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▶ **To cite this version:**

Yves Chaumette, Francis Rousseaux. Tests and perception, a vaster scope. International Conference on Communications, Computing and Control Applications (CCCA'11), Mar 2011, Hammamet, Tunisia. hal-00662706

HAL Id: hal-00662706
https://paris1.hal.science/hal-00662706

Submitted on 24 Jan 2012

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Tests and perception, a vaster scope

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Abstract— **Tests are based on a principle: to get results conform to expectations according to some rules. However the comparison of both processes is delimited by perception. Usually these perceptions of input data and output data are overlooked, yet they do exist. These four operations are modelled by a square reproducing a well-know diagram in the mathematical theory of categories. The subjective side induced by perception is reduced to a minimum in program testing, and objectivity is assumed with an analysis of criteria, functions and partition testing, hence of results of tests. However it can't be ignored in Non Functional Requirements, test expectations – which can themselves be tested - or about testing the understanding of business needs.**

Phenomenology can be modelled and these models can help to broaden the scope of tests, that's what this paper is aiming at. By dividing a math graph in semi-edges, one gets whorls – i.e. arrows without defined ends - which have a law of composition. Whorls are thus modelling perceptions and gestures, taking into account the gestation and the undefined. Plato already mentioned that a definition is based on undefined elements.

Thus whorls broaden the scope of interactions in integrating the movement. In a larger frame, loop arrows describe a return to One self in a rotation - through the Other - a pulsation is describing a return to oneself - though the Same - and spirals or whorls –in a mixed way - are describing relation to oneself in progression.

Keywords: perception, gesture, pulsation, model, whorl, arrow, negation

I. INTRODUCTION

Tests are the most analytical, detailed, rigorous part of a project, as the goal is to check the realization of what has been planned. Rene Guitart in La Pulsation mathématique [1] develops the idea that mathematics are not merely formal demonstration, with precise definitions and strict logics, it is also a building and exploratory activity in broadening the scope and imagining conceptual relationships. Rigour in the foundations balances with opening to possibilities, concentration on reasoning balances with synthetic view. This paper is aiming at applying such a pulsation to tests, showing the usefulness of perception. It will proceeds through a mathematical structure lying behind the principle of test, and will broaden the categorical structure. A new structure – whorls - can be introduced for modelling the idea of phenomenology thinkers describing perception. Negation and identity produce different behaviours for results and perceptions, this observation validates the new structure of whorls and opens the way to a third world: the world of poles, be they questions, instruments, purposes or values. These three worlds are then applied to tests, taking into account the results, the campaigns of tests and their objectives.

II. EXAMPLE: A QUERY

A. *Context of the query*

We'll take as an example of test and perception a quest for references. Our intent is to find references and we formulate in our mind, we build a query with keywords and we observe the items displayed by a research engine. So we question the matching of our expectations and the logics of the engine. Let us assume we are looking for a reference of the double path principle of testing.

B. *Observations*

At the words "Tests principles software" Google Scholar gives about 1,3 millions of answers. As the first page displays links with cells, lungs, one chooses to avoid the word biology: there remains only 913 000 answers; if chemistry and medicine are removed, 846 000 answers remains. However, the first page displays already 7 books on testing software.

The book of Myers [2], quoted 2525 times, can be downloaded, the SUDOC mentions it has been first published in 1979, a long way ago. The second edition is dated 2008 on Google Scholar yet the copyright is dated 2004. Some interesting features are found:

- "when you test a program, you want to add value to it" (page 10)
- "the intent of finding errors" (page 11). These 2 sentences reminds that testing is a purposeful activity.
- Ten principles are listed (page 16), they are clearly empirical.
- The first principle (page 16) states that it is necessary to define the expected output, and it goes on in requiring the description the input data and of the expected output data. Though the double path is not mentioned, this paragraph means it.

- The 6th principle broadens the view of checking: "seeing whether the program does what is it is not supposed to do".
- Each principle is then developed and the second principle states "A programmer should avoid attempting to test his or her own program" this alludes to the double path principle (neatly formulated below), and the psychological reason lies in the programmer misunderstanding (page 17)
- "Errors tends to come in clusters" (page 19) the reason is not known but it may be a symptom of the quality of this block of program.

A second book by Gilb and Finzy appears on this page, The PDF file enunciates principles (30 in number) without development, it can't be used in a theoretical paper for logics is missing. A third book by Perry in 2006 appears on this page, however the bibliometrics gives 0 to the rate of download and 3 for quotation count.

