Knowledge and relaying knowledge

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“We are drowning in information but we are thirsting for knowledge.”
(John Nesbitt)

1. Knowledge

The term ‘knowledge’ seems to be obvious at first glance. All of us automatically associate certain ideas with it, which partly go back a long way and more often than not to our school days. At school the contents of knowledge are ordered in syllabuses. These syllabuses correspond to the ideas of those responsible in Ministries of Education, according to what they consider students of a certain grade and at a certain stage should learn. The individual plays no role in this. What is prescribed has to be learnt regardless of who happens to be teaching or who is sitting opposite the teacher. What do the Thirty Years’ War, trigonometric formulae or “The Bell” (Die Glocke) have to do with Hans Müller, who is being taught somewhere in Germany? The obvious idea is that knowledge is something objective, has something to do with value ‘per se’, and that above all it is to be found outside of people and at best can be understood and assimilated by them – depending on how hard they work and their intelligence. We all know the feeling of having learnt something very hard which at best paid off to pass an exam, only to forget it immediately afterwards; or at the most it enjoys a brief renaissance as unused (“dead”) knowledge when doing crossword puzzles. It plays no part in everyday living.

Another notion of knowledge rests upon the differentiating of **data**, information and knowledge. Accordingly, data are texts, numbers or pictures that we are completely swamped by all the time. Newspapers, television or the internet: everywhere there is an overwhelming range of data. We are completely incapable of taking them all in fully. But who wants to anyway? Kurt Müller, for example, sits on edge in front of his television zapping from programme to programme with an average interval of three seconds in between. He is not interested in what is being presented. It is of no value whatsoever to Kurt until suddenly he hits on a programme which makes all the difference to him: a summary of the last day of play of the football league. His wife Klara sitting beside him is just as bored by the report as by everything that has gone before. Because Kurt can’t be persuaded to zap again, Klara goes into another room in a bad mood. The report is interesting for Kurt but not for Klara. She has other relevance criteria.

Data that are relevant and therefore make a difference are called **information**. They are relevant for the reason that they have something to do with actual wishes, needs or objectives. Kurt is a football fan, therefore football programmes interest him. Not so Klara. She might have stayed for a cooking programme.

Because people's wishes, needs or objectives differ, ascribing relevance is relative or subjective. The discussion about the strengths of individual teams supplies information to the football fan, for Klara this is data. Let's assume that Kurt uses the information from the report to deduce some prognoses for games on the following day, and let's assume further that he does the football pools and wins. Then he is not only happy, but he has also learned something, - that the ratings in the programme together with his own reflections were in principle correct (or to put it more carefully, were not completely wrong). **Knowledge** has come from information.

Personal relevance criteria decide as to whether we are dealing with data or information in each individual case. And it is only when information can be used that knowledge arises. Knowledge is interlocked with personal experience and causes changes in thinking, feeling and/or behaviour. It is possible that Kurt's success with the bet will spur him on to another try at the next opportunity. In so doing he will at the same time test the validity or "correctness" of his knowledge (or the assumptions he has made). If he succeeds again, his knowledge will have been confirmed and it will be reinforced. With time he will become more and more certain until he suddenly loses again. It is then, at the latest, that he must realise that his knowledge was incomplete or out-of-date due to some change in the outer circumstances.

Because knowledge is connected to experience, it cannot simply be handed out like a tennis ball. Let us assume that Kurt wants to share his knowledge with his friend Fritz. In that case, Kurt must first reproduce and explain his knowledge, Fritz must understand it (reconstruct) and assimilate it in the framework of his experience and his personal theories. If it makes sense to him, he will make use of Kurt's explanations and make his own experience with it. But it is possible that Kurt is unable to explain logically why he arrived at this or that bet. "Gut feeling" is what he might say. He finds further explanations difficult. He has been interested in football for many years. It is this background – i.e. the knowledge he has built up over the years – that enabled him to evaluate the information from the last football programme. This knowledge is present, but has remained blurred in his consciousness.

