world into existence possible to refer to as "the same" despite the fact that the members of the community have no common experience of this world except through the paper, mathematics education establishes certain things as existent in the world, with stable and geographically invariant properties. These things are *different* from mathematics education itself in the same way as that which a newspaper refers to is different from both its materiality (paper) and the activity of reading it.

<u>Learning about the power of mathematics</u>

In several ways, mathematics education transmits a message about the *power* of mathematics. There is a crux here however, that will play an important role later. It has to do with the way in which this power is realized. Because firstly, it is of course suggested that mathematics is a versatile and powerful tool, as it is by means of mathematics that all the puzzles are solved. Furthermore, as was noted above, mathematics at the same time functions as a norm or standard by which the solutions are judged – thus adding another dimension to its power: not only as tool but also as arbiter, deciding on what should pass as useful.

Secondly, however, this message would amount to nothing but "hot air" (cf. Rappaport 1999, 56), it was not made to have real material effects. The crux consists in the disconnect between the activity of solving the puzzles, and these effects. Because the effects become real only through the few trials of strength, and thus often with substantial delay and in a setting disconnected from the puzzle solving activity. Thus, it is not immediately obvious from the form of ritual that the power of mathematics in fact is *real* on not just "hot air" – this is something that the pupil will only by necessity realize with time.

My point here, and it is a rather difficult one, is that in school, the power of mathematics is basically fiction. The puzzles that are solved are related to a fictional world, and it is only in this world that mathematics is shown to work. In the "real world", that is, the world of schooling, *it does not matter* – not materially, practically – to what extent you manage to produce the correct answer. You will still get your lunch (if you are in Sweden); everybody will still sit from the same time in class working; the schedule stays the same. However, the results that you produce in this setting are accumulated, put in an archive – and the contents of this archive will of course have crucial effects. But that this is so is not very easy to see or understand. Thus the reality of the power of mathematics has to be "a matter of faith", so to speak, most of the time in school – it is an operation that the students needs to perform by themselves. It is up to the students to take school work seriously, because they will not get punished if they do not. And of course, the propensity to become better as puzzle solving depends on the degree to which it is taken seriously.

Thus, in a sense, what is measured by the trials of strength, is not only the ability of pupils to adapt to the school setting, but also the extent to which they have "chosen" to take school work seriously, that is, the extent to which they have taken the fictional power of mathematics to be real *for themselves*, the extent to which they have empathized with the realism of the puzzles.

In the trials of strength, having assumed the reality of the power of mathematics *pays off* as it turns out that the ability to solve the school puzzles are now translated into real effects; effects on the course of life.

In one sense it is only at this point that the *skill* of puzzle-solving is translated into a *powerful quantity* of mathematical knowledge. On the other hand, it is of course those students for which this skill has always already been exactly this – and there has always been taken seriously as really powerful – that are the more likely to have taken this skill seriously.

As I will come to later, this *assuming* – not only of the power of mathematics, but of the totality of the fictions of mathematics education, its order, can be seen as taking *play* seriously, in the same way as a good football player, when playing football, fully *assumes* this game, disregarding for the moment the non-seriousness of the setting. The difficult point is that school also measures, in its trials of strength, the degree to which a certain game has been assumed.

From power to worth

Rappaport refers to these "efficacious capacities" (23), the mechanisms by which ritual purportedly bring about its effects, as *the occult*. In mathematics education, the power of mathematical knowledge is occult. Mathematics education suggests that mathematical knowledge is something that people can have, inside them, in different amounts, that lends them efficacious power.

Continuing the reasoning above one can say that, throughout most of the puzzle-solving activity, it is not clear that the ability of an individual to solve puzzles *is* a power that transcends the particularities of the puzzle-solving situation. This is made clear later, through trials of strength.

The thing now is that the retroactive effect of this "realization" of the power of mathematical knowledge is that which looked like fiction from within school, as actually, in a sense *real*. Thus, what looks like a *mere* game, becomes, retroactively, real because it is treated *as if* it was reality; that ability to solve the puzzles are retroactively treated as if they corresponded to an ability to solve *real* problems. It is thus suggested by the ritual that this power *is* a real power.

The fascinating thing is how this operation retroactively endows *symbols* with power; the answers, put on pieces of paper are treated in trials of strength as if they were real solutions to real problems. One must note here that the *delay* plays the crucial role endowing the symbols with efficacious power. Had the effects been immediate, there would have been no need to *interpret* the effects as deriving from any particular sign. The delay makes it neccesary for the individuals themselves to *keep in mind*, so to speak, the power of the symbols with which they operate. The power is thus "subjective locally", in that it does not really matter in the situation as such how you conceive of what takes place – if you see it as "mere" puzzle-solving or as use of mathematics – but later it will turn out that those who saw it as use of mathematics *were right all along*. Thus, in school the occult power of mathematics is a *real* power, it is a correct interpretation of this power because it is only an interpretation of what actually takes place, a translation of ability to a certain language game. But this occult power becomes a *real* power, transcending the setting of schooling, by means of a sort of gigantic leap of abstraction, where all that took place in school, by means of a few trials, are translated into effects in the reality outside school.

As we have seen, the organization of the activity of puzzle-solving, its stability in time and invariability in space, the homogeneity and invariance of the sequences of puzzles as well as the accumulation of results, their abstraction and normalization up to the arrangement of the trials of strength where all students finally meet, represented by one single number signifying their entire performance in mathematics education, is the result of enormous efforts – both as regards the formation of this system, and as regards its maintenance. It is this system that fabricates the properties of "mathematical knowledge". The power of this machinery is collapsed into the *form* of an invisible something that people can have, that then functions as the *cause* of the performance of the individual within this system.

As a final step, the *power* of the individual is translated into *worth*, that is: as legitimate social position. This happens by means of the integration of the individual in the order, where her place is determined by her "amount of mathematical substance". Rappaport writes that the two messages of ritual – the canonical and the self-referential – are always transmitted together, and that they support each other:

> Ritual's unique significance arises out of the relationship of variations in representations indicating the current states of participants on the one hand to, on the other, the constancy of the order in which they are participating and which they are thereby realizing. (p 328)
>
> [V]ariant self-referential messages are sanctified, which is to say certified, through their association with the highly invariant canonical stream. (p 329)

What happens is thus that the individuals, represented by their different amounts of mathematical power, are inscribed in the *order* constituted by mathematics education, that is; they are positioned by means of this power in relation to the universal "tool" of mathematics and the "world" to which this tool applies. Mathematics, that has becom known through schooling as the universal arbiter over puzzle-solutions, becomes, through trials of strength, an arbiter over the worth of individuals, insofar as worth is equated with the ability to master the world.

