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Forget unlearning? How an empirically unwarranted concept from psychology was imported to flourish in management and organisation studies

Abstract

We provide a critique of the development in organisation studies of the idea of 'unlearning' as allegedly imported from the psychology literature by Hedberg (1981) and understood to mean the manageable discard of knowledge precedent to and aiding later learning. We re-review the psychology literature and in contrast to Hedberg, find that this definition of unlearning is not empirically warranted. We re-examine a selection of highly-cited articles in the organisational literature that claim to have conducted empirical research into it or with the Hedberg model of unlearning. We find none provide evidence of its existence. Typically, under the label 'unlearning' evidence is provided of a conventional process of theory-change; the setting aside (not deletion) of an established understanding in favour of new understanding when presented with perceived new facts. In all cases we examine, clear alternative and less problematic concepts would provide a better conceptual framework for the research, such as learning, theory-change, discard of practice and extinction. It follows that the 'unlearning literature' is not in fact the independent, scholarly and scientific literature that many of its adherents believe it to be. We recommend that for concepts allegedly imported from other disciplines more frequent commissioning of cross-disciplinary reviews may encourage the critical works so obviously lacking in the 'unlearning literature'.

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Introduction

In the management literature unlearning has become treated as an empirical and manageable process independent and precedent to learning, and the literature on unlearning has the superficial appearance of a successful and growing research area. Reviews are typically uncritical and credit Hedberg (1981) as the origin of this line of work (Huber 1991, p104), with a recent tendency to call Hedberg's book chapter 'seminal' (Becker 2005, p661; Tsang and Zahra 2008, p1435). Unlearning has been described as one of 'seven major contributions that have been influential since 1978' upon the field of organisational learning (Easterby-Smith, Antonacopoulou et al. 2004, p373). Hedberg's book chapter 'How Organisations Learn and Unlearn' is certainly much-cited, with a Web of Science search yielding 661 total ISI cites (28th June 2015) and a rising annual rate of citation. However, the feature that was decisive in attracting our interest is the growing number of empirical articles that are justified and framed by citation to Hedberg's (1981) work and that claim to have advanced understanding of 'unlearning' as an empirical process independent of learning (see Table 1). More than 30 years after Hedberg's (1981) book chapter, it might seem that here we have social scientific development in the management literature as we should expect and hope it to take place.

We provide here the thorough critical review of the unlearning literature that we could not find and which we believe it deserves.

We did so first, because as an allegedly manageable cognitive process independent of learning, it should be within the subject matter commonly addressed by psychologists: why then were we not aware of its existence from our knowledge of the psychology literature (one of us is psychology-educated)?

Second, although articles on unlearning have the mandatory 'literature review'

section and while there are ISI-categorised ‘review’ articles on unlearning, we found that these (with the partial exception of Klein (1989)) uncritically rehearsed articles in the management literature that used the word unlearning; none of them focused on the psychology literature which was the widely understood origin (through Hedberg (1981)) of this idea. We were surprised that Hedberg’s book chapter was taken as sufficient authority for the empirical value of unlearning.

This was so even for *Management Learning*, the journal ‘for critical reflexive scholarship on organisation and learning.’ In five articles in this journal in which unlearning is a central rather than a minor topic, as indicated by its presence in title or abstract, we find no criticism and no doubt expressed about its robustness as an idea or its worth as an empirical phenomenon. We would generally characterise these articles as seeking to apply, develop, synthetically review or model the idea (Pratt and Barnett 1997; Wijnhoven 2001; Antonacopoulou 2009; Hislop, Bosley et al. 2013) with one clear empirical work on unlearning (Tsang 2008) which we review fully later. Antonacopoulou is most cited with 30 total ISI cites (June 2015) and may illustrate what we find missing from this scholarship. Antonacopoulou styles her work as an ‘essay’ that seeks to orientate future management scholarship. Her ‘central message from this analysis is the importance of unlearning asking questions with research users so that the knowledge co-created can be actionable’ (Antonacopoulou 2009, p421). Within the 24 uses of the stem ‘unlearn’ in this essay our best guess at Antonacopoulou’s definition is that; ‘fundamentally, unlearning is a process of practicing asking different questions by building on the feedback loops (revealing the tensions) central to single, double and deuterio (triple) learning....’ (Antonacopoulou 2009, p424). She acknowledges that her definition is ‘in sharp contrast’ to the Hedberg (1981) line of scholarship (Antonacopoulou 2009, p424) with which we are concerned. Our problem is that she nowhere explains why she departs from what is, after all, the ‘unlearning