So long as Kurt's bets win, how he got his "gut feeling" can be all the same to him. If he can rely on it, he can be satisfied. What a pity that he only partly succeeds in letting Fritz in on his "secret knowledge". But at least he retains the aura of the unattainable 'wise man', at least as far as football is concerned.

Knowledge that cannot (in the first instance) be explained is called "implicit knowledge" (also action, experience and procedural knowledge). We all know a lot more (implicitly) than we do (explicitly). Experience allows the master

mechanic, for example, to find what is wrong with the engine far more quickly than his theoretically well-trained – even better-trained – apprentice, without the 'old hand' being able to explain why afterwards. Or how do we native speakers (of German) want to explain why we immediately understand the ambiguity of 'At the crossroads you have to drive round/run over the policeman'? (The meaning depends on how the word 'umfahren' is emphasised.) Or who would be able to write down offhand the most important grammatical rules he uses all the time without thinking? Explicit knowledge that can be put into words is clearly only the tip of our "knowledge iceberg".

Learning ensues through trial and error. Trial means to intervene actively in an outward happening, normally to achieve a certain thing. Error is – just like success – an answer of outside circumstances to this. Trial and success/error together form an experience. When a first attempt goes wrong and a second is successful, the person concerned has learnt something ("that's the way to do it"). This process is fundamental. Kurt's hit ratio when betting could get even better in time. Of course he will never reach 100 % (legally) because even football matches are much too complex, but experience (repeated processes of trial and error) promises improvement because the course of games is not entirely co-incidental. Even though Fritz has learned a few things from Kurt a short while before, he will nevertheless remain unsuccessful for quite a while yet - unless he strikes lucky, which in the case of a football match with its many possible interactive factors, is always possible.

Social learning also comes about through trial and error. In the first days with a new employer there are usually quite a lot of opportunities 'to put one's foot in it'. The social rules in force (how to behave, what is read as positive and what negative) are still unknown. As the 'new one', one has to rely on the feedback of the new colleagues to be able to fit in quickly. This process can take a longer or shorter time, depending on how subtly or directly this happens and how sensitively the person in question notices and understands. Learning a mother tongue is a further example. Babies imitate the sounds of their parents (trial) and in the case of success get a direct, enthusiastic feedback which encourages further attempts. Normally a loving correction ensues In the case of failure, thus encouraging the baby to try again and finally succeed.

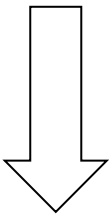
Knowledge can be understood as decision-making and responsibility or as the potential for solving problems respectively, which can pertain to achieving personal objectives, fulfilling wishes or satisfying personal needs. Hans Müller, for whom the 'Bell' (Glocke) is useless apart from getting him a good mark in German, acquires the information because the German mark is relevant for him. If he doesn't use it again later on in life, if his knowledge of the poem has

absolutely no effect on his actions, thinking or feeling, the text will disappear from his memory without ever having become (active) knowledge.

The notion that knowledge is a personal phenomenon bound to experience coincides with recent neuro-biological perceptions. The “Iowa Card Test” has become well-known in this context: test persons played a game of chance while they were connected up to a lie-detector. In the game they had to keep taking playing cards from two down-turned packs. One pack led to small wins in turn with small losses. The other pack led to fewer wins of higher amounts but also to frequent high losses. From the point of view of ‘maximising gain’ the first pack was clearly better, but the participants couldn’t know that, they merely noticed a small and chance part of the actual structure. But they learned and indeed (in the beginning) without knowing it! After about only ten moves the participants began to avoid the bad pack. The lie-detector established cold sweat and palpitations as soon as the hand moved in this direction. However the participants didn’t notice these reactions in their own bodies. Only after about the fiftieth move did they speak about a feeling of aversion towards the bad pack of cards. And only after about the eightieth move could the most intelligent players give a reason for their feelings and explain the principle of the game.

