NEST- PATHFINDER

Measuring the Impossible (MtI)

Brussels 28 May 2004
Summary of Main Points

Attendees:

Dr. Teresa Goodman
Dr. Kim Carneiro
Dr. Jan Bernheim
Dr. Soeren Ventegodt
Dr. Boris Mitrofanich Velichkovsky
Dr. Enrica Deregibus
Dr. Peter Theuns

Purpose of the meeting

The purpose of the meeting was to consult a varied set of experts from different backgrounds in order to help identify and discuss possible areas around the "***Measuring the Impossible***" topic raised by the attendees of a previous workshop organised on April 29.
ftp://ftp.cordis.lu/pub/nest/docs/summary_main_points_2904_workshop_en.pdf
Despite the short notice of the meeting, everybody prepared detailed presentations. Further assessment and consultation is being carried out to test and refine these ideas.

The meeting was organised as a brainstorming exercise, to reflect on interdisciplinary opportunities and novel investigative methods that could present prospects for significant advances in the scientific basis for quantifying human perception, measuring qualities which will be necessary for the understanding of human well being, and creating high-value products and services of the future.

Mr. William Cannel, Head of Unit for NEST, opened the meeting welcoming the attendees, and giving a brief background to the NEST programme and activities. This was followed by a short introduction of the PATHFINDER and the topic selection process by Alejandro Martin Hobdey. Finally Carlos Saraiva Martins introduced the topic "Measuring the Impossible" stressing the importance of complex measurements. Human response in any of the human senses, comfort, perceived quality, customer satisfaction, well-being, quality of life were some of key-words of his presentation.

There was then a "tour de table" during which the attendees had 10 minutes to present their initial views and opinions. The following topics and ideas, in "***key word form***", were raised by the attendees:

- Quality of life measurements
- Life experience
- Imaging perception
- Attention resolution, distribution of attention, different emotional states
- Taste, smell, appearance; models to predict, efficient design, industrial needs
- Multiparameter measurements
- Philosophy, theory, measurement
- Consciousness; beauty

- Comfort, user needs, biometric parameters, human attention
- Images: decision making, algorithmic discrimination
- Virtual reality, animation
- Satisfaction, desirability

At the end of the "tour de table" there was a general discussion to find common points and issues. An attempt was then made in the afternoon to agree on a common platform. In particular, the aim was to consider the motivation for the ideas, possible projects falling within the topic, as well as the research activities that could be pursued.

Much of the discussion in the afternoon centred on the influence of the "state of mind" in terms of the outcome of subjective responses. There was also a discussion regarding consciousness and the ability to measure "quality of life" or "beauty".

After some discussion it was concluded that "Quality" was a better common denominator than "beauty" and that human perception of quality of life, quality of products and quality of services and their relation to measurements could be an activity worth looking into. The majority of the participants have considered that it would be worth starting with a more focussed programme first and that many of the ideas developed could then be more widely applied in the longer term to quantify higher order perception. Participants were convinced that a bottom-up approach would lead to many good examples of multidisciplinarity.

End of meeting – next steps

Following the discussion, the participants were requested to submit a brief (1/2 to 1 page) summary of their observations and conclusions (compendium attached). In July the Unit will make its contribution to the work programme for next year. The subjects raised in the meeting and in the summaries will be analysed and may be subject to more detailed and specialised comments in the coming months in order to prepare the supporting document assuming a positive decision to include this MtI topic. The outcome of this meeting and of all the future steps in the process will be posted and kept up to date on the NEST web site (*http://www.cordis.lu/nest/home.html)*

Attachments: ***Annex 1:*** *Compendium of brief summaries received from attendees.*

Annex 1:

Compendium of comments received following the

28 May 2004 PATHFINDER Topic Identification workshop

Measuring the Impossible

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I found very interesting the meeting for the opportunity that it offered to put together very different experiences and points of view on such a stimulating and ambitious topic as Measuring the Impossible.
As an engineer working in an industrial context, even if in research activities, my approach is obviously rather technologic and I generally try to think to possible fields of application even for the most abstract ideas.
What emerged from the fruitful discussion around concepts as measuring quality of life, human perception and consciousness, is the common interest for the understanding of the perceived quality of things and how this perception changes according to various situations.
I see at least a couple of very interesting and challenging fields of application of this new frontier of the science:

1) the possibility to quantify the perceived performances of products, that is a common interest of all the industrial world, not only for pure marketing reasons but also to improve the quality and usefulness of products;
2) the measure in real time of the mental status of human beings in term of workload, attention and awareness according to the continuous variations of the context: this is a very important matter not only for automotive industry, but for all the developments related to human activity and work in presence of multiple tasks. We can mention for instance the design of systems, functions or services to be used while driving a vehicle, during a working activity or generally in a moving or challenging environment; the development of proactive systems able to support the user –driver or worker- and/or to prevent his/her possible wrong and dangerous actions; the design of self-aware user interfaces able to monitor the actions made by the user on the system, to evaluate the complexity of the current task, to foresee user's intentions; etc.
   The ever higher amount of information made available in every moment of the human life put researchers and engineers in the condition to solve very important safety issues. There is more and more the need to know the cognitive capacity and limits of the human mind as well as the level of risk to which we are exposed in condition of both physical and mental demanding activities.

