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The Knowledge-Attention-Gap: Do We Underestimate the Problem of Information Overload in Knowledge Management?

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Abstract: The generation of technical knowledge abounds while the underusage of existing knowledge potential remains a problem in business as well as in society. Generally speaking value can be extracted from knowledge in three ways:

- by exclusive use
- by faster access
- by better translation of public knowledge into products that yield private profit

Each way requires different approaches to KM. But in all cases the problem of how to deal with abundance arises: It arises at the individual as well as at the level of interface design in a knowledge dividing society.

First ideas to solve that problem refer to the individual rather than the interface design level:

- technical solutions
- psychological solutions
- neurological solutions

deal with the growing gap between abundant potential knowledge and scarce human attention on the one hand and with restricted human capacity to process information on the other.

For the time being a clear focus on good old virtues, such as will (focus), modesty (less is more) and courage (to decide under conditions of incomplete information and uncertainty) seem as trivial intellectually as hard to implement in practice.

Key Words: Knowledge Management, Information Overload, Document-Explosion, Intelligent Agents, Positive Ignorance
Category: A

1 Prologue: A confusing state of the art?

In theory knowledge management remains a patchwork of unrelated approaches, partly due to its interdisciplinary nature and partly because of a clear preference to create as opposed to resolve. This state of the art is reflected in the following quote:

"Knowledge Management (KM) is one now of the most ramified topics in the business arena. Much of this amplitude can be attributed to the number of fields that lay claim to the idea, or some part of it, including computer and information science, business strategy, macro economics and interpersonal dynamics to mention only a few. Proponents generally claim that this symphony of schemes is appropriate given the important, transversal and imminently practicable nature of Knowledge Management. Its critics, on the other hand, are hearing either a re-mix of older refrains, schizoid melodies or an outright cacophony. All parties agree that we are

nonetheless witnessing an explosion of interest in the term Knowledge Management and all that it may or may not imply." [Despres et. al. 2001]

Practitioners have mostly gone through the typical cycles of enthusiasm and disillusionment and started to ask tough business questions [Schneider 2001]. Knowledge management activity needs to be aligned with strategy and needs to be integrated into business operations.

Suppliers of technical solutions have also learnt their lessons at least at the level of sales' rhetoric: They stress the enabling character of technology, elaborate on solutions which support every day work and put effort into integrating existing knowledge-management-related systems.

All three groups of players mentioned above seem to have arrived at a turning point: Academicians struggle to define those characteristics of knowing that are relevant to its process design, practitioners start to accept that the new wonder pill will not solve organizational contradictions and behavioural shortcomings and software designers as well as system engineers refer more to context.

But there are some caveats peculiar to all three groups.

Academicians – obviously under the "publish or perish" dictate – fail to comply with the maxim of their own discipline: not to reinvent the wheel and to build on existing knowledge*. My – so far unsystematic – perception of conference papers and journal articles reveals astonishing evidence[1]: A plenitude of micro studies are undertaken to research knowledge creation and transfer in most diverse situations, from face to face to virtual, from national to intercultural, from not for profit to business organisations, from operations to managerial tasks, and a plethora of models are constructed by PhD students elaborating on similar questions – without taking into account their mutual incongruences and their incompatibilities with conflicting theoretical models.

Why does this paradox just happen to arise in a field that is focused on the balance between knowledge exploitation and knowledge generation?

Several reasons come to mind:

Incentive structures that prefer generation to exploitation have already been mentioned. Furthermore, references, instead of covering the existing knowledge* – in the sense of either building on or challenging its substance – seem to have degenerated into a pure ritual of name and notion (model) dropping. But the point to be made here, reaches beyond critisizing awkward habits within the scientific community and extends to the other players.

