FORGETTING WHAT IT WAS LIKE NOT TO KNOW THE GAP BETWEEN EXPERT SPEAKERS AND NON-EXPERT AUDIENCES

Barry Brophy

Mechanical Engineering, University College Dublin, Ireland
E-mail: barry.brophy@ucd.ie

ABSTRACT

One of the most important questions in engineering education is, 'What makes things difficult to explain?' One possible answer comes from looking at how people's understanding of a concept changes with familiarity. There seems to be a difference between how an expert relates to a concept and how a novice does.

This paper is based on experience of training engineers to give technical presentations. A surprising difference in the approach of two groups (namely: practising engineers of all ages, and undergraduate students) has been observed. This has arisen, not from a formal survey or experiment, but rather from averaging anecdotal experiences of the author over an eight-year period. It appears that students are more eager to use, and more imaginative in their use, of analogies and examples

It is not that practising engineers are unable to do this, but rather that they are unwilling. There seems to be a perception that they are not important. A reason for this if offered by the research of cognitive psychologist Kevin Dunbar on how scientists reason and communicate. It is suggested that what can only be described as 'expert-apathy' sets in when someone becomes very familiar with their material.

BACKGROUND

The observations at the centre of this paper were made over and eight-year period of training engineers to give technical presentations. In order to do this effectively, four communication tools are suggested to bridge the gap between the expert presenter and the non-expert audience. This gap always exists to some degree, and it is this gap that necessitates a presentation in the first place. Without such a gap, communication of knowledge can be carried out by a simpler means.

The four communication tools discussed are analogies, examples, demonstrations, and stories. A fuller description of how this is done, and the psychological rationale behind the use of each, is contained in [1]. For the purposes of this article, we will focus on just analogies and examples.

During this period, training was carried out with both engineering professionals and engineering students. The groups can be summarised as follows:

1. Engineering Professionals
Age: 22–60 (most under 40)

No of firms: 23
No. of people: 240
Method: 1-day or 2-day training course

2. Engineering Students
Age: 19-22
No of Colleges: 2
No. of students: 510
Method: 4 x 2-hour workshop, and trial presentations.

As part of both training exercises, participants received guidance in the use of analogies and examples for explaining technical concepts. The instances of these tools in the presentations already given by the participants are used to exemplify the points made. Then they are asked to brainstorm other presentation situations where these tools could be used. Frequently, in feedback sheets, this part of the course is cited as being the most interesting, and yet the number of ideas generated in the brainstorming exercise is low. Critically, the students consistently generate a greater number and a greater variety of examples and analogies than do the professional engineers. I believe that this observation offers an insight into one of the key reasons why technical presentations fail.

ANALYSIS OF EXERCISE

The observation cited above is surprising if you consider the ways in which the groups differ, in regard to oral presentations. The professionals have many advantages over the students. Primarily, they have good knowledge of their subject area. Very often students were required to give presentations on design projects on which they had worked for only a few afternoons. It is difficult, in such a scenario, to speak with authority or insight especially when the audience contains scrutinising academics with many years or even decades of experience.

The professionals, on the other hand, will usually be steeped in their subject. This may not make them world experts, but one of the key points of the training is to focus on the elements in which you have expertise relative to the audience. So, for example, a presentation to senior management might seem like a situation where the real experts are in the audience, but if the presenter focuses on the work carried out, his or her main findings and conclusion, and recommendations for the future, then the presenter is communicating knowledge that is genuinely new and useful to those attending. In regard to that knowledge, they are the experts.

Another way in which the students are at a disadvantage is that their presentations lack a goal-focus. Professional engineers are more likely to ask the question, ‘Why am I doing this? What do I wish to achieve?’ And although these aims can often be impractical or poorly aligned with the audience’s actual needs, at least there is a need that they can strive to meet. Student presentations, on the other hand, are given simply as an exercise in giving a presentation. The audience is a mock audience, and this renders all such presentations fundamentally unrealistic.

A third way in which the students are at a disadvantage, is their lack of experience. So why then in brainstorming exercises, and subsequent mock presentations, do they tend to use a far greater number and a far wider variety of analogies and examples then the professionals? One reason for this is suggested by work done by the cognitive psychologist Kevin Dunbar, on how scientists think and reason.