Several disciplines can contribute to reach these objectives, from psychology to medicine from physics to metrology and a number of other sciences and technologies.
The opportunity offered by the NEST program is just this interdisciplinary approach.
This interdisciplinarity can offer the chance to overcame the current limits encountered in such a complex field and maybe can help, when a simple measure is still not possible, to integrate several observing methods to obtain a meaningful estimation of unknown parameters.

Particularly for the first aforementioned item several different disciplines can contribute to measure not only the human perception with respect to the things, but also the properties of the things themselves and all the physical, biological and technological characteristics which contribute to determine user acceptance and perceived quality.
Similarly in the second case, cognitive sciences can cooperate with physical, biological and technological ones, including computer science and telematic, to be able not only to study the mental activity but also to monitor and measure the environmental conditions and the external scenario, the system or vehicle status as well as the physical status of the human being and his activity.

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I found the discussion very interesting and it was useful having inputs from diverse areas such as measurement laboratories, neurosciences and psychologists. However a broader range of inputs would have been even more valuable – it was a little disappointing that there were so few participants. Nevertheless I thought it was a constructive meeting and certainly helped to clarify my own thoughts regarding the subject.

In my opinion, based on the discussion at the meeting and with colleagues at NPL and elsewhere, the most useful focus for projects under the 'Measuring the Impossible' theme would be developing an improved understanding of, and an ability to measure or predict, 'quality'. There are many factors that can influence the perceived quality of a product, and the overall assessment will typically include input from more than one of our senses. For example, the quality of a car will be judged by a combination of factors including its appearance, the sound of the engine and the doors closing, the smell and feel of the interior, and the comfort of the driving position. Or the quality of a glass of wine might be judged by a combination of its appearance, its smell, and its taste.

Projects relating to measuring quality would need to involve inputs from many different scientific disciplines. For example:

- measurement scientists in areas such as optical radiation (i.e. light, colour, appearance), acoustics, thermal metrology, chemical metrology
- materials scientists
- visualisation and imaging
- neuroscience
- cognitive science and psychology
- computer science and IT

They would also need to seek to bring together very different approaches in order to build bridges (models) between entirely objective physical measurements and subjective opinions. Perceptual response mechanisms would need to be identified and interactions between these developed, and these models would need to be tested in 'real' (industrial) situations.

I believe that recent work in areas such as IT, imaging, visualisation, neuroscience, perceptual science and measurement science mean that there is now a real possibility of achieving an objective basis for assessments of key aspects of product quality. The ability to be able to predict consumer reaction to products would:

- reduce the need for the extensive prototyping which currently takes place
- improve production efficiency by reducing reliance on panels of experts in quality control
- reduce waste
- enable better prediction and control of human/product interactions, which could reduce road traffic accidents etc.

Much of the discussion at the workshop centred around the influence of consciousness or ‘state of mind’ on the outcome of subjective responses. For example, a good cup of coffee might not be highly rated by someone who is depressed, and a bad cup of coffee might be accepted as good by a happy person. This is, of course time, but this is a second order effect. The concept of being able to quantify the quality of a cup of coffee is still valid even if it is ultimately mediated by an individual’s state of mind; a ‘good’ cup of coffee will always be judged more highly than a ‘bad’ one. This idea is already well established in many areas, particularly the food and drink industries where panels of experts are used to access product quality on a regular basis. The desire would be to replace such expert panels with objective measurements.

There was also discussion regarding the ability to measure quality of life and more abstruse ‘quantities’ such as beauty. In my opinion these may well build upon the outcomes from an initially more focussed programme of work on measuring quality – many of the ideas developed in the latter could be more widely applied in the longer term.

There was also some suggestion that projects centred on measuring quality might be too ‘mundane’ or close to market to be appropriate for the NEST programme. I don’t think this is the case. On the contrary, there will need to be very major advances on the current scientific knowledge before we can begin to predict the complex ways in which humans interpret even an object as simple as an orange: without even touching it, it is possible to make a judgement of its freshness, ripeness, sweetness etc., yet viewing an image on a display screen (no matter how well the image is captured and displayed) does not allow us to make these same judgements. Solving these kinds of problem will involve inputs from many different disciplines and NEST would facilitate this. Without such a stimulus, progress will be slow and centred on specific sectors, and opportunities for sharing of expertise and the development of more generic approaches will be lost.

Søren Ventegodt[1] and Joav Merrick[2]

Philosophy of science: How can we identify the high-risk high-potential research for the day after tomorrow?

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We were asked to participate in a workshop to assist the European Commision on how to chose for financial support the high-risk high-potential basic research projects, which can give new scientic break-throughs and thus contribute significantly to the positive development of society, industry and economy the day after tomorrow. We have at this workshop analysed the problem in some detail; using the expierence from our own research in global quality of life we will suggest that the most promissing projects have the following characteristics:

1) They are lead by a brilliant researcher who expierience his research as “sweet science”, who wants to expleain the anomalies of his field of science and who live in a non-mainstreem scientific paradigm, 2) They are deeply engaged in the philosphoical problems of their research field and they search eagerly for a new understanding and new theory, giving new tools for measurement and creating change; results are taken as feedback on all levels from tool to theory and philosophy, 3) They are focused on a key point, that is an essential feature of the univers that create global change if interviened on.