My hypothesis is that the growing ease with which we produce, store and diffuse intellectual products globally via electronic devices will necessarily result in the following problems:

[1] see for instance the Third European Conference on Organizational Knowledge, Learning and Capabilities, 5 – 6 April 2002, Athens

- First, the sheer abundance of what could potentially be turned into knowledge* poses the challenge to deal with volume – or put in more popular terms – to cope with information overkill.
- Secondly, the principal volume-related incapacity to know it all poses a challenge to cope with incompleteness, ambiguity and uncertainty while orientational knowledge tends to assume a shorter life-cycle in itself.
- Thirdly, volume and speed in the shift in relevance, train and reinforce our capacity to shift attention rapidly but seem to weaken our capacity to concentrate on substance.
- Finally, the ease with which we store, produce and diffuse knowledge*, despite of organizing features of office software, seems to result in a gradual disappearance of the most simple organisational capacities, so that related incidents, such as correspondence and details pertinent to meetings and conferences are stored in a dispersed or random way making it difficult for individuals fighting tough time schedules to retrieve and to reintegrate them.

Let's take a look at the practical field and see whether we can observe similar challenges: The first wave of knowledge related activities has led to what I call the great documentation and externalisation initiative that in itself has resulted in rather unorganised abundance. Searching devices have hardly kept pace with an explosive growth of mail and documents deposited on the world wide web or on intra- and extranets[2]. Content providers as well as chief knowledge officers had to learn that production was not the bottleneck. There was no shortage of writers or senders but of readers and receivers, as reflected in the development of incentives: First everyone was rewarded who made a document available to others. Then, clicks were counted, so that senders learned to increase their ability to create attractive key words. Finally procedures of subjective evaluation were developed to capture the value created by any document made available on e-devices. In the end what should be rewarded, if at all, but that is another story, is the value created on markets to customers which we are still far from capturing.

A loss of office organising capacities seems to apply to the practical field as well. Attempts to develop "Netiquette" as a disciplined way to deal with mails, "cc" and attachments seem to deliver evidence of similar volume and relevance problems than in the academic field. Jeffrey Pfeffer's and Sutton's work on the talk-do-gap or smart-talk trap finally seems to point to the same conflict between rapid attention switching and superficial grasp of diverse issues and their concentrated and substantial elaboration [Pfeffer and Sutton 1999].

Does the third group deliver support and relief to the abundance of less structured information* or does it contribute to the problem? The answer is: Both. Faster searching machines, automated indexing, common platforms to integrate data* of different format and operating system origin, filters and intelligent agents can be counted on the relief side.

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[2] A study, undertaken at the University of Berkeley, demonstrates for 1999, that the number of mails and documents does not only abound in absolute figures but grows at a rate of over 100 % a year (Regents of the University of California 2000).

Proprietary standards (as in e-learning) and the general contribution to alleviating the difficulty in storing, processing and diffusing data* contribute to the problem.

In conclusion of this prologue I will explore the following propositions:

1) Incentive systems in Western cultures reinforce knowledge creation (even if faked) more than knowledge exploitation.
2) The ease in storing, processing and diffusing data* electronically has unintentionally led to a deterioration of human capabilities to capture, structure and understand its immanent knowledge potential and has increased the sheer volume of potential knowledge to a degree that overburdens decision makers.
3) The contribution of information and communication technology in solving the challenge of unorganised abundance is constantly counteracted by its potential to aggravate that challenge.

Together these three propositions form the challenge of information overkill. Knowledge management thus turns into the search for knowledge nuggets within an abundance of data-sand.

Humans who are supposed to restrict their knowledge work to those few fields where they are superior to computers, namely coping with incompleteness, ambiguity and uncertainty, may lose exactly those capabilities while drowning in "purposeless information".

2 The information overload challenge

2.1 Effects of information overload on people's time management, self-esteem and decision making

As demonstrated by the Berkeley study, information abounds globally. In the US employees surf on average one hour daily on the net, with less than 20 percent of that time considered to be directly related to work [Jackson 1998]. In an Austrian study among academicians respondents claimed to spend about 90 additional minutes a day to read and write emails, after they had learnt to ignore most of what they receive [Students' Group 2001].