The notion of the divine

It is useful here to connect to Rappaport's concept of *the divine*. It signifies that which ritual is about, its "spiritual referent" (23). Rappaport says about the divine that it is "not material in any ordinary sense", but that it nonetheless "exists […] has being"; that it is "powerful, or efficacious", that it "has the ability to cause effects" (397). For mathematics education, it is of course mathematics that is divine – it is present out there in reality, but it also has the property of being able to reside "inside" individuals. To the extent that an individual "has" mathematics, she is put in a privileged relationship to the world. This relatedness to the world, brought about by the simultaneous presence of mathematics "out there" and at the inside, have, according to the doctrine of mathematics education, a number of effects. One such effect is the ability to master the world, using mathematics as an instrument, working, so to speak, partly on itself, as it is both in the individual and in the world. Another effect, sometimes claimed to be of even greater importance, concerns *understanding*, a certain grasping of reality, of seeing it properly, as it really is.

This use of the notion of the divine can be usefully illustrated with the reasoning of Ole Skovsmose who contends that "mathematics is formatting our society" and that "[i]nformation technology may be seen as the materialisation of mathematics, or we may conceive mathematics as an entity hidden or 'frozen' in the computer" (Skovsmose 1994, 43). Here this second aspect of understanding has priority over instrumentality, as Skovsmose imagines the "having" of mathematics as a means of critique of reality; mathematical knowledge here becomes the key to "undoing" its undesireble aspects.

Similarly, Mogens Niss is well known for his "relevance paradox" refering to the contradiction between the great importance of mathematics in society and the invisibility for the individual of this importance – that is, insofar as she lacks mathematical knowledge (Niss 1980). This idea corresponds nicely with Rappaport's notion of the divine as a powerful but invisible cause, streched between mind, society, nature and technology (cf. the story of God and mathematics told in Funkenstein 1986).

The supreme value of mathematics is thus, in varying degrees, depending on their power, transferred to individuals. Note that occult power does not in itself denote *worth*. It is only by being associated with mathematics as divine, that the translation takes place.

A final step might be necessary to complete the picture. Rappaport talks about *the holy* as the totality of the divine, the occult, the sacred and the numinous. This is, then, the unity of mathematics education, mathematics, the performers and the performances – put shortly, the system and all that is attached to it. It comprises a *holy* part of the world, where things happen that transcend the humdrum of everyday life. It is holy, because it is about mathematics – the divine – it is holy, because this is the place where people receive the mathematical knowledge they need – the receive part of the divine, and aquire occult powers – the get to feel mathematics, to experience the numinous; and we learn about all this in the sacred postulated of mathematics education – asserting, again and again, as "calls to prayer", the worth of mathematics, its significance, its importance.

The question of identification

The analysis presented above raises several questions, at least some of which will be addressed in what follows. The most important is perhaps to what extent the messages transmitted by mathematics education are actually believed in. It turns out that the concept of "belief" is highly problematic, and that it needs to be sharply distinguished from the much more easily identified concept of *acceptance*, that is: publicly visible, practical acceptance. In what follows, I will discuss a number of complications that follows, basically, from the difference between acceptance and belief. It will turn out that, while it on the surface may seem that *absence of belief* would lessen the power of the messages over the performers of ritual, the opposite may very well be closer to the truth.

This argument circles around the concept of *identification*, that is, of identifying something as (the same as) something else. For instance, one may identify a statement as true, a description as a real or realistic, a property as valuable, a person as more or less worthy and – as a special case – one may identify a certain something as "oneself", as that which one is.

Given this idea of identification, one line of argument claims that institutions such as mathematics education leads the performers to (wrongly) identify its messages as truth or reality, and at the same time identify themselves as part of this supposedly true reality. This would then be an argument of "false consciousness", about the "social construction" of a false image of reality, preventing access, for the performers, to the real state of affairs.

The materiality of ideology: Althusser

A rather sophisticated version of this argument is presented by the French Marxist philosopher Louise Althusser (2001). The important point not to be missed in his analysis is that *ideology* is, as he puts it, "material" (2001, 164). By this he means that ideology is not to be identifies with any particular states of consciousness of individuals, but with institutions, part of the social that he calls *ideological state apparatuses* (ISAs). This concept fits perfectly with the above description of mathematics education, namely as a combination of on the one hand a system of practices – regulated by means not only of rules and habits but also through the form of buildings and technologies – and on the other a system of "beliefs". The material part of ideology *is real*, an inevitable part of the world in which people live, the point being that it is structured *as if* the other part, the "beliefs", were true, so that the only way to orient oneself successfully in this reality is by means of *taking them to be true*.

In the form of trials of strength, mathematics education is organized as if the puzzle-solving taking place in school corresponded to an ability to solve real problems. The education system is organized as if mathematical knowledge was a universal power to understand and master a world filled with puzzles, that one inevitably encounters in the course of one's life. And alas, schooling has been established, to *meet* this state of affairs, but then, at the same time, making it true, in so far as everyday life takes place in school. The most important point here is that it is only be *taking* mathematical knowledge to be a real power, and then naturally and accordingly learning how to solve the puzzles, that one will, in fact, become a master of reality. Ideology is imaginary *made real* in this way, that is, made *external* to the beliefs of the actors.

Where my analysis departs from Althusser's is in his understanding of the relationship between individuals and this "ideological reality". Althusser talks about "interpellation", meaning how individuals become *fused*, to use one of Rappaport's terms, with ideology. He talks, specifically, about how they become *subjects*, only as part of ideology, how they come to *identify who they are*, within the coordinates set up by ideology. In the case of mathematics education, it is easy to see how this would mean that people identify themselves with, "find themselves" in, their relationship to mathematics, as having this or that amount of mathematical knowledge, taking this knowledge to have occult power, and so on.

I take this to be almost exactly true, but only almost, because there is always – or at least usually – some space for doubt; some space for recognition that this world constituted by ritual *is not all that there is to reality* – and that there is, put loosely, something strange going on that does not completely make sense. One can talk about this in terms of a *lack* of identification. In Althussers framework, lack of identification would signify freedom for individuals to "think outside the box". In the argument that follows, it will instead be understood as a crucial component of how ideology – if this term is kept – keeps its hold over the performers of ritual.

<u>The priority of the message over real-life experience: Žižek.</u>

It is noted by Rappaport that in cases where immediate everyday life experience seems to contradict a ritual message, it is reality that needs to yield. For instance, in the case of mathematics education, if teachers find it difficult to explain to pupils in what situations they will have use of a particular piece of mathematics (say, algebra), this inability reflects back on the teachers as a sign of insufficient understanding of the relationship between mathematics and the world. More generally, the point can be illustrated with the respective arguments of Skovsmose (1994) and Niss (1980; 2001), both referring to "direct experience" that seems to contradict the message of mathematics education. Looking at reality, so to speak with an untrained eye, it seems that it does not really "contain" mathematics, nor that mathematical knowledge is very useful in everyday life. Instead of this being interpreted as a sign of a non-relatedness between mathematics education and reality, this *experience* of reality is taken to be defective, and contrasted with the "truth" of the view that can only be the result of taking part in mathematics education (this point is also presented in Lundin 2012a).