At the NEST Pathfinder 2005 Topic Identification Workshop, Brussels 28 May 2004 entitled”Measuring the impossible” we advised the European Commission’s Research Directorate-General, Directorate B, in the program Anticipation of Scientific and Technological Needs Activity, the New and Emerging Science and Technology, to give money to project focusing on the state of consciousness, how to understand it, how to map it, and how to develop it.

INTRODUCTION

We (SV) were invited by the European Commission’s Research Directorate-General, Directorate B, to participate in the Anticipation of Scientific and Technological Needs Activity, the New and Emerging Science and Technology (NEST) Pathfinder 2005 Topic Identification Workshop, Brussels 28 May 2004 entitled ”Measuring the impossible”.

The purpose of the NEST is to support unconventional, exploratory research witch cuts across or lies outside the thematic priority area of FP6, in particular because it is highly interdisciplinary and/or multidisciplinary.

In the end of the workshop, the leader of the NEST programm, William Connell, asked the participants to write down their reflections, and as we believe that the subject is of relevance to everybody who wants to support the high-risk high potential basic research, we have decided to make our reflections public in this paper.

RESEARCH FOR THE DAY AFTER TOMORROW IS MADE BY INDIVIDUAL PIONEERS

Resarch is made by researchers. This seems to be a tautological statement but the more futoristic and controversial (risky) research is, the more is it done by individial reseachers and not by a large group of researcehs in the established community. The pioneers are always few, and the geniousses are even fewer; the difficult question of supporting the research of the future is to find and support the individual researchers who are brilliant and whos project carry a strong potential for a major breakthroug in the future. These researchers carries some caracteristics: they are our of pace with their time – as there ideas and perspective is for tomorrow or even for the day after tomorrow – they have a great passion for science and they come from science for the sake of science itself – the experience what Francic Harry Compton Crick, receiving the Nobel Prize in 1962 for the groups discoveries concerning the molecular structure of nuclear acids and its significance for information transfer in living material called “sweet science”. They life and breathe science. They are science.

These people are seldom appreciated fully by the scientific society, as their interest in new research paradigms[1] often makes them controversial and of little use in producing what is contemporarily seen as good an valid mainstreem science. They are ahead of their time, and the question often is if they really are creacpots or the profets of tomorrow. So if one whishes to support the basic research, finding these young brillant students and researcher anb supporting them is a must.

MEASURING THE IMPOSSIBLE TAKES A ROCK-SOLID STRATEGY

In the Danish quality of life Survey 1990-2004 [2-12] we believed that a strong focus on philosophy of science and research methodology [13-20]was nessesary for measuring the global quality of life[21]. We understood early in the project that if we were to succes in taken science a nem step into the unknown we had to express our understanding of this topic philosophically[22-29], taking the essence of the filosophy into formal theories[21,30,31], given the new measuring instruments and also tool for improvement of the subject of the reseach. The results from aplying the tool for measuring and chancing[32-34] where then feeding back on all levels: on the measurings tools (the questionnaires[35,36]), on the tools for changing, on the theories, and on the philosophy[Figure 1].

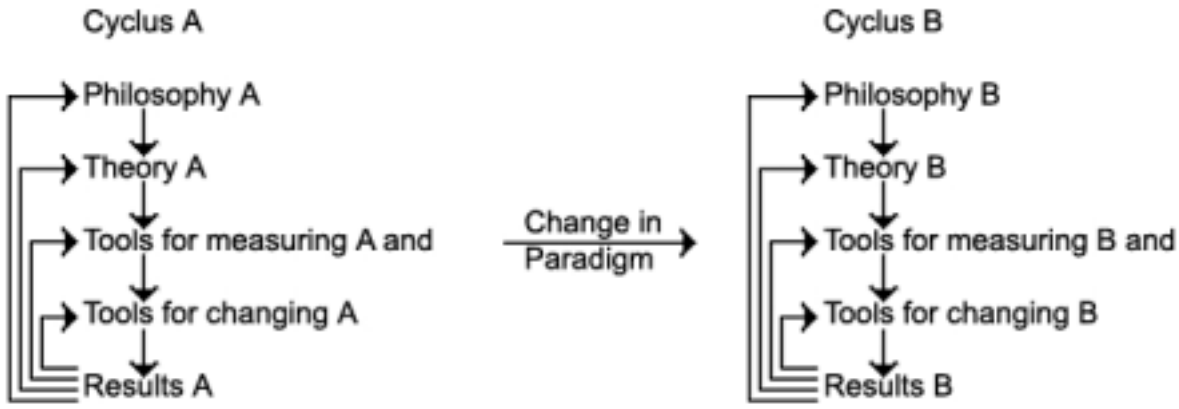

Figure 1: To measure the impossible – a new and unexplored area of reality (A) – takes understanding expressed as philosophy of A, new theory of A derived from the philosophy, new tools for measuring A and changing A derived from the theory, and results produced by the use of the combined tools, giving feed back to all levels above; while the results will confirm the correctness of the philosphy and theory for the normal researcer ignoring the anomalies of the research, the same results and anomalies will

lead the pionerer inte to new understanding and theory (a new research paradigm) and often to highly unexpected results – the scientific break through.