And appears to be downloaded the book of Pohl and al [6], it contains 473 pages and page VI one finds the "need for 2 distinct processes : domain and engineering" we call them expected and operational. The page VI adds variability which is close to laterality, thus coming in the line of this paper.

The second web page displays a presentation by Beck (a famous designer) and a copy of 9 pages from Boehm (another famous author) dated from 1991. The following page mentions a book by Mc Graw with 7 pages and a document of 2 pages about design and Testability. And time elapses after 40 minutes.

What did happen? The purpose was at the start, perception all the way, actions were performed and results arrived, some useful some useless. This paper will make a trial approach for modelling this behaviour.

III. THE CATEGORICAL STRUCTURE LYING BEHIND THE TESTS

Test consists in checking that one gets what has been expected [3 page VI]. This double path is sometimes forgottten when one is using the design of realization for implementing the tests, in this way this design is not checked. The same phenomenon happpens when one is testing the specifications and not going back to the business needs, their capture is assumed to be fine.

This double path becomes a closed circuit when it is perceived that the initial state is the same in both paths and the final state too. This double perception at the beginning and at the end is usually overlooked for it vanishes through the analysis of objectives, functionalities, criteria and tests scenarios. So perception is most often a mere observation of equality of records which can be dealt with a comparison program and hence produces only a return code.

When perception is noticed the double path draws a square, which is a well-known diagram in the mathematical theory of category.

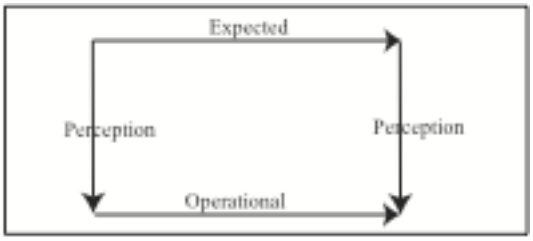


Figure 1. The square diagram of test

The mathematical theory of categories invented by Eilenberg and Mac Lane in 1945 [4] is the language in which all mathematical findings - algebraic structures and logics of propositions - are nowadays described.

A category is a set – or a class – of arrows - with a source and a target – equipped with a partial law of composition. This law of composition is associative. The sources and targets of these arrows are identified with loops which are neutral elements for the compositions of arrows [4 p 289].

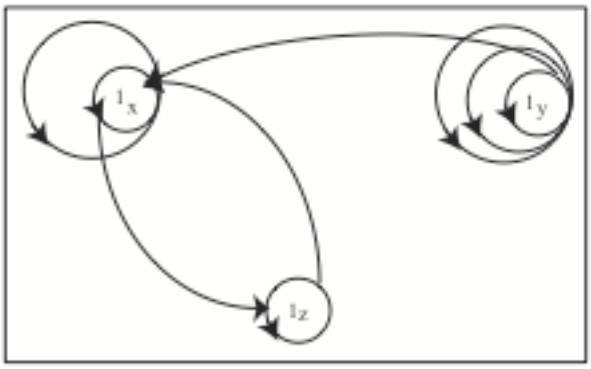


Figure 2. Example of category with 3 elements

Bailly & Longo [5] noticed that all transformations –in sciences - are seen as a triad: initial state, transition, final state. Thus an arrow with its source and target is modelling any interaction, the basis of systemic paradigm. In the semantic web, for example RDF (Resources Description Frameworks) [6] uses triples.

IV. THE TREND OF INTENTIONALITY, OPENING, LATERALITY

Perception has long been thought, including Kant [7] as a relationship between an object and a subject and this is based on the same triad noticed above. However the statute of the object was questioned by Hegel [8 §1, §214] and Schopenhauer [9] went on. Husserl [10] noticed that consciousness is an opening, an expectation; in hanging up the attention, perception becomes a dyad: someone in relation to … ; the object is not yet grasped. This conception has been followed by Barbaras, Patocka [commented in Barbaras 11], Badiou [12]. This last author even used the word laterality, a very geometric word. This remark concerns perception in the field of knowledge, and Gilles Chatelet [resumed in 13] transposed it in the field of action, it is a gesture, a part of gestation. A gesture takes place in a world "in the making", a

world where things are happening and are not yet being defined. A gesture is thus a process without defined beginning nor end. One may notice the use of the present participative – and not the past participative – in the language describing a gesture.
This pleads for a dyad basis and not a triad. How can it be modelled ?
Indeed, a vector is a dyad with a point and an opening but it goes straight in its direction and it lacks laterality: exploration of the surrounding space. The concept of vector relates to an age of certainty, which fits well with Descartes and Newton.