This phenomenon has been identified by the Slovenian philosopher Slavoj Žižek. He discusses the seemingly promising idea that "ideological prejudices" would be counteracted by a "pre-ideological level of everyday experience". In the case of mathematics education, this would amount to the everyday experience of most people of not using mathematics would make the message of mathematics education, that mathematics is used every so often in everyday life, seem implausible. Žižek's corresponding example involves a German in the 1930's, who after being bombarded with anti-semitic propaganda about Jews being schemers, wire-pullers and so on, cannot help recognizing that his neighbor does not at all fits this description. Žižek asks rhetorically: "Does not this everyday experience offer an irreducible resistance to the ideological construction?" and answers that it does not, at least not if he has been grasped by ideology. What happens then is instead, to the contrary, that the discrepancy start to work *in favor* of ideology. In the case of anti-semitism, the message of the discrepancy becomes one of the deceitfulness of appearance: "'You see how dangerous they really are? It is difficult to recognize their real nature. They hide it behind the mask of everyday appearance - and it is exactly this hiding of one's real nature, this duplicity, that is a basic feature of the Jewish nature" (Žižek 1989, 49–50). In the case of mathematics education it is reality itself that is deceitful, mathematics being hidden beneath appearances, making mathematics education all the more important to get beyond them, to what is *actually* there, to *true* understanding.

4. Complications

This last example points to a problem with *ritual messages*, as Rappaport calls it, or *ideology* as it is call in the Marxist tradition, namely that it can never totally prevent the occurrence of seemingly contradictory experience. And, contrary to what Žižek's example seems to suggest, these contradictory instances are not so easily swept away by rationalizations. Instead, as Žižek argues at length in his oeuvre , these contradictions are "contained" by the individual through a quite complex interplay between mechanisms of identification and dis-identification, that is by the subject taking various different *stances*, not exactly towards reality, but towards the inter-relationships between different parts of the world: public propositions, performance of others and oneself, beliefs of others and oneself and how the world actually is.

<u>The non-invisibility of ritual and the non-realism of "realism"</u>

A first "problem" of the messages produced by ritual performance, that prevents them from encompassing all of reality is the presence, in this reality, of something that inevitably looks very much like a ritual. The point of the argument above was that the ritual messages makes ritual practice seem purposeful. Nonetheless, there are always – and not the least in the case of mathematics education – *elements* of ritual practice, that it is very difficult for its message to explain. Its repetitiveness for instance. It just makes very little sense that the learning of mathematics, according to the ritual message a most wonderful experience of creativity and beauty, should take place in such a formalized, rigid and punctilious setting. Even worse, it is difficult from within mathematics education to explain why mathematics – being such a useful resource – is the object of so much aversion. Put shortly, there is a part of the very center of the world of mathematics education that does not quite fit into the picture – and that is mathematics education itself. I think it is appropriate to call this the "non-invisibility" of ritual, because as the ritual message serves to "cover" so to speak, the ritual form of ritual, by making it appear through its own optic, through the things which it brings into existence, there always remains (at least this is clear in the case of mathematics education) a residue, that does not quite make sense.

A second problems concerns the "realism" of the world suggested by mathematics education. Take this word-problem for instance, used in PISA 2000:

> A pizzeria serves two round pizzas of the same thickness in different sizes. The smaller one has a diameter of 30 cm and costs 30 zeds. The larger one has a diameter of 40 cm and costs 40 zeds.
>
> Which pizza is better value for money? Show your reasoning. (OECD 2000)

We have here an example of what I above have referred to as a *puzzle*, being "realistic" in that it is suggested that producing the right solution to this puzzle, that is a solution corresponding to an ideal established by ritual, corresponds to the solution of a "real puzzle", that one may encounter outside school. However, to see this problem as "realistic" demands that one assumes a particular perspective on what is *essential* to solving the puzzle, and what is not (Dowling 1998; Lave 1993; Lundin 2012a). Put shortly, and understating the case, there are many differences between solving this puzzle in school, and the everyday life activity of buying pizza. These differences constitute a second obstacle, comparable with that of the non-invisibility of the ritual. It is, in a sense, obvious that the school work of solving puzzles does not *actually* correspond to solving real world problems; rather there is some kind of similarity, but this similarity may very well be the object of contention – as it in fact is, in the case of mathematics education. It may thus very well be claimed, from within modern society, that the performance of mathematics education is in fact irrelevant for anything but itself; that the word it tries to bring into existence is in fact only fiction, non-real.

The point now, is that despite both of these problems, these obstacles, as one could say, to *total* identification with the ritual's messages, with a total identification of that message as real and true, these messages maintain a grasp of modern society. What remains to be understood, is how this "grasping", so to speak, of ritual functions.

Acceptance and belief

As a first step towards such understanding we need to get a more detailed picture of the relationship between *acceptance* and *belief*. A first thing to note is that belief, as conceived of by modern common sense, is no trans-historical and transcultural constant of humanity. The concept has an origin and a history. The anthropologist Talal Asad discusses the present day assumption that "belief is a distinctive mental state characteristic of all religions", and reaches an opposite conclusion:

> It is preeminently the Christian church that has occupied itself with identifying, cultivating, and testing belief as a verbalizable inner condition of true religion. (Asad 1993, 48)

The fundamental point is that our contemporary concept of "belief" took form as part of the modern concept of religion as consisting of a "set of propositions to which believers gave assent" (Asad 1993, 41). This made different religious "beliefs" comparable with each other, and with modern science. It should be noted that present day Christians are generally no exception to this view of their own religiosity:

> In modern society, where knowledge is rooted either in an a-Christian everyday life or in a-religious science, the Christian apologist tends not to regard belief as the conclusion to a knowledge process but as its precondition. However, the knowledge that he promises will not pass for knowledge of social life, still less for the systematic knowledge of objects that natural science provides. *Her claim is to a particular state of mind, a sense of conviction,* not a corpus of practical knowledge. (47, my emphasis)

This stands in sharp contrast with how Asad describes how "religion" – here thus not at all fitting the modern meaning of this term – could work among "pious learned Christians of the twelfth century":

> Christian belief would then have been built on knowledge- knowledge of theological doctrine, of canon law and Church courts, of the details of clerical liberties, of the powers of ecclesiastical office (over souls, bodies, properties), of the preconditions and effects of confession, of the rules of religious orders, of the locations and virtues of shrines, of the lives of the saints, and so forth. Familiarity with all such (religious) knowledge was a precondition for normal social life, and belief (*embodied in practice and discourse*) an orientation for effective activity in it – whether on the part of the religious clergy, the secular clergy, or the laity. (47, my emphasis)

Thus, we make a mistake when we think of the social life of, say, the twelfth century, as in a sense "mistaken" because of erroneous religious beliefs about reality, because the "beliefs" that were held then do not fit our modern concept of beliefs as conviction of the truth of a set of propositions. Religious life was rather organized by means of *knowledge* relevant for this life. The "truth" of this knowledge, beyond this area of practical applicability, was not a matter of central interest.