Let's now put the argument of not reinventing the wheel at its extreme: If a researcher were to include everything ever published on her subject historically and globally she would either have to push her subject to the extremest niche or end up re-appraising for several years what is already out there. As the latter is neither inspiring nor conforms to the way we learn the world (that is by rediscovering) procedures have been developed to rationalise the exercise. So the researcher will only refer to a few mainstream and recent sources and select only those few aspects that help him make his point. Still, the official rule remains that researchers, standing on the shoulders of giants, as Newton said, are supposed to take existing knowledge into account while contributing invention and new thoughts. Growing older they learn that they are safe if they comply to referencing some salient works that become salient exactly because they fulfil the function as a substitute for profound search and study. In psychology such a split between formal and informal rules is called a double-bind. Double-bind

situations in early childhood undermine people's self-esteem which in turn undermines their ability to cope with authority in a sound way.

We can recognise that – put to the extreme – abundant information undermines democracy which is very much in contrast to common wisdom and the benefits promised by proponents of a "better e-society".

Similarly, if in the practical field we became really serious about the underusage of existing knowledge* and reconsidered every idea, every concept and every project that have ever popped up, the reassessment of best practices and benchmarks would last beyond the time any strategic window were open on the market. Economically we can easily come up with an equation-based model to solve this double-bind that is based on speedy action and sound research before action is undertaken: If the cost-benefit ratio of knowledge generation is better than the cost-benefit ratio of knowledge exploitation than they should generate, otherwise they should exploit. The problem is, that in most cases we don't know which numbers to fill into our equation so that practitioners are left without reliable clues how to act. Again schizophrenia raises feelings of insecurity and makes people more prone to manipulation.

One has to think to the extreme to test arguments, but in everyday life extremes happen rarely. What happens is a general disequilibrium between the amount of information that is relevant to any task and is accessible, although at some transaction cost, and the amount of knowledge anyone is able to process thoroughly. Let's illustrate this point with the matter of knowledge management. My estimation is that at least two conferences are offered a day globally, books and articles abound, so that nobody has the slightest chance to cover the matter fully. How do people react to such an unbalanced reality? They start to work longer hours [Reich 2001] and doctors report that many suffer from stress or burnout which are counterproductive to innovative and independent thinking.

As a second effect of information overload we can therefore state its function to make innovation less probable- again a contra-intuitive finding, as common wisdom would expect more access to information to result in more combinatory innovation.

As Dörner demonstrates in his research there is no linear relationship between the quality of a decision and the quantity of information available to take it. Economic theory inclines us to accumulate information to take better decisions if we can gather it at low cost as homo oeconomicus calculates his best alternative based on complete information. But, Dörner has found out that the quality of decisions taken by his test persons – all holding degrees and top leadership positions – deteriorated progressively as they were exposed to information overload and time pressure. They tended to fall back into simplifications, black and white picturing of situations and random filtering of information [Dörner 1998].

The "solutions" preferred in situations of information overload combined with pressure to act on urgencies tended to be authoritarian, even violent or childish.

Damasio, in his book on Descartes' Error makes the point that humans use their emotions and intuitions to survive. If the links between their emotional and cognitive centres are cut by some accident, the individual remains able to score high on intelligence tests but must be taken under custody because (s)he is unable to take any decision out of a nearly infinite realm of opportunities [Damasio 1997, 108ff].

As a third effect of information overload we can therefore adhere to the fact that it deteriorates the quality of decision making, processes as well as outcomes.

2.2 Remedies for information overload

So far our analysis has led us to the conclusion that humans can improve on their work and lives by having access to information in principle, but that this positive effect is counteracted by information overload. So what knowledge management should do is to find remedies for this problem. Overload can, to be exact, only be defined with reference to a certain context and a certain individual as abilities to digest differ between people and situations. Nevertheless, globalisation and digitalisation combined with higher education of larger parts of world population have led to a situation of structural abundance: No one can process all the information that is accessible and relevant to a current task.

Remedies for overload can be divided into three categories: technical, psychological and neurological.