V. WHORL, A DYADIC STRUCTURE

In order to find a dyad, one may come back to the graph underlying the category of arrows. Instead of a triad based on two vertices and an edge, one is looking for a 2-based structure. A vertex with half an edge – like people stretching one's hand – is a poor structure, it would soon fall on the usual graph. Half an edge around a vertex and another half edge won't give much, it will also lead to a graph. To remove both ends of an edge is a worthwhile hypothesis as this gesture of removing dots is used in some areas of mathematics [14]. A whorl is thus an oriented edge without ends, and whorls obey to a partial law of composition, as do the arrows. This law is also associative, if $s_1 \circ s_2$ and $s_2 \circ s_3$ do exist then
$(s_1 \circ s_2) \circ s_3 = s_1 \circ (s_2 \circ s_3)$

Whorls have interiority and a relational ability. Whorls can project on a category giving a loop. Thus two composed whorls project and give an arrow.

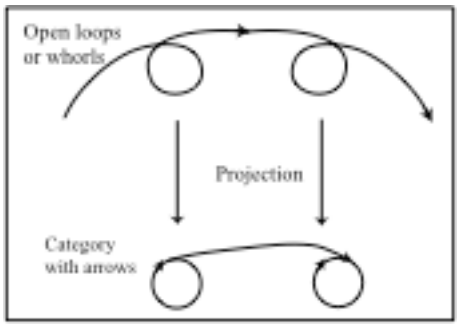


Figure 3. Projection of whorls onto arrows

Several whorls projecting on the same loop can have a (partial) order. Whorls can have universal solutions, a set of whorls can be factorized through one whorl. This may be used to describe a cone: the perception of an object is common to many perceptions, and it is almost in that way that Kant described the notion of an object: as the limit of a cone. The concept of cone was introduced in categories of arrows, yet it may be applied with whorls, an universal solution is then the invariant or filtering of the many elements composing the cone [4 p 55, 71].

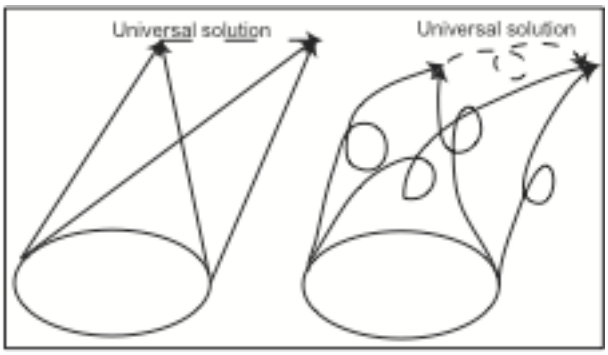


Figure 4. Cones of arrows and whorls

On a dyadic basis too, an object results of an invariant impression common to many impressions. For example, a tree appears as such as we can have many looks at it and a part of the impression remains similar in these different points of view. Such an impression has no subject and no object, that what means "removing the ends"; the laying down and definition of the object as well as the subject are hanged up.

In mathematics, a topos [4 p 289] is a special category with a final object and a classifier object: this enables to say that some propositions are true or not, and thus to assert judgments. Toposes are useful as most of the operations that can be made with sets can be made in them: this name *topos* (meaning place in Greek) reminds that these operations are located. Whorls are weakened arrows, sets of whorls are weakened categories, they can't have a final object and thus they can't be classified as true; the language of whorls escapes judgement. Judgement and perception are complementary, noticed Myers and Briggs [15], following Jung [16].

VI. NEGATION, IDENTITY AND 3 WORLDS

As noticed Hegel with the concept of nothingness [8 §40] and Badiou [12], negation operates in one way with actions – or logical propositions- and in another way with perceptions. Perceptions can't be negated, they have a reverse side [12 page 146]: one can perceive there is not any more an object there, however this perception can't be erased. Similarly, the play of a test scenario might show defaults, but this play can't be ignored.
A perception is an enquiry within a space of possible results, however this space has to be founded, usually it is a question that arouses the enquiry and brings about answers. It is a purpose or a value that arouses gestures, moves and which brings about activities that compose a project. The foundation of the space of possible results might be called a pole, as a pole of attraction; it has no negation, no inverse, and no reverse. The question 'why' can't be negated, it matters more or less, the same is true for an instrument, it is a tool for measuring a grandeur or a dimension, but it is not a measurement neither a result. A pole can be viewed as a blackhole as the geometry of actions collapse.
The three worlds of actions, gestures, and poles can be seen in most of our deeds; for example a paper deals with a topics – its pole –, it follows a logical thread while keeping an