COGNITIVE PSYCHOLOGY RESEARCH ON THE USE OF ANALOGIES

Kevin Dunbar, at McGill University, has studied the reasoning processes of scientists as they carry out their work. His research team has videotaped and audio-taped leading molecular biologists and immunologists as they reason and communicate in their weekly laboratory meetings. These scientists would have been discussing research findings: analysing data, formulating theories and designing experiments. Dunbar and his team analysed these meetings sentence by sentence and noticed some interesting things in relation to the use of analogy.

Firstly, analogical thinking is a key component of all scientific reasoning with anywhere from 2 to 14 analogies used in each of the laboratory meetings studied. Secondly, these analogies were based on deep structural features. In other words, the analogies weren't just connecting superficial features in the communication process, they were doing real work. And thirdly, and most importantly, the tentative analogies that researchers formed to explain findings at the meetings were largely forgotten several months later, although the final findings of the experiments were remembered. It was as if the analogies were being used when bridging to a new mental representation but when this new representation became firmly established, they were forgotten. Dunbar himself commented, 'The scientists appear to be using the analogies as scaffolding. Once they serve their purpose of building new explanations, they are discarded.' [2]

Presenters, who are expert in their subject, don't often see the need for this kind of bridging. They understand what they are talking about; they just 'know' it, and that's it. However, the audience is feeling their way in the dark and will benefit from such bridging analogies. In fact, in their absence, they will attempt to form analogies of their own, prompting such questions as "Is this like..." and "Would this be similar to..." and so on.

A core mode of learning is the process of using analogies to form temporary platforms in the mind until they become solid, and then further analogies can be formed to bridge to the next concept, and so on. When young children are being taught multiplication, the concept is built up as an analogy with addition. For example, eight multiplied by six, is expressed as eight added a total of six times. So, the concept of multiplication starts life as a multiple addition. Division is then taught, not usually by analogy with subtraction, but by analogy with multiplication, as a sort of reverse-multiplication process. However, when these new concepts become solid, there is no longer a need to relate them to previous analogical levels. I'm sure most people reading this paper have a firm enough understanding of the concept of multiplication – you just know it. And not only that, you have probably long forgotten the methods and analogies used when learning it in the first place.

This 'discarding of the analogical level' may explain the phenomenon described earlier. It often occurred to me when working with professionals that it wasn't that they couldn't form analogies (or for that matter examples) but rather that they couldn't see a pressing need to do so. Students however, attend lectures on a daily basis and are steeped in the problem of 'trying to understand', so the process of trying to bridge the gap between the presenter and the audience seems somehow more reasonable and pressing to them, and they are more inventive and energetic in doing so.

DISCUSSION

Like any problem, the question we need to pose now is, how do to solve it? However, this particular issue is tricky as it is not apparent to those who succumb to it, and therefore not perceived as a problem that needs to be solved. Audiences in presentations, and students in lectures, will almost never point out to the presenter that he is failing them. For presentations in the workplace, the problem of the presenter not helping to build meaning with the use of well chosen examples and analogies, may be hidden among other problems, such as setting an unrealistic presentation aim. In Universities, students may not be the best critics of their lecturers as they may not be aware of other ways of tackling the teaching goal. Certainly scoring a module or a lecturer's teaching out of 5, on an end of term survey, as often happens, is not very helpful. In both cases (presentations and lectures) the presenter is not made aware of this crucial shortcoming.

On top of this, analogies have a bad name with some technical presenters. I recently spoke with a retired engineer who said he didn't care for analogies, and found them to be trite and confusing. However, during the course of our conversation, he made many references to the presentations that he had given as part of his job. I pointed out to him, that in so doing, he was both drawing analogies and citing examples.

An analogy (and its close cousin an example) is formed any time a pre-existing concept is used to describe a new one, and this form or comparative (or what cognitive psychologists refer to as 'schematic') reasoning [3] is used far more often than people realise. It is important to recognise this, and to study the process further, so that presenters and lecturers can be made aware of how to use these powerful explanatory tools.

REFERENCES

1. Brophy, B., The Natural Presenter: Turning Conversations into Presentations, Institute of Chartered Accountants in Ireland, 2007
2. Dunbar, K, The Analogical Paradox. In Gentner, D., Holyoak, J., Kokinov, B., The Analogical Mind: Perspectives from Cognitive Science, MIT Press 2001, p313-334
3. Hunt, E, Problem Solving. In Sternberg, R., D., Thinking and Problem Solving, Academic Press 1994, p215-232