orthodoxy' within the management literature: her definition is simply asserted and used repeatedly, without sourcing and without explanation and with no attempt to explain how it differs in definition or practice from the trivial 'ask different questions'. The Hedberg-unlearning orthodoxy at least appears to be a stable definition through time that has undergone repeated investigation and development.

A third reason for this review is that we wanted to know how unlearning was distinguished from what we considered to be our conventional idea of 'theory-change.' Theory is a 'system of ideas held as explanation of a group of facts or phenomena' (Oxford English Dictionary 2nd edn.1989) and our understanding of the process of theory-change is that the acquisition of new facts or phenomena may challenge established theory so that the theory may eventually be set aside in favour of an alternative with perceived superior explanatory power. 'Set aside' in the above acknowledges that old theory remains known and may even retain its utility in certain fields of application (as is the case for Newtonian mechanics despite the advent of special relativity). This simple model makes sense of theory-change in detailed empirical studies with which we are familiar (Kuhn 1970, pp53ff; MacFarlane 1984; Hounshell and Smith 1988; Thagard 1999). Yet in none of these studies had we encountered unlearning as the manageable cognitive process it is supposed to be, independent to learning and able to delete established understanding precedent to and in aid of the acquisition of new understanding.

The last reason for this review relates to the above: we believed we *had* encountered the Hedberg model of unlearning - in common English usage where we had assumed that it was used metaphorically. It is a position in organisational research that metaphor may be a means of developing a research field, of making sense of phenomena (Cornelissen, Oswick et al. 2008) and initially we thought this might have been a motivation for at least some

unlearning authors. However close inspection of the dictionary revealed something we were not aware of - a crucial ambiguity in the common meaning and usage of 'unlearn'. 'To unlearn' is certainly defined to include the Hedberg idea; 'to discard from knowledge *or memory* [our italics]; to give up knowledge of (something)' (Oxford English Dictionary 2nd edn.1989) but in the examples of usage provided it was not always clear to us whether metaphorical invocation of the Hedberg idea of discard from memory was intended or theory-change as we defined it above. So an example of usage is '[the microscope] will ocularily evince and unlearn them their opinions' and with no more information both interpretations are possible. It seems that 'unlearn' in common use may metaphorically refer to the Hedberg idea or literally to our model of theory-change. We expected the unlearning literature to respond by carefully defining its terms so as to avoid these dangerous ambiguities. We expected such definitions to be common across unlearning scholars and to be sustained in the conduct and analysis of any empirical work.

Our review applies the standard to the scientific literature on unlearning that unlearning must be shown empirically to be something more than our conventional process of theory-change, for otherwise it offers nothing new. As we do this we also seek to understand what coherence and meaning can be attributed to 30 years of citation and apparent development of Hedberg's (1981) work on unlearning.

The structure of the article is as follows. We establish what Hedberg (1981) and his principal interpreters Nystrom and Starbuck (1984) actually said about unlearning. Then, since the authority of the psychology literature was used to buttress Hedberg's and Nystrom and Starbuck's assertions, we are the first to review the psychology literature afresh since Hedberg for the empirical evidence which is said to be the origin of Hedberg's idea of unlearning. We then selectively review the most cited management and organisation articles

dedicated to review or empirical study of the Hedberg, Nystrom and Starbuck unlearning model.