To enter this life, means primarily to *accept* this way of living in its totality. Such acceptance does not necessarily correspond to any particular state of "belief". Rappaport is in total agreement with this line of argument: like Asad, he finds the centrality ascribed to belief in modern conceptions of religion problematic and ultimately mistaken. He writes that "belief is an inward state, knowable subjectively if at all, and it would be entirely unwarranted either for us or for participants or witnesses to assume that participation in a ritual would necessarily indicate such a state" (1999, 120), and continues:

> Acceptance, in contrast, is not a private state, but a public act, visible both to witnesses and to performers themselves. People may accept because they believe, but acceptance not only is not itself belief; it doesn't even imply belief. (ibid.)

Given these distinctions, it should be obvious that mathematics education is much more of a system of practices that you need to *accept*, than a sort of "religion", defined by a set of propositions, that people *believes* in, and thus choose. Mathematics education seems to fit quite well with Asad's description of the twelfth century, in the sense that it contains lots of knowledge that is true, useful and necessary concerning how the system works, what you can and should to, what is forbidden and how you should lead your life to become accepted or even successful.

The "problem", so to speak, of mathematics education, is that it is part of *modern* society – not the twelfth century – where such "merely conventional" knowledge, pertaining only to social life, must be anchored in something that goes beyond it. This means that, while mathematics education is in a way a well-functioning system of conventional practices related to values and symbols that needs to be accepted and that you need to know about to orient yourself successfully within this system, the participants in this system, being "moderns", are to some extent preoccupied with questions of belief.

Thus, as a first step, one may conclude – following Asad and Rappaport – that the messages of mathematics education are not usually "believed in", in the modern religious sense of "belief" as a state of mind, as conviction of the truth of a set of propositions. One should rather see mathematics education and its messages as something that participants accept and take for granted, disregarding questions of ultimate truth.

However, as a second step it is necessary to recognize that this is not exactly true, because as moderns, the participants *are* in fact to some extent preoccupied with the question of truth and belief. Put shortly, it is simply not *acceptable*, in modern society, that school should be a "mere" convention. Mathematics education is of course supposed to be a *science*. This means that it is actually crucial for this institution that it does not contain the kind of beliefs today characterized as "religious".

Thus, the problem is that mathematics education *is* a system of practices that *needs* to be accepted in modern society. This system *is* conventional in a similar way as Christianity was, say, before the thirteenth century. Thus, as you accept the system, you acquire knowledge that is “true” about this system and which you need to orient yourself successfully in this system. On the other hand, this “knowledge” in a sense *needs to be rejected*, exactly insofar as it seems to be internal to the system. It is central to the performers, being “scientific” that they do not *identify* with the workings of the system – as this system being real and true and themselves as “believing” in it – but to the contrary *anchor their own identity* in something external to this system, taken to be real and true. It should not be difficult to see emerging here a dichotomy – between on the one hand *school* as system of conventions founded on tradition, and on the other hand *science* as that, real and true, on which school should be – but is in fact not – founded. This is the dichotomy expressed in the “standard critique”.

The rhetorical figure of the standard critique is not unique to mathematics education, but characteristic both of modernity in general, in its constant call for renewal, and progressive education in particular. It is no coincidence however that the contradiction is particularly strong as regards mathematics education: Mathematics, and “mathematical thinking” has been associated with *purity* throughout the history of modernity (Toulmin 1992).

The subjection of play

Citizens of modern societies are obliged to accept mathematics education. Since we are at the same time quite aware of the traditional and conventional nature of mathematics education, this obligation constitutes a contradiction. It is the nature and consequences of this contradiction that I will explore in what follows.

In modern society, children are introduced to mathematics education at such an early age that when we moderns start to make it an object of critical reflection, we are then already familiar with it from the inside – we know it, so to speak, by heart. As children we are placed in *practices* – of training and assessment –, which we inevitably over time start to accept as normal, that is, as normal parts of our lives. These practices are not meaningless or pointless. To the contrary, they are imbued with language and meaning. We learn, every day, what we are doing and why we are doing it. We are learning mathematics, because mathematics is something that we need to know. This meaning, furthermore, is not just a silent background to our activity. Mathematics education is a world of things with value – knowledge, understanding, learning, ability – and even if we only successively become familiar with all these words and invisible things, we soon learn the name of the game, its dynamics. Central to mathematics education is the desire to get the right answer, the desire to understand, to make sense. We learn that we are supposed to have this desire, primarily by the structure of the activity – the positive feedback we get when being right – but also, as a supplement, by simply being told to take mathematics education seriously. What happens is, I contend, that we all become immersed in mathematics education as we perform it, we become, as Rappaport puts it, fused with its *order*, the things and values it brings into existence.

At the start, we are just put into mathematics education, having neither reason nor power to do anything but accept it. Later, however, we may want to object. Then it becomes clear that we are obliged to accept it; that we are forced to participate in mathematics education. Not only are there laws regulating participation – we also have no choice but to take it seriously and perform well if we want to have good chances of getting anywhere later in social and professional life. Thus, as said above in relation to Althusser, mathematics education needs to be accepted as a fact, as real.

In practice, we relate to this world of mathematics education in a similar way as so called “primitive” people relate to their own rituals and myths. When such myths contradicts how nature actually works, people are more often than not aware of the difference. So that when something practical needs to be done, they take care of it to the best of their ability. They do not go into performance of ritual believing in occult efficacy. The pizza-example above illustrates how this pertains to our own culture. When buying pizza, we are undistracted by our experience of mathematics education. We do not bring out pen and paper. The same goes for the totality of everyday life. We know very well the difference between how to solve puzzles in school, and how to manage everyday life in the best way. We do not feel obliged to use algebra, to formulate mathematical models, to clearly state “answers” on paper in full sentences with units, or bring the pocket calculator with us as a source of mathematical power; in the same way as a “primitive” would not trust their her totem animal, the tiger, not to eat her, but make sure to protect herself as needed. Mathematics education and life outside school are different activities, and we are aware of the difference. Thus, in a similar was as a rain-dance may produce meaning, linking the human realm with gods and nature humanity, mathematics education produces meaning, linking humanity with nature and mathematics.

In this perspective, that is, *had we not been modern*, mathematics education would make perfect sense. But, following here the reasoning of Bruno Latour (1993), we think that we are modern, and we can thus not accept this contradiction, between the meaning produced by ritual, and how we at other times see that reality “really works”.

What we have here is a contradiction: On the one hand, we are obliged to *accept* mathematics education and engage with its meaning. Not only are we forced to spend much time in school where it is virtually impossible not to become immersed in mathematics education as we skip along the sequence of realistic puzzles, the meaning of mathematics education is also *realized* in the social structure of our modern society, making this meaning a fact. On the other hand, however, we are obliged to *reject* this meaning as nonsensical. To make the point clear: insofar as we recognize that mathematics education is a ritual, we are obliged to reject this practice, as rituals have no place in modern society.