Whith a new philosophy[37-40] we could then formujlate a new series of theories[41-47], new tools for measuring[48] and creating the change [49,50] etc. leading the team to a completely new research program[51], and completely unexpected results, seemingly being able to help hiv- and cancerpatients with the new technology[52,53].

As Kuhn has pointed out[1], the scientific results will often only confirm the correctness of the philosphy and theory for a researcer who is busy with producing papers and with meeting the needs of the world with his science, the business making him ignore the most difficult, strange and disturbing anomalies of the research (with an example from our own research: the spontaneous remission of metastasied cancer with a few patients while most pateins die[53]), the same results and anomalies will lead the pionerer inte deep contemplation and into a new understanding and a theory (a new research paradigm) and often to highly unexpected an valuable results – the scientic break through (i.e. learning what is nessesary to induce the spontaours remission[53]).

So, what caracterises the project of a high risk – high potential researcher? We believe that his projekt always will be designed with a stong focus on the fundamental philosphy of his research subject and with an eye wide open for the anomalies of the field of his research.

FOCUSING THE RESEARCH

We learned at the workshop that *The NEST PATHFINDER initiative* will support research "with urgency and potental for future societal, industrial or econimoc relevance"; the problem is how to pic the research projects and scientist most likely for contributing on the large scale. To optimize this probability it is important to focus on the possibility for change and what creates it.

If we look at the three large areas of interest of the EU – 6th Framework NEST program [Figure 2]:

This is of cause only one way of many to focus, and the natural way to focus in the tradition of our research pointing to the surprising fact that QOL, health and ability in general seem to be primarily determined by consciousness[2].

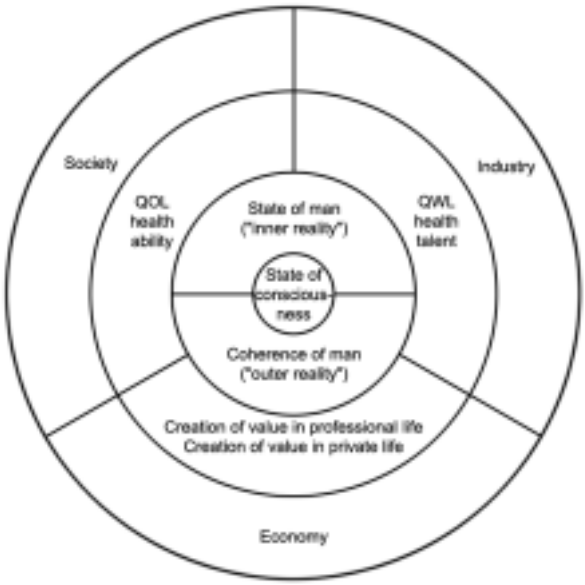

Figure 2: If you want to make basic scince likely to give a major scientific break through improving society, industry and economy in the future, you are most likely to succes if you find a key-point-project, i.e. a research project that

focuses on how to understand and how to develop consciousness [22-29,48])

CONCLUSION

The research project(s) which are most promissing to be of importance for the day after tomorrow, are the projects meeting the following criteria:

1. It must be lead by a brilliant researcher who expierience his research as “sweet science” and who is deeply involved with the philosophical problems of his field

2. The project must aim at developing new theory explaining the anomalies of the field, and new tools for measurement and intervention, that is: it must come from a new (non-mainstreem) research paradigm

3. It must be focused on They are focused on a key point, that is an essential feature of the univers that create global change if interviened on. We suggest that the post promissing key pont is the state of consciusness, how to understand it, how to map it, and how to develop it[2].

We stronly believe that the most direct way to highly unexpected scientific results and new scientic break-through wich will contribute to the positive development of society, industry and economy is to supporting the researchers working with such projects *in person*. We also recommend that after the researcher is identified, and that the nature of his commitment is analysed through descriptions of them from there peer to secure that he meets the criteria, he should have full controle over the fundings for his research, to be completely free to follow his own path of the research. A grant size of 2 to10 mio EURO for a period of 3-10 years is recommended.

This is our recommendation after participating in the NEST Pathfinder 2005 Topic Identification Workshop, Brussels 28 May 2004, entitled ”Measuring the impossible”.

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Ever since Galileo, measurement and quantification were a prerequisite to any essential progress in science and technology… Still, there are domains of importance both for our everyday life and advance in knowledge that escape quantification… In some cases, those are hard facts of science that put constrains on quantification. For instance, according to Bohr, Dirac and Heisenberg, it is impossible -- in microworlds -- to simultaneously measure different parameters of a particle at the same high level of precision. With development of nanotechnologies and microelectronics, the inevitable question will emerge how to deal with this type of constrains. On the other flank of the scientific spectrum, those are all the domains where higher-order emotions and perceptions (such as feeling of beauty), human values and personal sense are of importance. Any measurement procedure, as already emphasized by Immanuel Kant, interferes with these phenomena and, by changing them, leads to distortions in quantification. Here, again, the question is how to deal with this situation as the subjective phenomena have to be objectified for a proper evaluation of usability and ergonomic quality of industrial products and within large-scale investigations of well-being.