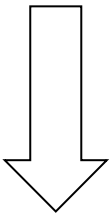
The learning process that becomes clear from this experiment runs via the following steps:

Repeated experience



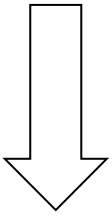
Unconscious emotional reaction

(Pattern recognition and body reaction)



Conscious emotional reaction

(“Gut feeling”, intuition)



Comprehension of the connections

(Description and explanation of the patterns)

According to the understanding of neuro-science, knowledge is a fundamental operation of the brain and from an evolutional-biological standpoint much older than our human consciousness. Our brain is permanently processing actual experiences by examining them for regularities or patterns, thus in a certain sense evaluates statistically. If it has recognised a pattern, it lays it aside for future use. In this way we retain the general above all and not the particular from our concrete experiences. This is very useful, for otherwise we would have to note endlessly many details and then collate them every time with the current one. Even so our brain is always in danger of identifying patterns which don't exist in reality. Maybe Kurt's gut feeling is also deceiving him. His brain reacted to certain (selective) perceptions and drew conclusions gained by experience from them which did indeed prove him right several times. But maybe he only won by chance because in reality totally other reasons were responsible for the match results.

When our brain processes current experiences, it examines them and compares them with patterns that are already stored. If it is at all possible, it tries to confirm the patterns already at hand and to reinforce them. This is economically advantageous because it restricts the number of patterns to be compared, but it makes the recognition of basically new material more difficult. It is possible to create completely new patterns but our brain finds this difficult. From this, a certain inflexibility - which is otherwise hard to understand – in explaining, acting and evaluating can be explained. Kurt will probably still hang on to his successful betting behaviour even when the first flops make themselves apparent. His ideas about how things work and what matters have become 'harder' during the era of success. Without thinking about it, he will pay particular attention to the kind of news that fits in with his ideas and he will skim over those items that do not fit the bill. Either he won't bother to take in 'unsuitable' information or he'll play it down with comforting explanations. Only when failure keeps coming back or when other things keep happening to irritate him will his usual way of thinking possibly start to falter.

When we learn something new, we link it to experiences (patterns) we already have. That is to say we are able to increase our knowledge, above all, where we know a whole lot already! New things only remain in our heads when there are links to the old. This process begins at the point of awareness.

What we don't know, we are also unable to recognise. Awareness is dependent on former knowledge. How should Klara, Kurt's wife, understand the new game tactics of his favourite club if she doesn't even know that there is such a thing as tactics in team sports and how one can recognise them?

Our sensory organs can only discern the outer reality in small sections because the whole complexity of our environment with all its elements, variations and dynamics is basically not ascertainable. In addition, our possibilities of cognitive processing are limited. Our recognition and understanding depend on how our nervous system functions, what it can decode and how it deals with the decoded information. Therefore, an absolute, definitive and person-independent knowledge is not possible – at least as far as our conscious understanding is concerned. Knowledge is a model for reality. If people agree on a certain model, they often take it to be “true”. That reinforces the orientation function of the model and brings security. But this can be deceptive. The way we ascertain the world around us is more to do with our ideas about it than with the thing itself. As a result, our scientific understanding is mostly not as good as its reputation. History has a host of examples of grandiose fallacies, which were taken for granted for a long time (“the earth is flat”, “space and time are absolute quantities” or “rising company gains automatically lead to higher employment”). In spite of its high standing (and without wishing to challenge its value) scientific knowledge is mostly controversial and contestable – which when viewed positively is the reason for our scientific cognition. If models and substantiations survive a critical discourse unscathed, they emerge all the stronger from it. They remain valid (provisionally) for as long as they are not refuted. But when all is said and done, the real quality of our reality models is manifested in its usefulness, which in turn depends on whether they are able to give orientation and facilitate success. The area of pure logic and mathematics represents an exception to what has just been said. In this case it is a matter of something like “analytical truths”, which go beyond human experience and inasmuch can be person-independent and objective. For the normal presentation of questions and problems in organisations, however, analytical truths are not generally of much help.