Actually, at the same time as mathematics education took its modern shape, anthropology and sociology of religion contributed to creating what Latour calls the “great divide”, between modernity and pre-moderns, and at the same time, modernity and “primitive” cultures. Thus, the modern concepts of religion, ritual, myth were designed to fit only *them*, never us; *they* confuse the human realm with nature, thought that things had meaning in themselves, believed in occult efficacy, in the presence of incorporeal divinities – we don’t. Thus – if we moderns find ourselves performing ritual – something that *could have seen* as perfectly normal, we are obliged to reject this practice. The same of course goes just as well for non-founded meaning. If it is claimed, by mathematics education, that we use mathematics in everyday life, and the mathematics education is a necessary precondition for successful participation in modern society – and this is not literally true! – then we need to reject this message; we are obliged to reject it.

It is useful here to compare mathematics education with Christmas. Christmas is also a fact of modern life. It is also a ritual and a myth, a meaning with which everybody has to engage – though in a way quite different from mathematics education. The crucial difference between Christmas and mathematics education is that nobody believes Christmas to be rational, to have a scientific foundation. In relation to Christmas, we act as non-moderns, accepting this as something we simply do, every year, as a matter of fact. We are of course moderns, so we may reflect critically upon the non-foundedness of Christmas or any other tradition – but we need not reject it. We are not that modern (yet).

Mathematics education, however – and this of course comes as no surprise given its subject matter – is supposed to be scientific; it cannot be accepted as a sort of constant Christmas celebration. It must be rejected, but it cannot, in practice, be rejected, as little as it possible to reject Christmas (that is – you can of course run away, but you will then have to face the consequences of doing that in a world where Christmas or mathematics education is the kind of fact that it is).

Ambivalence

A most difficult question now is what we take reality to "really be", *beyond* the meaning produced by mathematics education. Where do we get to know how the world really is? Well, in school, of course – that is the place where we learn about science. Where do we get to know about mathematics? Of course in school. Here is the crux of this article. When we reject mathematics education as a pointless ritual founded on false beliefs about reality, we find our truth and real reality in nothing but a purified version of the message of mathematics education itself.

The situation can be compared to what the historian of religion Michael Allen Gillespie writes about the "wealth and corruption" of the Christian church in the centuries preceding the reforms initiated by Luther in 1517. There was then a "longing for a more original and purer Christianity", a "longing for a purer religious practice" and thus even before Luther sustained efforts to reform the church (2008, 102). Atheism was simply out of the question. The search for alternatives was framed by a world-view constituted by Christianity. The same goes for mathematics education today. Atheism today means lack of faith in science. Such sentiments have certainly been seen – I think of for example of Heidegger (2010) or the authors of the *Dialectic of Enlightenment* (Adorno 1997) and their descendants. However, the reactions have been strong. In practice, anyone claiming publicly that they do not believe in science would have great difficulties functioning in he university today; attaining a position within the education system would be virtually impossible. Thus, it is accepted and often even called upon to protest against current practices in the academic world. However, the only morally acceptable alternative is a "purer and more original" science.

Obligation is a key word for understanding the dynamics of mathematics education. As we have seen, there are two contradictory obligations in play: the practical obligation to accept mathematics education, and the so to speak ethico-espistmological obligation to reject it. I will try to show that they are actually two sides of the same basic contradictory situation.

Enjoying play

Central to this contradiction is what might be called ways of enjoying or, more generally, ways of engaging with the world. Firstly, consider playing a game. Following the German philosopher Robert Pfaller, one can note that games follow rules that lack any other foundation than that they belong to the game. Furthermore, games may relate to "things" such as a "goal", "penalty", "red card", "corner", and the like, which receive their meaning from the game. In the same way as Rappaport talks about enactment of meaning in ritual performance, such things are brought into existence by the performance of playing the game. There *are,* basically, such things as corners and penalties, when the game of soccer is played. The point now is that *playing soccer* is a way of engaging with reality. It is an activity where the participants accept the rules of the game, knowing very well that they lack foundations. They choose to accept them, because, at least typically, they enjoy the game.

Pfaller talks about this way of engaging with reality in terms of seeing-through, that is: it is a way of engaging with reality that is mediated by a "layer", so to speak, of things that on the one hand exist in that they are brought into existence by performance, but on the other are known to be "artifacts", so to speak, of the game. Players know very well that it is "only a game", and that there would be no such thing as a "red card", was there not soccer. However, since there is soccer, there are red cards. The card is as real as the player receiving it.

It might seem plausible to think that this seen-through character of the realities brought into existence in playing would make their grasp of players weaker than that of reality "taken seriously". The contrary seems truer. Experience shows that games are often taken very seriously. In fact, a soccer player that plays as if soccer was "just for fun" do not understand what soccer is about. It needs to be taken seriously. Only then is it "fun" in the right way. And "fun" may not be the right word to describe the point of it. The point is of course *winning*, and to do this the game needs to be taken seriously.

A characteristic feature of games is that it is comparatively easy to understand how they work. They have rules, they take place at a special place in a clearly defined time-frame; entering the game you are assigned a pre-established role – midfielder, goalkeeper – and you do not need to *invent* the characteristics of this role: it has been established by others than yourself; the function of the role is largely invariant in space and stable in time – but at the same time allowing for variation regulated by the rules of the game. This *setting* of the game makes it in a way easier to engage, easier to become *immersed* in it, because there are much less of the ambiguities of everyday life; games allows you to *stop reflecting*, to stop shouldering for a while the responsibilities of adulthood, to stop thinking ahead, at least no further than to the end of the game. Following the Dutch cultural historian Johan Huizinga, Robert Pfaller calls immersion in game-play "the holy seriousness of play" (Pfaller 2002, 92 et passim).

What this concept intends to catch is how the very "non-seriousness" of the game, actually opens up for a seriousness *greater* than that of "serious" everyday and professional life. A crucial mechanism for this to happen is that we, when we participate in play, are not really ourselves – it is clear that we play a role, that we are obliged by the rules of the game to act "as if", and this, it seems, makes us in a certain way *free* from exactly "being ourselves". Thus, somewhat paradoxically, the strict and formal rules of the game, while obviously restricting the scope of what can be done and said, also opens up a special kind of freedom.

Soccer, Baseball, Table tennis – such games obviously fit this description. Extending the definition somewhat, Christmas and Halloween could also be included. They open up restricted spaces and timeframes where there are at the same time "arbitrary" rules and norms that you need to accept, but where at the same time special kinds of behavior is allowed and appreciated. As individuals, we have no choice but to accept these traditions, even though we can refrain from active participation (to some extent at least). At a social level however, it is recognized that they are "kept", so to speak, because they are in general appreciated parts of our culture, in the same way as soccer and table tennis. People enjoy acting "as if" Santa Claus existed, actively bringing him into existence by performing pre-established acts, invariant in space, stable in time.

Enjoying refraining from play

Secondly, consider being the one in a collective grasped by ideological illusion, who knows the real state of affairs. This can also be enjoyable, but in a quite different way (cf. Sloterdijk 1987). This type of enjoyment is characteristic for *modernity*. We moderns can simply not get enough of comparisons with the past and other cultures, demonstrating our superiority in terms of knowledge. This is, one could say, a narcissistic kind of enjoyment. We love ourselves; we love to see our superiority reflected in the mistakes and illusions of others.