Interdisciplinary clusters:

(1). Is there overall progress in measurement theory, including evolution of underlying mathematical models? What are scientific perspectives for soft (or light?) and opportunistic (?) measurement? What is contribution of contemporary fast computing and large-data-base facilities (e.g. data-mining) to the measuring of the (previously) impossible?

Mathematics, Metrology, Computer Sciences, History of Science, Psychophysics

(2). What are morally sound and, in the same time, quantifiable solutions for the cases where available resources are clearly limited but social and individual demands are not? Would it be possible in the future to treat human emotional states and values in line with mathematical probabilities and physical or, perhaps, biological facts?

Decision Science, Medicine, Behavioural Economics, Moral Philosophy, Theology

(3). Methods of measuring and visualisation of invisible processes on the time-space scale of quantum physics. Can these scientific methods and approaches be used for a better interfacing of human operators in the emerging field of industrial nanotechnologies?

Physics, Chemistry, Computer Graphics, Nanorobotics, Cognitive Ergonomics

(4). Would it be possible in a near or, perhaps, middle-term future to quantify human conscious states, especially human subjective perception? Is there any solution in view, which extends beyond a simple psychophysical ascribing of numbers and rather emphasizing the holistic and meaningful nature of complex perceptual representation?

Neuroscience, Computer Graphics, Usability Engineering, Art History, Psychophysics

(5). Well-being and other similar perspectives…

Sociology, Human Ecology, Economics, Metrology, Industrial Design, Psychology

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- **Does it make sense?**

Yes. All measurements are in the end only relevant if they are perceived relevant by human beings. Although human well being may or may not be measurable at present, it is at least in part related to a multitude of measurable quantities. Some examples:

A medical doctor bases the decision about the treatment of a patient on a number of quantitative measurements such as blood pressure and body temperature, But the same doctor arrives at quite different results at different times, and different doctors arrive at different results at the same time. This leads to unnecessary treatment of healthy people and to lack of treatment of sick patients. The better doctors can measure, the better will they cure people.

Quality control of products that are produced in large quantities is often performed by persons. The more we understand which measures that lead to acceptance and rejection, the better can we optimize the construction process.

The importance of human perception of complex measurements performed within classical metrology fields today, sometimes called "soft Metrology" is not far from the importance of human perception that is involved in non-quantitative "measurements" related to quality of life studies.

The more quantitatively we understand the relation between measurable quantities and human well-being the better can we construct products and circumstances that make people happy.

Conclusion:
A project that focuses on Quality of products and Quality of life and combines true measurements and real theoretic treatment of human perception could be interesting to pursue

- **Advice is needed on:**

– Setting appropriate constraints on such a diverse topic

Projects should combine "good" measurements[1] with human perceptions that are relevant for quality of products and quality of life.

– Interdisciplinary research and novel investigative methods

Measurements are traditionally looked upon as "hard" science, whereas perception is related to soft sciences. Looking at human beings as measurement instruments has already led and vice versa to interesting results.

[1] Good measurements are quantifiable, traceable to some reference, reproducible and understood to the degree that *a priori* uncertainties can be estimated.

- Prospects for significant advance in the scientific basis for quantifying human perception and human well being

  Considering how low our present knowledge is about how people perceive quality, prospects for significant advantages are very good.

- What other issues are important

  A framework project could help increasing the publicly available knowledge, whereas much the knowledge today is confidential.

Qualitative or quantitative measurement?

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In the natural sciences, quantification of measurement is usually ‘‘easy’’ (not necessarily cheap). In fact, the natural sciences mainly deal with constructs (the objects that need to be measured) that are directly accessible and which are therefore named ‘‘empirical’’ or ‘concrete’ constructs. The distinguishing feature of concrete constructs is that you can measure them directly, without further operationalization. That is, the variables that are *actually* measured and the constructs that one *wishes* to measure are the same.

In contrast, the humanities, the human sciences and often the social sciences mainly deal with ‘hypothetical’ or ‘abstract’ constructs that can only be measured indirectly. Here the variables that are measured in fact are operationalizations of the construct of interest (many would define hypothetical constructs as ‘latent variables’). The human sciences have been trying to develop objective measures similar to those found in the natural sciences. Inevitably, measurements in human sciences can often not attain the same quality as in natural sciences. Problems with sensitivity, reliability (stability) and validity (match between construct of interest and its operationalization) of measurements often persist. Sometimes operationalizations require a multidimensional approach: instead of directly measuring the construct of interest, several associated, contributing or surrogate variables are measured, and, using some combination rule, the results are integrated in a single index or figure (as, for example, in intelligence tests or the Human Development Index).