overview of the goal – a whorl – and transmits ideas, procedures or results – arrows modelling interactions.
Each of this world has a special movement related to identity, the return to Self.
One may return to the Self classically in two ways through the Same or through the Other [17].
1) The return to Self through the Other depicts a movement to the outward, a rotation which goes out of the centre, explores the outside and comes back from the periphery. This movement is a loop, an arrow returning to itself, such is the definition of objects within a category.
2) The return to self through the Same depicts a movement inward, never giving up its centre and it depicts a pulsation.
3) A gesture – or inquiry – being the interface between a pole and an action has a composed movement: action gives a rotation while the pulsation produced by a pole expresses through radii i.e. movements forward. A whorl is not stable and does not return to itself, yet several whorls may produce a ring which is stable. Thus a gesture goes back to the Same through a spiralling movement, exploring the surroundings and coming back in a ring composed of many whorls. Spirals are almost ignored in the western theory (save in the Waltzes of Vienna) while they are promoted in the eastern conception as movement of Vishnu [18], in Chinese martial arts and dervish.

VII. THE 3 WORLDS IN THE TESTS

Three worlds appear in front of negation, what do they give to the testing process? Results of a test can be good, bad or fuzzy.



Figure 5. 3 results for a test

These results come through campaigns that are composed of plays of scenarios, these plays can't be negated, they are enquiries in the software, finally an objective of tests is creating the space for these campaigns. An objective is thus a type with several instances of play which can take value on the set of possible results.

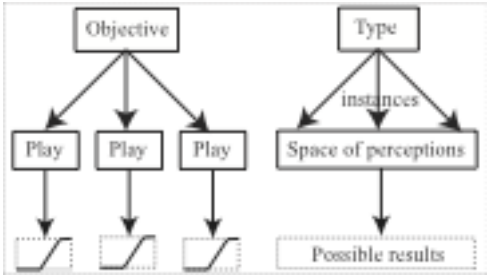


Figure 6. 3 levels in tests

The various objectives are themselves ordered according to a tree, as tests are aroused by the intent of checking the developed code, the fundamental intent being to "assess the quality of computer software" [Wikipedia quoted in 19] and hence detecting the failures. But this order of the various objectives of testing escapes the scope of this paper.

The pulsation described by Guitart is obvious in testing. In the most detailed part, tests concern a program and the results may be good or bad, when tests extend to a package the results may be fuzzy. When integration grows, the results concern the attainement of SLA and perception matters more. When the functioning of a whole system is considered, what matters is the objective and the attention turn to the poles of testing campaigns. Thus the pulsation applies both to results and to the scale of the three worlds.

VIII. THE DOUBLE PATH PRINCIPLE REVISITED

The diagram of the double path may be reviewed with the three worlds, the movement forward in time between the as-is state and the to-be state is expressing the pulsation of the purpose. This purpose arouses preparation of the test campaigns and observation of its results. A whorl projects on an arrow; preparation of tests induces planning, study, creation of test games, and observation produced the action of comparison of expected and obtained results.

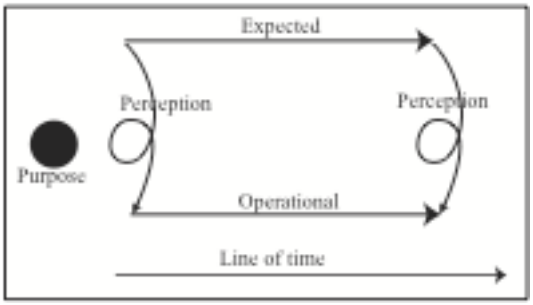


Figure 7. The square diagram of test revisited

This diagram might be extended to the relationship of the business line and the development: business line is expecting some uses of the application which are fulfilled or not by the deployed software.