The most characteristically modern of modern institutions is of course science. Not long ago, positivists tried to purify the limits between science and everything else. The word *knowledge* was to be reserved for science – all else was to become either emotions, art, fantasy, or illegitimate pseudo-scientific speculation (e.g. Carnap 1932). Thus, when performing science, when participating in it, when taking it seriously, what we take seriously is reality and truth – as real and true as it gets. The enjoyable part of this, is being the ones who know, who understands reality as it really is.

Pfaller analyses these two possibilities of enjoyment in terms of kinds of subjectivity. Characteristic for the enjoyment of play is a certain lack of interest in who one "really is", and correspondingly what is "really real". The enjoyment lies in the escape from such considerations, and Pfaller contends that there are cultures where this stance is typical.

For the opposite kind of subjectivity, knowing who one really is, and then *acting* according to the properties of this person (this "something") that one really is, and furthermore, knowing what is really real, and then acting only in a way that makes sense from the point of view of this knowledge, is a central concern. This is a way of being where it is central to "be true", to oneself and to reality; to take oneself and reality seriously, to refrain from nonsense, from play.

The Christian origin of modern mathematics education. Religion and Science.

Mathematics education owes a lot from Christianity. The story about this relationship between modern mathematics education and Christianity is yet to be written. Here is a sketch:

The modern doctrine of learning and knowing mathematics is largely the result of an *incorporation* of mathematics into a pre-existing discourse on what we today would call religious conversion. It was not just any Christianity, but a protestant version, for which the *inner* was central; to *be* the right kind of human, having the right relationship to God and God's creation. This kind of Christianity, the protestant variety, was the result of a great reform, initiated by Luther, against the false pretentions of the Christianity of his day – against empty rituals and the integration of Christianity with politics, power and social hierarchies. His was a doctrine of separation between inner true faith and outer corrupted society. This doctrine constituted the foundation onto which modern educational theory was built. From this we owe the separation between school and society, the idea of inner movement, of the growth of knowledge and of the necessity of regulated formation for becoming a "whole" adult human being (cf. Oelkers, Osterwalder, and Tenorth 2003; Osterwalder 2003).

Interestingly, we also owe much of the social organization of schooling from the Christian church. It is quite possible for follow historically the series of shifts by which the churchgoing of the 19th century, at least in Sweden, was transformed into schooling of children and youth; the process by which teaching of children became a profession, in the early 20th century finally completely separated from ecclesiastical concerns.

What this historical background intends to make clear is that, on the one hand, mathematics education to a large extent, both as regards practice and as regards doctrine, has the structure of a religion. At the same time, however, its subject matter, *mathematics*, is of course supposed to be science.

The thing now, is that religion and science is typically related to in opposite ways. We may today think that Christians in the past "believed" in a way that would seem both impossible and inevitable somewhat stupid today. The message of recent anthropology and sociology of religion is, as was mentioned above, that our concept of "belief" is a modern construction unfit to make sense of the function of, for instance, the place of Christianity in Europe in the 18th century. As Rappaport explains about religion and ritual generally, one should talk about acceptance, not belief.

When it comes to modern science, however, the situation is quite different. It should be noted that "science", for most part of the history of modernity, was tightly interwoven with Christian concerns, and one should thus be careful to talk about "belief" in science, in the same way as one should be careful with such talk in relation to religion. Sometimes in the 19th century, this changed however, and science became separated from religion. Sharply separated at that! If became the opposite of religion (Gaukroger 2006). This happened as part of the movement of "positivism", and incidentally, some positivists thought that science should *replace* religion, including the founding of a new scientific, positivistic "church". The activities of this church however would of course not be "play" or other nonsense. This activity would of course *make sense* according to science and thus how reality really is – and those participating in this activity would of course be able to stand for what they do, answer to it, believe in it. Here the concept of belief is fully appropriate.

Modern mathematics education was shaped at exactly this juncture in modern history, when science was separated from religion. It was now that mathematics became one of the big school subjects, as part of the rapidly emerging secular national systems of education. I think it is quite useful to see mathematics education as part of a project of establishing a "scientific church". The religious dimension of this project dropped out of the picture just as it started to take off at the turn of the 19th century. The almost "catastrophic" shift in meaning of doctrines of learning and knowing of this time is interesting in its own right, but falls outside the scope of this paper. I will instead continue the analysis how mathematics education, much because of this history, is related to.

The other supposed to believe and the other supposed to know.

It is useful here to distinguish between on the one hand *the subject supposed to believe* and on the other *the subject supposed to know*. I borrow this distinction from psychoanalysis. It signifies different ways of relating, at the same time to "others" and to oneself. One talks thus about the "big Other", as an "instance" that is presupposed as the background against which actions become meaningful.

Religious practice is centrally related to the subject that is supposed to believe. The idea is that such activity become meaningful only in relation to "others" who believe in the meaningfulness of this activity and the truth and reality of its messages, the existence of the invisible things that it is related to, and so on. Oneself, however, may very well be excepted from such belief! This is part of the story about how modern mathematics education is typically related to. People do not believe in the meaningfulness of its rituals and not even in the truth of its messages – but they perform them anyway! They *accept* mathematics education, in its totality. It is impossible to explain exactly why, but one answer would be that, in modern society, one do not have much choice but to accept it. We are all put in school as children. Those who chose to reject it, perhaps as they realize its falsity, pay a high price.

Science, on the contrary, is related to the subject supposed to know. If we think that others actually *believe*, wrongly, in mathematics education, while we "know better", the opposite is the case when it comes to mathematics: we know very well that we do *not* know, but – alas – we have *faith* in the fact that there are others that know. This is how science works and how it is supposed to work: we are supposed, as moderns, to have faith in science, to know that there are others that know better.

Thus, when we relate to people in education, the normal stance is to think oneself to be the one who knows better; when we relate to scientists, the normal stance is to think that they are the ones who know.

To be modern, then, can be described as on the one hand rejecting religion, that is, rejecting all that remains of religion in education, that is: most of education, this education that *others* apparently believe in, in a way that makes it into such a persistent part of society. On the other hand, moderns have faith in science, in the truth, reality and power of science – despite not actually "knowing" very much about it, thus instead presupposing that there are *others* that know.

Let me now add two things to this picture. Firstly, that "science", in this problematic structure of knowledge, faith and ascription of beliefs to others, is something that we come to know about through education. It is through mathematics education that we learn about the powers of mathematics, its presence, and so on.

Did I not just say that people *do not* believe in the messaged transmitted by mathematics education? Here is the crux. What happens is, I contend, and this is admittedly a rather complicated argument, that this message works on two levels, where it is both rejected and affirmed. It is rejected insofar as it is *recognized* that it is a message emerging out of the institution of mathematics education. This goes, for instance, for the endless series of reports about mathematics education, asserting its necessity for self-confidence, democracy, and so on. Such reports are typically not "believed in", in the sense just described. The stance towards them fits much better with the idea of the *other* that is supposed to believe. Such reports are *accepted*. What people do, however, is to contrast these "vulgar" messages of mathematics education – stupid, repetitive, unbelievable – with a *real and true* mathematics, standing over and above mathematics education: science. The trick consists in this "behind" or "beyond" *also* being a message produced by mathematics education. This is the other level on which the message of mathematics education works, the level that escapes us.