Especially when the constructs of interest are *subjective* and *individual*, multidimensional approaches may not be very successful and have little credit with the public. Probably behavior (at least often) depends on mechanisms that are ruled by subjective impressions rather than by reactions to objective stimuli (Like “I cry because I *feel* unhappy, not because I *am* unhappy”). An objectivated measure for happiness, sketchily, may come down to something like “tell me your income, your health, the kind of house you live in, if you’re married, how many children you have etc. …, and I ‘ll conclude how happy you are”. Clearly, many people will not easily accept such inference to represent their state.

Operationalization often implies that constructs that are subjective in origin are in fact ‘objectivated’ using multidimensional approaches, like factor analysis, resulting in some universal formula that dictates which elements combine into the construct of interest.

Although such approaches may be interesting when it comes to (objectively) comparing groups of people or countries e.g. in order to decide on priorities for human aid projects, on the individual level people may not agree with the inferred state of well-being. The weaknesses of the multidimensional approaches are obviously

1) Questionnaires are always incomplete, and may omit things that are very important for certain people or groups.

2) Different people attribute different importance to components, items or dimensions of the construct.

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3) Constituting items and dimensions are not necessarily independent variables, but may interact, and therefore have little validity in isolation.

In general, multidimensional operationalizations of several constructs, like quality-of-life, happiness, feelings of insecurity, job satisfaction etc. prove unsuccessful as people feel that the questions and outcomes do not really correspond to their own situation.. For example, a combination of several multidimensional scales could explain only about one third of the variance of global quality of life of several thousand patients[3].

For all these reasons, multidimensional approaches are more *descriptive* than *evaluative,* and global assessments of overall happiness are necessary.
In the human sciences there is nowadays some dichotomy between 'Qualitative' and 'Quantitative' research. In fact, this dichotomy probably over-emphasizes the differences between these two approaches. Probably they have more in common than many think at present. In our opinion the distinction between qualitative and quantitative research is no more than a difference in assumed levels of measurement.

Qualitative research typically is fully based on (at least) NOMINAL measurement, that is a categorical approach where comparison is based solely on 'equality' and 'difference'. A consequence of the full focus being on equality and difference is that a lot of effort is devoted to perfectly describing or defining the discerned categories. Full attention is on the content of what exactly determines belonging the one or the other category. Qualitative research can be exemplary to quantitative research for its thorough approach of describing categories.

Quantitative approaches are the alternative to qualitative approaches: measurement is then in principle on INTERVAL or higher level[4] measurement scales.

Important to note is that quantitative approaches also comprise categories that can be 'equal' or 'different', but on top of that there the focus seems to be rather on the other defining features of the scale levels: 'order', 'distance', 'absolute zero', and 'unit of measurement'. In quantitative research the focus is rather on 'how much difference' there is between studied objects than on 'what kind of difference' there is.

Results in Quality of Life research, to mention one example, have shown that asking similar, but yet slightly different questions can bring about very different responses (for example 'how has your life been recently?' versus 'how have you been') (Bernheim J.L., Theuns P., Mazaheri M., Rose M., submitted). It seems that the precise content of the question DOES matter.

A challenge for future research on measurement in human sciences can be to investigate and deepen knowledge on 'How to ask the proper questions?'. Here qualitative approaches can instill their main focus on content (of the distinguished categories), while quantitative approaches can entail the quantitative (often statistical or mathematical) comparison of different categories.

One kind of approach that offers an alternative to multidimensional quantification approaches to measurement is the global rating scale (Visual Analogue Scale, n-point scale, etc.).

[3] Rose et al. 'Gesundheitsbezogene Lebensqualität', ein Teil der 'allgemeinen Lebensqualität? Pp 206-221 in *Lebensqualitätsforschung,* Bullinger M, Siegrist J and Ravens-Sieberer, Eds, Hogrefe verlag für Psychologie, Göttingen, Bern, Toronto, Seattle.

[4] Note that ORDINAL measurement is somewhat controversial. Many qualitative researchers would probably state that such approach fully fits in qualitative research. However, many measurement approaches in so-called 'quantitative' research in human sciences, including for example many multi-item measures using e.g. with Likert-like scales, are in fact not superior to 'good ordinal' measurement.

Although such scales have often been criticized for being less reliable than other (usually multi-item) approaches, it is also known that the quality of measurement can be improved through proper instruction. Especially in case the goal of measurement is to evaluate some subjective hypothetical construct (like happiness, sleepiness, well-being, pain, …) global rating scales are an alternative or a necessary complement to summated multi-item scales. An obvious advantage of single item rating scales is that each individual can rely on their own, subjective appreciation of the construct and translate that directly into some rating, rather than having to take some artificial frame of reference into account. One such approach is ACSA (Anamnestic Comparative Self-Assessment) to measure subjective quality of life (Bernheim, 1999).

