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Response to Keynote Lecture by Donald A. Norman (5 September 2000)

Respondent to Donald A. Norman, "Information Technologies in Cognitive Processes," *Information: Science and Technology for the Next Century*, Rome, Rome, La Sapienza, 5 September 2000.

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1. Introduction

Professor Norman's work on Human Computer Interface (HCI) has made him one of the great figures of the field. His spontaneous lecture raises many stimulating ideas. While I agree fully with his basic premise that knowledge is not information, there are a three points on which agreement is more difficult. These centre around: 1) problem-based learning; 2) researchers versus practitioners and 3) distance education and the developing world.

2. Problem-Based Learning

In Professor Norman's approach, present day teaching is by abstraction and he assures us that cognitive science can help students by giving them problems, by making teaching problem-based. The idea of problem based-learning is attractive. It was, however, first introduced by Professor Howard Barrows in the field of Medicine (McMaster University, Canada) in the 1970s. The University of Maastricht was the first to apply problem-based learning as an approach across the curriculum.

While extremely useful, especially in medicine and the more practical sciences, there are also subtle problems with Problem Based Learning (PBL). Traditionally a student learned first to master existing knowledge. This made them a Master of Arts/Science. They then proceeded to become learned (*doctus*), which entailed actively creating new knowledge. By contrast, problem-based learning gives students problems to solve, which means that they are passively reacting to someone else's problem, and usually someone else's agenda.

One of the basic assertions of those in cognitive science is that they emphasize the importance of the user, rather than the technology *per se*. On the surface, this is admirable. But if, in the process, the user is reduced to someone who passively reacts to others' problems rather than actively defining their own problems, does this not reduce the user to a slave responding to some master's questions rather than emphasizing the

uniqueness of the user? To put it provocatively, cognitive science emphasizes the user but reduces the user to someone who is used.

This tendency to make learning into something reactive has further consequences. It assumes, for instance, that one does not need to react until the problem poses itself. Hence, in America problem-based learning has become closely associated with the idea of just-in-time learning; that one only reacts to problems at the last minute when there is no time to think about it properly. The Millenium bug is an excellent case in point. Had computer programmers thought actively rather than reacted passively, they would have recognized long ago that the millenium was coming.

In this context the development of Universal Mobile Telecommunications Services (UMTS) is particularly interesting. In the United States, where a problem solving, passive reaction to situations dominates, persons are only now becoming aware that mobile telephony is a problem that needs to be solved. By contrast, in Europe, where there is a more active approach to knowledge, the potential problem was foreseen in the early 1980s and work on standardization has continued quietly but steadily for the past two decades such that UMTS is now becoming a reality. Simply to react passively to others' problems is not enough. Education must teach us actively to foresee the future and solve challenges before they even become problems.

3. Researchers versus Practitioners

In his lecture, Professor Norman makes a distinction between researchers and practitioners, between persons who produce papers and those who make products, which we use. He goes on to emphasize that practitioners in industry have no time for theory. They want to be good enough, he claims, but they do not have to be correct. This may sound convincing and attractive, but it is potentially a dangerous approach.

In engineering most things are approximations. There is a range of tolerances within which a device or a machine will work. Sometimes it seems to make no apparent difference if an object is a few millimeters larger or smaller. But this does not mean that these figures are arbitrary. The United States preaches Total Quality Control (TQC) but now often finds itself in situations where Japanese or European quality is simply higher. Spark plugs, for instance, which were invented by Bosch in Germany, are produced as Champion spark plugs in the United States, which are considered to be of lesser quality than those elsewhere. Champion spark plugs, which arrive in Japan as part of an American-Japanese trade agreement, are carefully upgraded by the Japanese. Firestone is also the discovering the consequences of taking too lightly the narrow tolerances of quality production.

In engineering one can pretend that things do not have to be correct. In other fields such as mathematics and physics, correctness is not a matter of choice. A calculation or a formula is either correct or it is wrong. The effectiveness of approximate knowledge in engineering should not confuse us about the limitations thereof in other fields.

Science and technology provide us with universal, generic rules and laws. The arts provide us with precise descriptions of the exceptions, the particulars, the unique. If we are to arrive at a new synthesis of knowledge we need to integrate the knowledge of universals and particulars at a new level. Intelligent objects should not only provide us with technical specifications in the form of Industry Foundation Classes. They should also provide us with knowledge of the cultural and historical dimensions of an object: about its various restorations, about its earlier contexts, about the diverse interpretations concerning same etc.

In the past, researchers in the arts and sciences were at (mainly) public universities. Their ideas were then developed by private industry. Then universities became places of Research and Development (R&D). Now the rhetoric is that all research should have practical consequences that only applied research is acceptable and that basic or fundamental research is passé. Two striking consequences are: 1) a trend to work as one learns, and 2) a trend to begin start up companies as a hobby as soon as possible. In North America even high school students are in on this trend. As a result students no longer have any sustained time to develop an independent world-view. Ironically, Professor Norman speaks of researchers and practitioners as separate but assumes a context where their separate viewpoints can no longer be maintained. We need an integration of theory and practice, of research and action but we must be careful to maintain a framework where these two viewpoints are properly sustained.

4. Distance Education and the Developing World

Professor Norman describes vividly his vision for distance education in the form of NextU as a future necessity. He acknowledges that one-to-one live education is superior to distance education, but claims that this is too costly for some. When pressed, he admits that these "some" are especially persons in the developing countries "such as Brazil and China". Implicit in this approach is a subtle opposition between physical universities in the developed world and virtual universities in the developing world. If we accept this approach we shall merely increase an already too blatant digital divide.

In the long term, there are deeper problems with this approach. In 1995, 95 % of Internet users were in the United States. At the end of 2000 the US users are just over 40% and it is predicted that by 2005 this figure will go down to c. 25%. From a global perspective the US represents 4% of the world's population. Countries such as China are reported to be increasing their Internet presence at a rate of 10 million users per month. China's recent rejection of the arbitrary restrictions imposed by the Internet Consortium on Assigned Names and Numbers (ICANN) signals a very real need for a vision that includes all countries of the world within a single vision. An imperialistic formula, which assumes that education technology can be exported in the way that they were in colonial times, is outdated. We need a vision for education that is global, that includes the East and West, North and South in one coherent view. The dangers of Professor Norman's wonderfully stimulating lecture thus lie more in his implicit, unspoken assumptions than in the charm, wit and eloquence of his explicitly important text.