Technical remedies are devices that filter information to exclude irrelevant material, that automate retrieval and indexing (intelligent agents) or that support the recognition of patterns and causal relations in huge amounts of seemingly unrelated data (data-mining). They build on the superiority of computers in processing high volumes at high speed. If supplied with criteria and set rules, computers can take on large parts of knowledge work, such as structuring, compiling, condensing and comparing data. Office programs offer classical functions of time and meeting management, of organising daily tasks and keeping files of addresses, links and task-specific documents. But, the best system is only as good as the individual using it. Therefore progress in productivity lags behind its technical potential. But on the whole we could claim, that we are about to witness a revolution in enhanced productivity, resulting from the multiplication of growing computing power with growing connective capacity, growing and cheap storage capacity and open software standards, such as XML for the time being [Brown 2002]. My guess, though, is that growth in volume of outcome, made possible by such progress, combined with a decline in human capacity and discipline due to the ease in processing, storing and diffusing information, will outgrow the potential technology offers to solve the overload challenge. Technical progress in the past has usually consumed about one third to one half of its potential to reduce complexity in order to cope with the complexity inherent to itself.

Psychological remedies address the way humans cope with structural overload. Abilities that are less trained nowadays because computers make life easy, have become even more important: The ability to set priorities and to know what one wants, the ability to understand the essence of an issue and the ability to know what one does not know (enlightened ignorance) and to know what one does not need to know (positive ignorance). To cope with an abundance of choices, easy to access, requires strong will, however, will is weakened by the mere existence of abundant choices. Problem solving and pattern recognition abilities need to be trained from early childhood while our educational systems still put a premium on reproducing information. Positive ignorance may be the toughest issue here as we still try to live up to the vision of the “Renaissance Man” who knows all about her world. It must not be tackled mechanically as serendipity is to be considered. Serendipity means openness to seemingly irrelevant pieces of information that may, by chance, fall into a highly relevant picture later on.

One way to cope with overload from a learning perspective is to train people to withstand the seduction of volume, another would be to train their capacity to digest more. The first way focuses on highly effective use of information by keeping the old virtues of thinking alive. Unfortunately this is counteracted by industry that distracts consumers by a plenitude of attention-capturing options that consume time needed to think and to learn. The second way follows the philosophy of adapting humans to the new technical environment rather than the other way round. Courses in fast reading, in attention switching and in memorizing shall increase the ability to process large volumes of information. As with technical remedies I expect this type of solution to follow the pattern depicted in the old fairy tale of the hedgehogs and the rabbit: They will always lag behind.

A third category of remedies targets the interface of human and artificial intelligence. Human brains will be extended by computing power added to all kinds of devices, attached to cloths, glasses, watches or even directly to the cortex. If by 2009 a computer, priced at 1000 $, can process one trillion operations per second humans will be "relieved" of many procedures we used to call thinking by then. By 2029 a 1000 $ computer will have the power of 1000 human brains: It will have processed the whole body of human literature, fine art and natural science and most probably have a consciousness [Kurzweil 2001]. I will not speculate too far into the future but we will have to deal with some deeply philosophical questions then.

Again, a biological alternative is at hand to complement or substitute for artificial intelligence. By training and revoking different ancient and traditional practices to enter other states of mind that transcend the wave length and frequencies our brain operates in its normal state, we may learn faster as is assumed in superlearning and understand faster as reported about states of trance. If we compare the amount of research money devoted to technical progress and to rediscover old wisdom that is considered to be esoteric, it becomes quite easy to predict the future. Kurzweil's spiritual machines will appear with a much higher probability than humans with a natural gift of Schamanism to put a long story short.

3 Conclusion

In this paper I have argued that scholars and practitioners of knowledge management have, for some incomprehensible reason, neglected a phenomenon that threatens to counteract their progress, namely information overload.

They have not only neglected this phenomenon but contribute to it by following a linear vision of accumulating ever more information to improve the productivity of knowledge work. I have pointed to empirical evidence and at the same time argued the case of structural conflict caused by abundance of information. Both points render the concept of better work based on ever more information obsolete. Under conditions of information overload and computer support in thinking.

1) Humans will regress in their capacity to think as it is acquired in evolutionary processes of learning and preserved in constant use. The assumed high and typically human level of knowledge work, namely dealing with uncertainty, ambiguity and incompleteness, may never be reached by

any human if a future kid's environment does not offer any training in basic cognitive functions that will be taken over by computers.