IX. PULSATION IN THE LIFE-CYCLE OF TESTING

The pulsation in the three worlds applies also to the testing life-cycle. The pulse expands about the expectation, starting with the overview of the system purpose, going to testing objectives, campaigns, functions, scenarios, and test cases; this marks the most detailed part. All this study of preparing tests is an enquiry going from a pole to many planned interactions. Then the pulse contracts back, starting from results, integrating packages, non-regression tests, and ending in comparing the system results with objectives, this comparison refers to the purpose of the system. This can be modelled in a life cycle shown in figure 8.

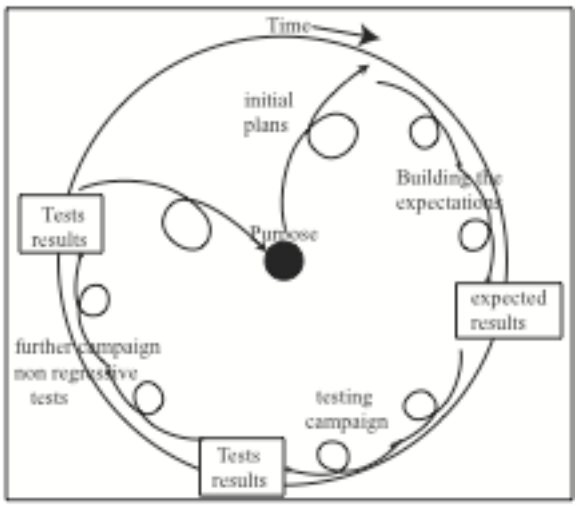


Figure 8. General life cycle of testing

Let us come back to our example and apply this modelling to it.

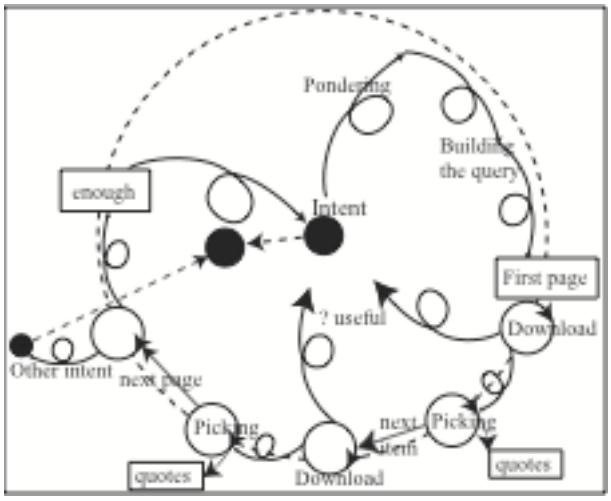


Figure 9. Model of the example query

In the diagram all actions are in italics, the objects resulting from an action are embedded in rectangles. Most of gestures and perceptions are producing actions, such as "building of the query", however they are shown as gestures. Ideas that do not correspond to the initial quest are all gathered under the whorl as 'Other intent', they include some sentences by Myers [2 page 16 , 6th Principle], design and testatibility, the documents from Beck and Boehm.

The initial intent has produced results: references were found, thus the expectation of finding references and the approach by the selected key words have been found worthwhile; the understanding of the algorithm of a research engine has been confirmed, in spite of the 134 000 answers. However, the notion of principle has shown to be a guide for action thus weakening its scope. With this refinement and the new perspectives the intent has slightly moved. This move evidenced in this example can be observed in our usual quests.

X. THREATS TO VALIDITY

A human trend is to set limits in order to define. Any budget requires a beginning and an end. To consider something without ends is strange and it might be a reason to reject whorls and gestures. Obviously it is possible to consider only results, yet as noticed Hegel "the naked result is the corpse which has let the trend behind itself" [20 page 45]. Gestation enriches the process and can describe creativeness. However, whorls can be like enzymes who catalyze a reaction yet do not appear in the result. That's the way Guitart [21] describes the use of some mathematical structures.

The natural trend in front of novelty is to come back to a well-known domain. If any perception gives way to an action, i.e. any whorl projects onto an arrow, the conception of whorls would be useless, though negation operates differently; in that case usual ontology would be convenient. However if the rate of conversion is one for 10 or even of 1 for one million – one object standing for one million perceptions – indeed the world of perceptions would have some uses and not only a formal status.

XI. PERSPECTIVES

This 3-world frame can be applied to describe priorities of an application in the business line, it can be used for describing movement in real-time computing when results arrived well after the process and the movement can't be cut in slices.
Parallel computing might benefit of this model as the process matters more than the transitory results. Finally, modelling the intent and the gestures might be useful for developing an application, if one can see the project in an intentional view.

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