The obligation to care

The message of mathematics education is that, *as moderns*, it is our obligation to care about mathematics. While we reject mathematics education – we think – both the stupid ritual and the hyperbolic assertions of its importance, this fundamental idea about mathematics is something that we seemingly cannot keep at bay. Our performance of schoolwork, our sustained acceptance of engaging with the imaginary of mathematics education, with taking it seriously, with being immersed in it, inevitably leaves a *trace* – and this trace has the form of a certain *obligation* or *demand* to have faith in science and mathematics. We *need* to have such faith while we are in school, to make sense of that reality, and we become endowed with what could perhaps be called “meaningful habits” of physical action, of feeling and of thinking, that just continue “running”, as a sort of compulsion – not always there, but activated in certain circumstances.

The production of this demand can usefully be understood with the help of Robert Pfaller’s analysis of what happens when we are forced to play a game. He points to the fact that even if we do not play voluntarily, and even if we do not believe in the imaginary of the game, over time it is impossible not to become grasped by it, by this imagery being internalized, in a way *installed* in ourselves, as an instance to which we inevitably have to relate; an instance, on the least having power over feelings of joy and guilt.

What I contend is thus that mathematics education *installs*, so to speak, in its participants, an obligation to care about mathematics. This obligation is not conscious, however, but remains in a state that is perhaps best described as *vague*.

When people are asked what they think of mathematics, they most often say that it is most important – but perhaps add that they are not very good at it – and perhaps they even add that this is a shame. If people are asked what they *do* – they do of course not talk about mathematics. I contend that assertions concerning stances towards mathematics are – in a quite specific sense – lip service, and that there hides, behind these statements, nothing less than hate. People know that they are supposed to say that mathematics is important. That makes them proper moderns, with faith in science, faith in those supposed to know. However, being modern is hard work. It is a way of being that is difficult to combine with things enjoyable – like play, like not caring about what is true and real – not caring about mathematics.

The naïve observer

In this section, I will be concerned with the above-mentioned *instance* that I claim is installed in all of us through our performance of mathematics education. This instance demands that we love mathematics. Robert Pfaller calls this instance the “naïve observer”. This concept, of the naïve observer, is closely related to what psychoanalytically inspired philosophers call the “big Other”. It is an instance *in* ourselves that, in a way, contains all that we know – unconsciously – about how the world works. Thus, importantly, we may very well “know” things that are not necessarily completely true; we may for instance “know” that people despise us, and thus live in a world in which we are despised, as we are constantly despised by this *instance*, functioning as a kind of stand in for *actual* others despising us.

The concept of gaze

This instance is also centrally related to the concept of *gaze*. This is not our gaze, but a gaze that is directed at us. Through this instance, we see ourselves. Importantly, it is from the “perspective” of this gaze that we evaluate our way of being in the world, our actions. A typical application of this idea of the gaze would be how women, who want to be beautiful, supposedly adjust to a “male gaze”, finding this beauty attractive.

Imaginary and symbolic identification

Gaze is related to the difference between *imaginary* and *symbolic* identification. As is brilliantly explained by Slavoj Žižek in his *The Sublime Object of Ideology*: imaginary identification relates to what we want to be like; who we want to be like; what kind of person we want to be. Symbolic identification has to do with the position *from which* it is this kind of person becomes likeable. Again, if a woman desires to be thin, she identifies, on the level of the imaginary, with thin women. On the symbolic level however, she identifies with, as one would express it, with a “male gaze”.

What we get from mathematics, installed in ourselves, is thus a *gaze* from which we evaluate ourselves – not universally, luckily: this gaze cares little about who we marry – but in relation to science and mathematics. Another way to express this is that we identify symbolically with what we think is science, but what is in fact rather the education system; the position from which people are evaluated according to their love of mathematics, not to mention, of course, according to their amounts of mathematical knowledge.

We cannot control with what we identify. That is a central message of this analysis. As we are immersed in play; forced or lured into taking the game of mathematics education, we start to evaluate ourselves according to the standards of the game. This is something that happens beyond our backs; gradually, imperceptibly – *while*, perhaps we are busy complaining about its pointlessness, its lack of realism, its ritual character. The trick is that we are pushed – not towards belief in mathematics education; it would seem very difficult to smuggle *that* into our soul without us noticing the contradiction. Instead we are pushed towards science; what at the surface seems to be the very *opposite* to mathematics education. The further we move away from mathematics education; the more distance we put between this failed institution and ourselves, the more we hate it – to put it sharply – the firmer is our own personal mathematical gaze installed in our unconscious.

The naivety of the observer

Is there no room for resistance? Yes, there is! Luckily. Because it is not for nothing that Pfaller calls this instance the *naïve* observer. It turns out, as something like an empirical fact, that the kind of internalized “observer” that becomes the result of activities such as mathematics education, does not really understand the details and nuances of human subjectivity. It does not “know”, so to speak”, what we think and feel; credulously, it seems to accept what *seems to be the case*.

The mechanism can be illustrated by acts of politeness. To be polite has nothing to do with thinking; it has to do with performance. Thus, if we for some reason fail to perform appropriately, we feel shame. These feelings are, as a matter of fact, not very dependent on any particular other participant being offended by our behavior, or even noticing it. The shame just comes, as a kind of automatic response to our failure. The one who “saw us” was, in this scenario, the “naïve observer”, an instance that was installed in ourselves as we were brought up. It is *for him* (or her), that we act politely – and again, in fact, this is an instance that it is very difficult to surmount or escape – for instance as regards politeness. You may think that you can violate the rules of politeness at will, but that is most probably not true. Even less true would be that you, in such a scenario, would have control over your emotions. The very point of the argument is that *the body* has become hardwired to “see” and evaluate situations, and in relation to this, to our bodies, we are quite powerless.

Another example is how we often react, physiologically, when we for some reason are late to a meeting or have to cancel it. In particular if the reasons are complicated. Assume, for examples sake, that a series of events has occurred that sound very much like a story that someone would invent as an excuse. In this scenario, again, it may very well be very difficult to avoid feelings of shame *even though we know very well* that our excuse is actually valid, *and* our colleagues and friends trust us, *and* we know that they trust us. The thing in this scenario is that the naïve observer – part of ourselves – is so *stupid* that he cannot grasp that this series of events has really happened. *He*, that is – unluckily – part of ourselves, cannot be convinced of this state of affairs. He just takes a superficial look and concludes, idiotically, that we have invented an excuse to avoid having to go to the meeting. Thus, we cannot avoid the shame.

In the first case, the naïve observer actually does a very useful job keeping social relations and society together – keeping us on track, so to speak, preventing us from acting out whatever it is that goes on in our brain. In the second case, the naïve observer just pointlessly makes us feel bad. Its naïveté works to our disadvantage. I will now come to how this naïveté on the contrary can be made to work to our advantage.