2) They will take worse decisions with regard to desired outcome as evidenced by Dörner's experimental settings and Damasio's neurological cases.
3) They will easily fall prey to all kinds of political and commercial manipulation as their lives will be constantly stressed by the gap between the amount of information that is relevant and in principle accessible and the amount they are able to digest. In our contemporary society which blames this structural gap on individuals and the educational system, low self-esteem of the non-elites may result and thus threaten democracy.

Remedies to cope with overload while benefiting from the promises of a knowledge society can be categorised into technical, psychological and neurological.

I have excluded a scenario of successful neo-Ludditism where the progress of computer, connective, storage and A.I. capacity becomes stagnant.

I expect a combination of technical and affirmative psychological procedures to gain market share as they follow the self reproducing dynamic of markets in general: Each solution breeds a multitude of new problems that require entrepreneurs who invent new solutions that will again breed problems. The most probable scenario is not necessarily the most reasonable one.

If we spent as much money on humans as we do spend on their technical support that may finally result in their substitution or – as Kurzweil says, in their co-existence with higher intelligence just like animals co-exist with us today – we may achieve results that are cheaper and superior even in terms of productivity and most certainly in terms of ethical standards that are so far bound to biological entities called humans.

References

[Brown/Seely (02)] Brown/Seely, J.: "An Epistemological Perspective on Organizations Afford Knowing." Keynote Address to The Third European Conference on Organizational Knowledge Learning and Capabilities, April 6th, Athens (2002)

[Damasco (97)] Damasio, Antonio, R.: "Descartes Irrtum. Fühlen, Denken und das menschliche Gehirn." dtv, München, 5. Auflage (2000)

[Despres (01)] Despres, Charles/Chanvel, Daniele: "The Thinking Behind the Action in Knowledge Management." Proc. of the Second European Conference on Knowledge Management, Bled (Slovenia), 8 – 9 November 2001 ; pp 133 – 152.

[Dörner (98)] Dörner, Dietrich: „Die Logik des Misslingens. Strategisches Denken in komplexen Situationen." Rowohlt, Reinbek bei Hamburg (1998).

[Jackson (98)] Jackson, Maggie: "E-mail just the latest way workers keep in touch." Associated Press, Compiled in: Cremers R., strategic-news@olsy.nl, 23.5.1998

[Kurzweil (02)] Kurzweil, Ray: „Homo S@piens. Leben im 21. Jahrhundert. Was bleibt vom Menschen?" (Original 1999: The Age of spiritual Machines) Econ München, 3. Auflage (2002).

[Pfeffer (99)] Pfeffer, J./Sutton, R.: "The Smart-Talk Trap." Harvard Business Review, May-June 1999, pp. 135 – 142.

[Regents of the University of California (00)] Regents of the University of California (Ed.): "How much information?" www.sims.berkeley.edu/how-much-info/summary.htm, downloaded: 28.11.2000

[Reich (01)] Reich, Robert: "The Future of Success" Knopf

[Schneider (01)] Schneider, Ursula: „Die 7 Todsünden im Wissensmanagement." FAZ Verlag, Frankfurt (2001)

[Students' Group (01)] Students' Group, University of Linz: Seminar Paper on "Individual Strategies to use e-mail in the Academic World – an empirical study", Linz 2001

[*] As all work on knowledge management this paper will be exposed to the difficulty of talking about concepts that lack clear definition. In the following I will distinguish between "data" (texts, images) as observables that turn into information if related to a context and therefore endowed with meaning. Assuming a common context of global society I will therefore often refer to information on the net and thus deviate from Bateson's definition that information is subjective, namely a difference that makes a difference (which I highly appreciate). Everything stored on a medium, be it paper or electronic, will not be conceptualised as knowledge in this paper, which uses the concept of knowledge as related to a consciousness and assumes that so far consciousness only exists in humans. Structures on media, be they texts, images, formulae, therefore are only potential knowledge. They turn into the latter if a human brain processes them.