The most important points summarized again

- Spoken statements will be heard and understood differently. The person imparting knowledge has no direct control over what comes over to others and what others construe with it.

- Learning and knowledge are essentially linked to experience (with the exception of pure logic and mathematics). Acquiring knowledge happens by trial and error. Things that have been heard and seen that do not link in with our experience and our personal theories are not effective and will be quickly be forgotten. Abstract tenets, knowledge we have read up, unprocessed recommendations or advice can be important information. But they only gain value through use. Then they are integrated into an experience context and (personal) knowledge.

- Because knowledge is linked to experience, it is always unique and individual (see exception above). Strictly speaking we cannot, therefore, pass on our knowledge to others. Even so it is possible in an interactive process for the knowledge of one person to be partially integrated into the world of experience of another. The dialogue often leads at the same time to a new anchoring of knowledge on the part of the teacher so that the boundary between teacher and pupil can disappear.

- We all know a lot more than we can say. The example of the Iowa Card Test shows that our conscious knowledge that can be put into words (explicit or declarative knowledge) is only the tip of our personal “knowledge iceberg”. Over and above that we possess additional implicit (action, experience and procedural) knowledge that we ourselves are not exactly aware of, but which is highly effective because it controls our behaviour significantly.

2. Conveying knowledge

The basic ways to convey knowledge are by **showing** and **explaining**. If one person shows another how he does certain things, he enables the other to watch and to do the same. Classical professional training, for example, follows this path. When someone has worked alongside his master for years, he takes over a large part of his expertise together with his special knacks and routines as a matter of course. Both live in similar work contexts for a long time and have similar experiences and therefore similar knowledge can arise. When the master shows what he does, he is relaying implicit knowledge at the same time, e.g. knacks and routines which he couldn't readily explain and give reasons for. Video films are only a partial alternative since no dialogue is possible for answering questions, corrections, exchange of experiences or for a critical discourse. Moreover psychological studies have shown that it is much easier to learn if a personal relationship comes about between the teacher and the pupil.

Explaining knowledge is far more difficult because the teacher has to explain what he is doing in the right words. In order to do this, he must recapitulate what has been learned theoretically, link it with his experience-knowledge and reconstruct the whole process logically, i.e. in the form of a describable and comprehensible model. Maybe he needs the help of an observer for this who is able to extract the unknown rules of his actions with him.

Demonstrating usually conveys more information than explanations, but by explaining a lot can be understood more precisely and more deeply. Best of all is a combination of demonstrating and explaining. Experiencing things 'live' with the corresponding commentaries makes it easier to understand as well as to remember later on because all the senses are addressed and activated. But it is often not possible to visit a factory, laboratory or an office together. And often there is hardly anything relevant to observe directly. For this reason, films and cartoons are often used to show certain things that it is not possible to observe as such or, only very elaborately, in reality. Graphics and diagrams have the disadvantage, in comparison to films, that movements cannot be presented directly. But they are suitable for useful simplifications. They can reduce complexity and allow the essence of what is meant to come to the fore.

People store knowledge in different formats and contexts. It is possible to differentiate between categorical and associative knowledge structures, (what does that belong to? whom or what is that similar to?), normative knowledge structures (why do we do that?), inferential knowledge structures (why is it so? what consequences does it have?) and procedural knowledge structures (how do we do that? in what sequence?). Knowledge about the organisation of an event is, for example, procedural knowledge, knowledge about strategies for successful

marketing is an example of associative knowledge together with inferential knowledge. When the contents of knowledge are visualised, such differences play an important role. There are some examples of this in the appendix (diagrams 1 to 4).

In order to relay complex facts and circumstances, several fundamentals have proved themselves (the following list is not indicative of an order of priority):

1. Docking on to the recipient

One cannot simply pass knowledge on like a tennis ball. One person's knowledge must be relevant for the other and fit into his world of experience. Only then will the other accept and integrate it. Suitability and relevance can happen to coincide, but as far as a targeted relaying of knowledge is concerned, it is more promising to dock on deliberately. Under certain circumstances, a prior "recipient analysis" may be necessary. Docking can be objective (aims and assignments of the other person) or personal (his personal interests and needs, his perceptions, ways of thinking and explaining).