Quasi activity and interpassivity

It is quite possible to *fool* the naïve observer. The gaze of mathematics demands that we care about mathematics, loves it, knows it, feels bad if do not know it, uses it, acknowledges its presence in the world, its usefulness, and so on. However, it knows nothing directly about what we think and feel. It watches us from a certain distance, so to speak. This opens up for interesting possibilities.

Pfaller has analyzed the behavior of consumers in consumer society. His favorite examples concern TV. Assume that there is a Champions League football match this evening. Let us say it is an unmissable match: Barcelona versus Manchester United. Some friends ask if I want to join them for dinner, and I of course have to reply that *unfortunately*, I cannot come – because of the football. Football on TV is of course complete nonsense. But I have become grasped by it. I cannot resist. Resist what? Sitting there, mesmerized, in front of the TV – then instantly forgetting everything about this match, instead looking forward to the next. Insofar as I enjoy this, it would count as the “others supposed to believe” kind of activity – thoroughly unscientific; one and a half hours of being in another world, far away, doing something completely different, that is, imagining all this; knowing very well that it is just a fantasy, but enjoying it anyway. Note here, that, as I “must” watch it, I do not really do it by free choice. There is a power in play here; that in this particular case could be said to work to my advantage (if I do not regret missing the dinner with friends). What happens if I try to resist the urge to watch TV? How can it be resisted?

Pfaller’s favorite examples concern people who try to resist. What they do is to use tools, artifacts, to fool the naïve observer. In the case above: why not videotape the game, and watch it after the dinner? This may in fact not work very well, because we are, it seems, obliged to watch sports events “live” – the gaze watching us will accept nothing less. A solution could be to have the match playing in the background; only sound, say. The point now, is that we – the boy inside us – *will be satisfied* at some point, where the arrangement clearly enough indicates that we actually watches the match. If we then *really* watches it – or if we instead chat with our friends – that is none of his business, and beyond his control.

Another example concerns books. Some people, like myself, feel an obligation to read; new books, articles found, classics. We are, we have learned, the kind of person that likes to read. If we do not do it, the body responds with unease. Unfortunately, it takes very much time to read, and if you are to understand you must concentrate, which is difficult if you are tired. Thus – when an article is found on the internet, it may instead be copied to the hard-drive. There you have it! The naïve observer takes note – it cannot see the difference from superficial surfing and saving, and the hard work of reading. *Buying* books may also help. Or *copying* texts; sorting them, archiving them. It is so much easier, as it can be done mechanically and often much quicker than reading: enormous amounts if words can be downloaded with little effort: and the naïve observer is impressed. And then we can turn on the TV.

Quasi-activity. The transmission of messages to the naïve observer.

Slavoj Žižek calls these kind of activities *quasi*. Another word, used by Pfaller, is *ritual*. They are acts, the primary purpose of which is to *signify* action, not really to do anything (while of course *something* is always done, albeit often in a seemingly impractical way). They are *directed* to the naïve observer, this instance that is constantly watching us, that demands from us that we *are* in complicated and inconvenient ways, having interests, being engaged, *believing* in things supposedly important.

Interpassivity. Letting "others" do the work of signification.

The most *efficient* way of satisfying the naïve observer is to have a machine – or if that does not work – someone else perform the work of signification, of *signaling*, so to speak, to the naïve other, who we really are, erecting a shield of meaning, behind which we can do other things.

Pfaller uses the burning candle as an illustration of how this works; candles burning to signify – sitting there silently in the church long after everybody has left, continuing the prayer (Pfaller 2002, 42). A more striking example are Buddhist praying wheels. Texts with prayers are put inside them. They then "pray" as they are moved by the wind. Who prays? There is simply prayer – and it is accepted; by the naïve observer. After having set up the wheels, everybody can continue with whatever practical or fun activities that needs to be done; I think here of the *eye* in the Lord of the Rings – mesmerized by the spinning prayer wheels – involuntarily allowing life to go on as normal, undistracted by religious obligations. The expression that Pfaller and Žižek use for this kind of "action" performed by proxy is *interpassivity*.

We are obliged to be modern, to believe in science, to love mathematics, to use it, to constantly acknowledge its presence, to "see it" everywhere. To actually *do* that, one would need to be crazy. And this is a lesson to be learned about the messages of ritual – to identify with them completely amounts to craziness just as much as their total rejection. Normal is proper distance.

What we do – practically, in a way, but not without its costs – is to leave the work of caring about mathematics to the children. They are weak, uninformed, and malleable. They can be our praying wheel.

If it only was that simple. Our naïve observers are not *that* naïve. They see what is going on. That is: *we* see it. Instead of love of mathematics, we see ritual. Instead of acknowledgement of presence, we see fake realism. Instead of *attention*, being paid to mathematics, we see mechanical computations – signifying nothing!

The general tendency in modern society is that people want to have as little to do as possible with mathematics, and even less with mathematics education. Thus, people strive for *interpassive* solutions to the obligation to engage with it. Mathematics education is such a solution. Well insulated from adult society. *Others* do it. And we have ourselves *done our duty*, paid tribute, as children, in the same way as our children will do in time. We pass through mathematics education. As society, we thus signify to ourselves who we are – namely moderns, caring about science and mathematics, living in a world imbued by it, in a world where scientific knowledge is king, and superstition is long gone. However, we cannot help seeing the ritual and seeing through its messages.

The standard critique revisited

We do two things about this. Firstly, we say that *this thing here*, what actually goes on, that is not *it* – and we try to convince ourselves that mathematics education as it actually is, in fact almost does not exist; because the future is so near, and then it will be something else – because we are just about to change it. Secondly, we simply *tell* this naïve fellow, ourselves, what it is that we *mean*. This is our second praying wheel – the production of research and publications, ad nauseam repeating how we *mean* what mathematics is, and how mathematics education work. The point is that these texts are only read by one single person: the naïve other. They are not written to be read by real people. And here is the answer to why they are thence written: because of what the activity of writing signifies.

We understand now, also, the contradiction between the high status of mathematics and the low status of mathematics education, expressed in a way in the standard critique. We despise those in our society who are allotted the ungrateful task of being our signifying machine. This is a machine that we are dependent on, in that it relieves us of the heavy burden of believing, but a machine that, paradoxically, can only perform this function for us *as malfunctioning*. It is hard to imagine a more ungrateful task than being an operator of this machine (i.e. a teacher); receiving constant blame from those who it actually serves: laughing at the incompetence and ignorance of teachers is probably one of the most modern activities there are, and one of the most stupidly mistaken.

The strange thing then, is that mathematics education does two *opposite* things at the same time. On the one hand, it is *for* mathematics – it creates all these messages about its greatness, traps us in the imagery of pure scientific modernity. On the other, it functions as a defense *against* this obligation of mathematical purity; it erects a shield around society, making it invisible to the mathematical gaze that can see nothing but the tasks of mathematics education the performance of which brings this protective shield into existence. That is modern mathematics education – as fascinatingly complex and modern a fabrication as any Star Wars spaceship.

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