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Bernheim J.L., Theuns P., Mazaheri M., Rose M. (submitted). The potential of Anamnestic Comparative Self Assessment (ACSA) to reduce bias in the measurement of Subjective Well-Being (SWB). II. An empirical study. J. of Happiness studies

Measuring the perception of Quality of Life (QOL)

Quantifying what is qualitative - Making objective what is subjective

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Background

Reasons for measuring Quality of Life

- To calculate
  - QALYs (Quality Adjusted Life Years)
  - HALYs (Happiness Adjusted Life Years)

- As input and outcome measures for
  - Policies: health, social, economic, ...
  - Research

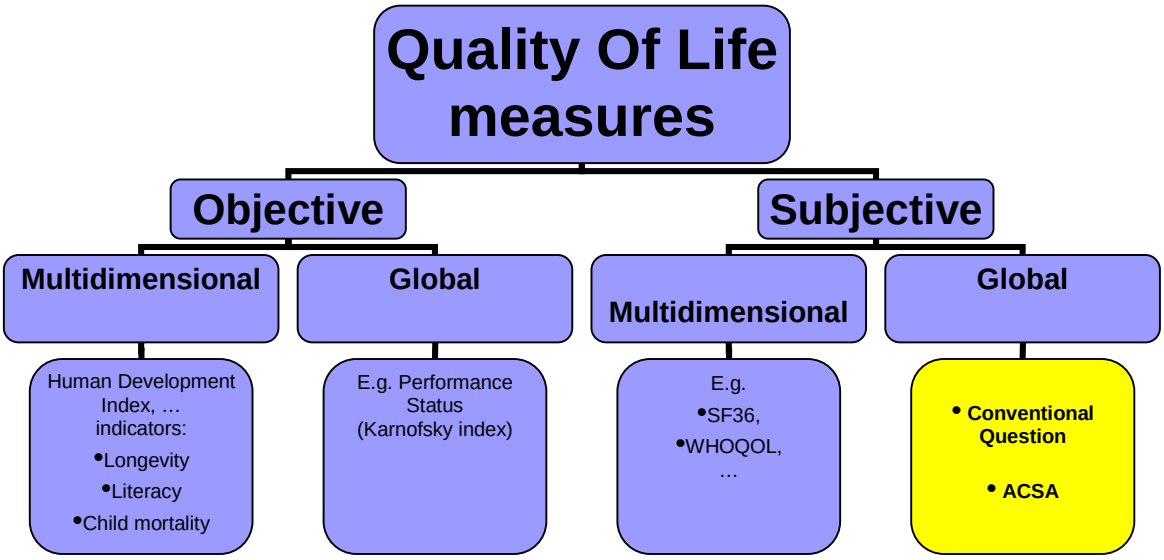
Necessity of single-item rating

- Multidimensional questionnaires are always incomplete
- Individual people have different preferences
- Dimensions of QoL are not independent, but interacting (life = complex, therefore QoL = emergent)
- Response shifts (at different times, people may attribute different values to different dimensions)

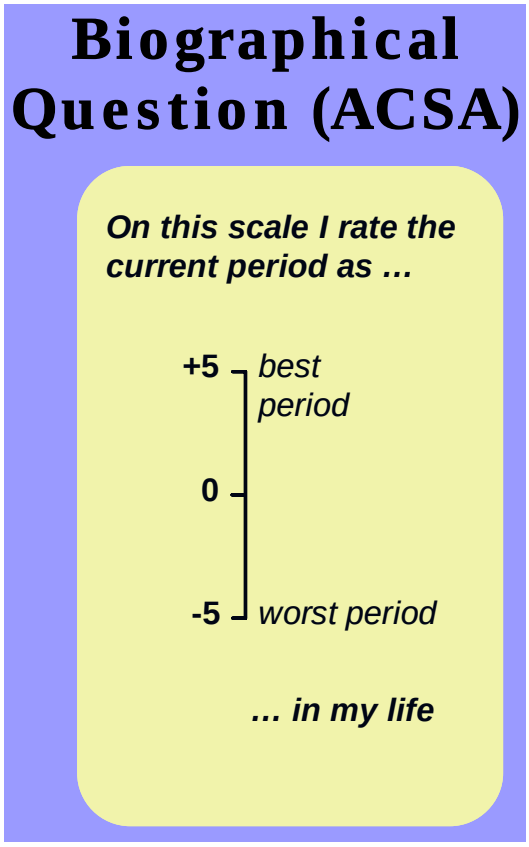
Which global question is the better ?
Problems with the conventional global question on QOL

- Trivialisation of response
  ("How are you today?")
- Proximate / peer relativity
  (~the neighbours)
- Cultural bias (Diener, Veenhoven)

For global subjective quality of life (sQOL), the conventional question (CQ) asks about happiness, wellbeing or life satisfaction. Besides in the social sciences, global sQOL is useful also in health-related QOL research when overall impact of disease and treatment must be estimated. Rating is on a scale between e.g. "extremely happy" and "extremely unhappy". However, some disadvantages of these scales include trivialization and ephemerity of responses, and biases by proximate, peer- and cultural relativity. These problems hamper the comparability of QOL research data, e.g. across diseases, trials or cultures and sub-cultures.
Here follows a taxonomy of QOL instruments.



Proposed alternative.
ACSA's differs from CQ by using the respondent's memories of his best and worst periods in life (given ratings +5 and -5 respectively) as the extreme ends of the scale. The elicited scores for sQOL are relative to these anchors. Respondents typically attribute +5 to periods of love experiences, births or professional achievements. Experiential nadirs, rated -5, are typically loss of a loved person, imprisonment, bankruptcy or a serious disease.