2. Finding the right measure of information

If too little information is available, the issue at hand is not – or only inadequately - exposed, essential aspects and correlations are not considered. If there is too much information, the focus and thus orientation get lost. It makes sense to emphasise the essence of the knowledge to be conveyed ("this is what it's about"), to denote the respective context only in rough outline and then ensure that it is ignored. It should only be taken into account again if it is necessary for understanding important questions and partial aspects. Intelligibility frequently requires sacrificing the whole.

3. Denoting perspectives

Complex issues can not be dealt with as a whole but only in parts. And what is observed depends on the individual perspective. A stock exchange speculator's perspective of a company (what he sees as important) will differ starkly from that of an industrial council, a temporary employee or the competent tax office. Identifying the different perspectives helps to understand explanations better. Conversely, a sudden change of perspective in the argumentation leads to confusion.

4. From the general to the particular

The general provides an overall view, the particular takes care of specifics. That is pretty much as with different flight altitudes. At a high flight altitude details get lost but the rougher structures become clear. At a lower altitude, the details in the landscape can be seen. Intelligibility is usually greater when explanations start off as generalisations and then become more concrete. Generalisations will tend to awaken associations and experiences in the other person, rather than specific details.

5. From the simple to the complicated/complex

If the conveying of knowledge begins by describing simple coherencies, it is easier to link on to one's own fund of knowledge and on this basis to follow new and/or complicated trains of thought. Even so, simplicity can lapse into triviality, if for example the relevant context or basic assumptions and correlations are continuously faded out or remain unaddressed. In this case, things are deliberately or naively cut out of their context. This leads to misunderstandings and false conclusions. Triviality is less suited to clarification than to emotionalisation. To present issues correctly but at the same time simply and not trivially requires a high degree of understanding, because new decisions have to keep being made as to which context factors can be left aside for the time being and which ones have to be put back in the picture. Some oversimplified (trivial) or uncomplicated presentations therefore sometimes indicate that the person in question himself has not quite understood or that he's less interested in communicating than in manipulation and showmanship.

6. From the known to the unknown

This principle follows the realisation that learning is above all successful when something was already known. New information needs experiential points of contact in order to be understood, integrated and later remembered. It is recommended for this reason when describing and explaining new facts to use terms, pictures or metaphors that are familiar to the pupil.

7. Simplicity, structuring and conciseness

Dealing with and conveying complexity requires simplification. This can mean concentrating on an extract (focus) or on a few extracts (modules or partial systems) with their fundamental inner and outer inter-relationships. Of necessity, single aspects will be neglected by doing this and some particulars generalised. A structure for explanations built on this is necessary for the overall view and orientation. This must not be too deep or too superficial. Furthermore,

conciseness is important. It puts words in a nutshell. Verbose or flowery explanations can distract and cause the focus in question to be lost.

When conveying complex contents, the use of an introductory diagram is recommended, in which the fundamental elements to be dealt with later in detail, are listed and presented in their most important inter-relationships (see diagram 5). It then acts as a visualised structure. It is also helpful to work with the model of the solution cone (see diagram 6). With the aid of this it is easier to denote the level of abstraction currently being used (e.g. “We are talking about individual departments, not about the company as a whole or even about our branch”) and to centre the focus on this (e.g. ”We are talking about the Control Department”), which at the same time means leaving out the less relevant areas (e.g. “We are not talking about the Development Department”). A discussion often suffers because the focus is blithely changed and abstraction levels are skipped over. In such a case, the individual contributions can, in themselves, be clever and worth thinking about but the linking between the individual contributions gets lost, and confusion is rife.

