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The "Contrat Didactique" permanent clauses, global breaches

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The **contrat didactique** focuses on the respective "teacher" and "student" in relation to the knowledge that is taught.

It was introduced first by Guy Brousseau (France) to explain rules and mutual expectations for mathematical behavior, on the part of both teacher and student, that are observed within each subject of study.

Changes in particular aspects of the **contrat didactique** are part of the daily functioning of the classroom.

*The **contrat** is modified whenever a new subject matter is introduced, or when students need to change activities with regard to the same subject matter.*

These changes in the **contrat didactique** are an essential part of the progression of the mathematics course: they give the rhythm of this progression.

*As some aspects of the **contrat didactique** change, some of its invariant aspects become apparent and are reinforced. These are the **permanent clause***

In certain cases, particular subject matter can threaten aspects of the **contrat** that up to now have been shown to be invariant.

*It was those aspects of the **contrat** which define the respective roles of the teacher and the student, in relation to the knowledge.*

The teaching of proofs in geometry has such an effect.

In France this teaching is introduced when the pupil is about 13 years old. At this point, the student is asked to prove what previously he or she was only asked to describe.

We have studied such problems in remedial sessions with low-achieving students in geometry, age 13-14.

*These sessions supported our hypotheses concerning the **breach of contrat** created by the transition from the geometry of drawings to the geometry of proofs. As a result, we developed a remedial strategy in which the rules of the "didactic game" were renegotiated.*

To make a case in point, let us consider Sophie, a low-achiever in geometry, aged 13, and an average pupil in other subjects.

*During remedial sessions, discussions of her mathematical work led her to found a new appreciation of the **contrat**. Her attitude towards mathematical work changed subtly. The changes were subconscious since the **contrat didactique** is never explicit, even when violations of it are, nevertheless, penalised.*

Insight into the nature of geometrical activities replaced her non mathematical strategies for coping with the demands of her mathematics course.

Sophie studies only to get average marks so that her parents would not "nag" her: to enjoy a peaceful family life. She does not try to learn mathematics for its own sake. But she now has to provide proofs of her own, and that requires mastery of the material.

The **breach of contrat** we have to deal with in Sophie's remedial work is the result of three problems concerning the one who teaches, the one who is taught, and what is taught.

It lay at first in Sophie's know-how concerning geometrical activities. In most cases, like most of the pupils, she had to

make neat drawings and to describe these properties of the figure which she could see. For any mathematical issue considered, she could tell whether she was supposed to provide a solution of her own, or to let the teacher deal with it. Still better: she could usually get the right answer without understanding what was at stake.

The second problem lay in the teacher's know-how about the subject matter that he was teaching. At any point in the time, pupils were expecting him or her to know the right answer and give credence to their belief that he or she did indeed know the right answer. Moreover, the teacher was responsible for the assessment of the pupil's answer, this is no longer the rule.

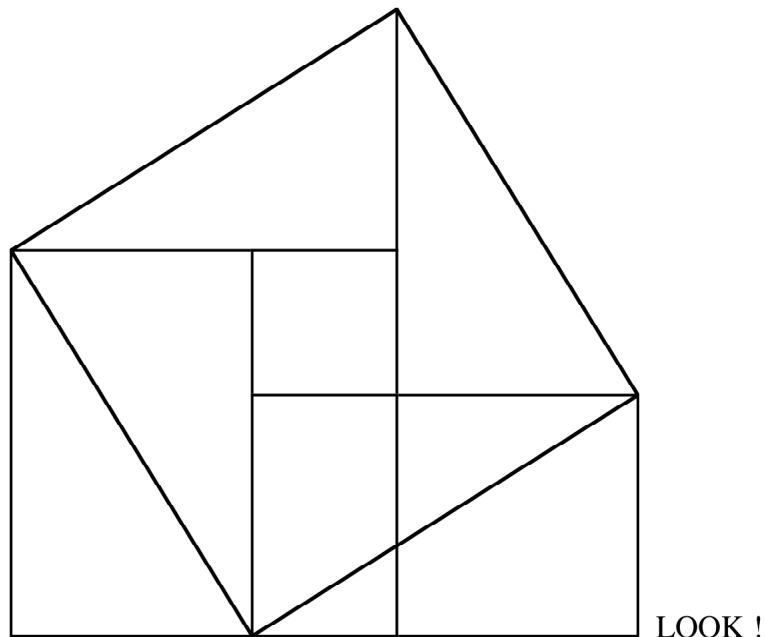
This creates the third problem, for both the teacher and the student, with respect to geometric ideas. In previous conditions, pupils were only expected to show that they duly see "facts" whereas they were expecting the teacher possibly to provide "proofs", and to point out these facts, helping them in their work.

*These clauses should change now, so that the one who is taught may provide proofs of his or her own; this makes the **breach of contrat didactique** we have to deal with.*

These constraints notwithstanding, some pupils do learn geometry, and making proofs. They are exceptions, and do it on their own.

The euclidean way of making proofs bewilders most pupils; Sophie is not rare. The euclidean work is at the beginning of a new kind of mathematics.

From this point on, a mathematical utterance is more than just expressing a mathematical truth - as this so-called proof of Pythagoras's theorem, from Bhascara, 1114 A.D., does:



A piece of mathematics now contains both statements and the means of establishing their mathematical truthfulness. It must allow the control of its proving aspect.

To be precise, there are three stages:

- *first, it announces what is to be proved, and thereby the truthfulness of it and the exactitude of the proof;*
- *second, it establishes markers or signs which indicate that the mathematical statement is indeed a proof;*
- *third, it has a structure which enables one to control that the proof of this statement is indeed logical.*

The euclidean idea of proof appears first as the solution to a contradiction in a theoretical game.

In everyday life, you don't worry about contradictions: you need only to change your point of view at the very moment when a contradiction appears, and forget the previous one.

In a theoretical game, others players are controlling your activities, and you may not maintain two contradictory points of view, one for each of the two different situations.

Our remedial sessions try to deal with these three problems and this hypothesis:

As far as she is concerned, Sophie wants to solve her problem without using her new ideas about geometry and proofs: for reasons of her own, she does not want to get good marks at maths, moreover at geometry.

Nevertheless, a new kind of **contrat didactique** will be renegotiated, and Sophie will be able to be an average pupil, even in the geometry course.

During the last geometry lesson of the year, Sophie finally decided to attempt a mathematical proof. Her teacher, recognising the effort she had made, marked it "10.5 out of 20: too complicated, but good".

The proof she provided was incomplete, false, but Sophie was able to say: "It's O.K. now. I don't need any more remedial sessions".

Sophie finally accepted the rules of the game, her teacher accepted the effort, both could therefore go on further things.

This was the happy ending.

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