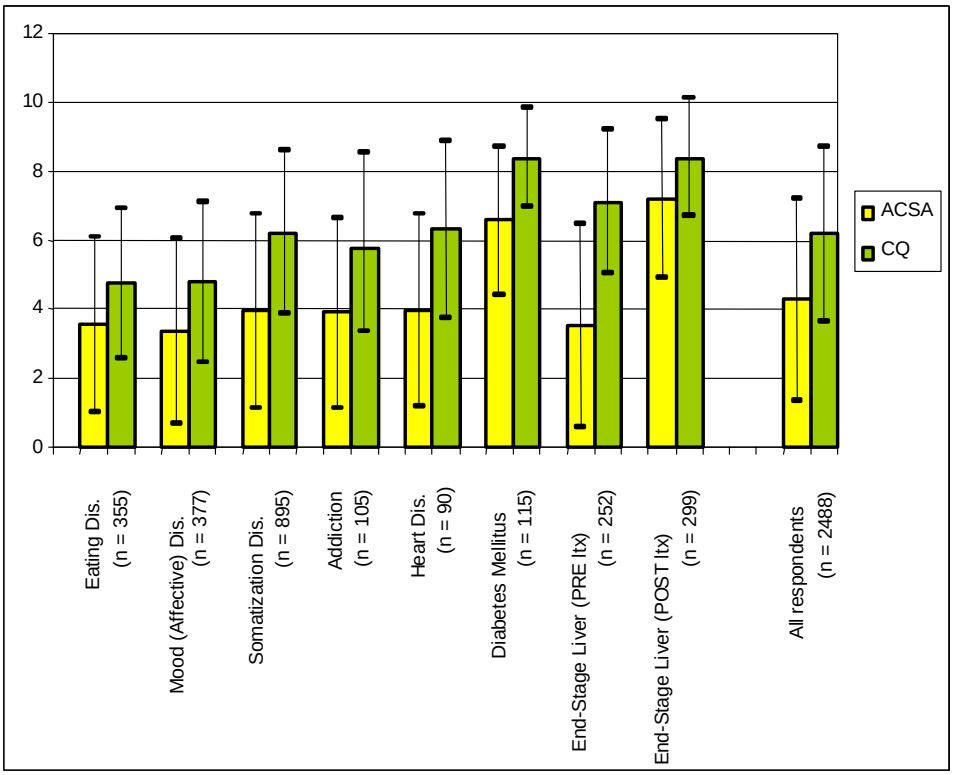
Empirical study

ACSA and the conventional global life-satisfaction question (CQ) were administered in parallel to 2488 university hospital patients suffering from a wide range of psychiatric and somatic diseases.

Eating Dis.	n=	355
Mood (Affective) Dis.	n=	377
Somatization Dis.	n=	895
Addiction	n=	105
Heart Dis.	n=	90
Diabetes Mellitus	n=	115
End-Stage Liver Dis. (pre transplantation)	n=	252
End-Stage Liver Dis. (post transplantation)	n=	299
Total	**n=**	**2488**

Results

The variation coefficients of the sQOL ratings were 0.69 for ACSA and 0.41 for CQ, indicating that ACSA differentiated better than CQ between patients. In patients with end-stage liver disease (ESLD), the average difference in mean rating between the situation before and after life-saving liver transplantation reached 4 points on an 11-point scale with ACSA (N=132), versus 1.5 points with CQ (N=103). Thus, in a retest situation at a later time, ACSA proved more responsive, i.e. more sensitive to objective evolution of the health state. In the psychiatric disorder groups (N=1732), socio-demographic data could be related to sQOL ratings. Contrary to the CQ, ACSA was not influenced by individually static (i.e. trait-like) socio-demographic variables such as sex, age, nationality or marital status.



Discussion

Compared to the CQ on sQOL, ACSA offers:

a) solemnity (as it refers to one's own life review), which discourages trivial or socially desirable responses,
b) concreteness of the (extremes of the) scale rather than the artificiality or abstraction of the 'best possible' state (e.g. young + healthy + rich + smart + handsome + loved + famous…), and its 'worst' counterpart,
c) internal, personal rather than external anchor points, with therefore more sensitivity to internal changes and less bias by proximate, peer and cultural relativities, and by shifts in expectations or habituation,
d) lower sensitivity to traits since these tend to persist throughout life.

Higher **responsiveness** of ACSA to longitudinal evolution may be due to its use of **biographical** references

Lesser **sensitivity** of ACSA to **invariant socio-demographic variables** may be due to its use of an **internal** standard

Conclusion

ACSA

- Minimally sensitive to socio-demographic variables
- More sensitive to objective changes
- Sightly more discriminating

In cross-sectional studies, depending on one's study objectives, ACSA should be considered as a complement or an alternative to conventional sQOL instruments. In intercultural comparisons and in longitudinal or intervention studies, it is probably more reliable, and may avoid the necessity of adjustments for several confounding factors.

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