8. Motivation/stimulation

If somebody is stimulated, he/she is more observant, has more energy and has more fun learning. Again, too much energy can make the process of understanding difficult, but teaching procedures suffer more often from a lack, rather than a surplus of energy. Successful docking has a stimulating effect because the pupil notices that it is about him, about his objectives and needs. Moreover, stimulation succeeds through surprises, the unexpected, disassociations that are as original as possible (analogies or metaphors), irritations and provocations, humour, skilful questions, active inclusion in a dialogue or in an acting sequence, a media spectacle: all of these are possible ways of stimulating people.

9. Disassociation

Disassociation signifies the transmission of meaning, and infers the use of analogies, metaphors, maps, illustrations or stories. Through the transmission of meaning, something new is experienced through something already known (intuitive) and different areas of knowledge are connected up (e.g. “automobile evolution”). Through this, docking and hence understanding and remembering are made easier. By the same token, the use of a wrong metaphor can of course lead to uncertainty and confusion. Metaphors can be used in a text (“transporting information”) or for visualisation. Possibilities are: artificial objects (e.g. a funnel) and natural objects (e.g. waterfall), activities (e.g. juggling) or well-known stories

(e.g. Icarus). Useful examples for visualisations can be found in the appendix (Table 1).

Disassociations surprise and can therefore stimulate. Apart from this, more information is conveyed. It is well known that a picture says more than 1000 words, and over the centuries the most important contents of knowledge have been passed from generation to generation by means of stories. All of us think in story-forms all the time, as they contain not only “dry” individual pieces of information such as, for example, a vocabulary list, but also sense, contexts, emotions and evaluations.

10. Learning procedures, retention quota and work memory

People also differ in the way they learn. Action-orientated people ask themselves when learning what they will be able to do practically with what they are being presented with. Accordingly, they will listen and pay attention selectively. Experience-orientated people will ask themselves how they and other participants will feel when using what they have learned. And reflection-orientated people will above all pursue the question as to how things should be understood and how exactly they correlate, in the first instance independently of the practical results and possible ways of experiencing. These differences can play a part in preparing the knowledge to be taught. For example, managers would generally think more in an action-orientated way, researchers and experts more often in a reflection-orientated way. If in doubt, it is recommended to mix the forms of presentation and to pay attention to selecting the types of examples so that all the learning procedures are “covered”.

In preparing the knowledge to be taught it is furthermore important to take the limitations of the human working memory into account. We are merely able to process five up to a maximum of nine pieces of information (words, numbers, pictures) at the same time for a short period of a few seconds, i.e. to visualise them and order them and link them to one another. A surplus of information therefore quickly leads to mental overload and lack of understanding.

Finally, it should be taken into account that different sensations remain in the memory to varying degrees. Surveys show that usually only 10 % of what has been read is remembered, 20 % of what has been heard, 30 % of what has been seen (scenically), 50 % of what has been seen and heard, 70 % of what has been explained to others, and 90 % of what one has done oneself. Thus the strong experiential bond of knowledge and learning is revealed.

3. Knowledge and conveying/imparting knowledge

When Kurt wanted to partially pass on to Fritz the knowledge he had acquired over the years about football matches, both of them quickly noticed that this process was anything but simple and could not be taken for granted. Actually, Kurt wanted to, but he couldn't make himself so readily understood. And Fritz wanted to understand him but it wasn't so easy for him either. Knowledge is a complex phenomenon and conveying it is linked to many pre-requisites.

The model of the Nuremberg Funnel is tempting but deceptive in this context. It suggests that teaching is nothing more than pouring a prepared (knowledge-) liquid into the pupil's head and that the latter is capable of taking in what he should learn and store it in his head. Unfortunately, there is no such thing as the Nuremberg Funnel or any such comparable process. Instead, imparting knowledge requires concentrated and strenuous activity on the part of everyone concerned. Teaching knowledge is inter-action, it defines reality (or what the participants assume that to be) and requires a mutual approach and involvement. And in the end, both sides will have changed their (reality) ideas a little.