Hedberg, Nystrom and Starbuck's development of 'unlearning'

On the first page of Hedberg (1981) unlearning is introduced without source citation as an essential part of the definition of 'understanding', as follows,

'Knowledge grows, and simultaneously it becomes obsolete as reality changes. Understanding involves both learning new knowledge and discarding obsolete knowledge. The discarding activity – unlearning – is as important a part of understanding as is adding new knowledge. In fact, it seems as if slow unlearning is a crucial weakness of many organizations' (Hedberg 1981, p3).

It appears that unlearning is to be understood as an independent process to learning. This is confirmed in the dedicated subsection 'how unlearning occurs' that begins,

'Unlearning is a process through which learners discard knowledge. Unlearning makes way for new responses and mental maps.' (Hedberg 1981, p18)

The addition is that unlearning may *precede* and therefore aid later learning ('new responses and mental maps'). Nystrom and Starbuck develop Hedberg's unlearning idea;

'Our colleague, Bo Hedberg, reviewed the psychological literature and concluded that unlearning must precede the learning of new behaviours' (Nystrom and Starbuck 1984, p58).

Nystrom and Starbuck (1984) clearly credit Hedberg's unlearning idea to his review of the psychology literature and by their addition of the word 'must' they turn Hedberg's formulation into a general process, necessarily precedent to learning. As their title 'To Avoid Organisational Crises, Unlearn' declares, their contribution is to add another idea – that unlearning can and should be *managed*.

There are four related assertions here that for convenience will subsequently be referred to as the 'Hedberg, Nystrom and Starbuck assertions':

1. Unlearning as the discard of knowledge is an *independent* process to learning.
2. Unlearning *precedes* learning.
3. Unlearning *aids* both later learning and adoption of practice.
4. The idea that unlearning can be 'managed' i.e. knowledge may be deliberately and intentionally discarded or 'removed' to *facilitate* later learning.

In a pattern that will become familiar, our problem is that Nystrom and Starbuck's purported examples of the management of unlearning are not clearly examples of the management of unlearning as they define it; 'top managers can stimulate their own unlearning and new learning in at least three ways: they can listen to dissents, convert events into learning opportunities, and adopt experimental frames of reference' (Nystrom and Starbuck 1984, p59). None of these three seems very remarkable and we are at a loss to understand why they should stimulate unlearning as defined by Nystrom and Starbuck rather than the commonplace setting-aside of one understanding for another.

Since Hedberg's idea was attributed by Nystrom and Starbuck to his review of the psychology literature we sought to review that literature to find the source of Hedberg's ideas.

Unlearning in the psychology literature

Our first step was to search for the word 'unlearn' in the psychology literature. We found that unlearning is not one of the 8200 official, American Psychological Association (APA)-controlled technical terms listed in the Thesaurus of Psychological Index Terms. This thesaurus is compiled to index the APA-maintained PsycINFO database which provides complete coverage of the psychology literature since the 19th century (with, at the time of writing, 3.3 million records, covering 2500 journals). Since unlearning is not a recognised technical term in psychology, it is not surprising that a search on 'unlearning' in the Index Terms field of the PsycINFO database yields no records at all. To make the significance of the statement clear, it means that in psychology, a discipline that defines itself as the scientific study of mind and behaviour, the word 'unlearning' has not been found to have descriptive utility because the various processes it might metaphorically refer to are already unambiguously covered by nine other technical terms (learning, forgetting, memory decay, amnesia, extinction, interference, negative transfer, inhibition and suppression). In other words, psychologists do not consider 'unlearning' to refer to what they understand as a real-world phenomenon that can be empirically distinguished from the nine phenomena listed above.

A subsidiary, lesser question is whether the word as such ever occurs in the experimental psychology literature and how it is then used. A free-text search on 'unlearning OR unlearn' in the Title, Abstract, and Keyword fields of the 3.3 million records of the PsycINFO database does yield 439 records of English-language journal articles that use the word. When attributing meaning to occurrences of unlearning in this literature it is necessary to remember that

the index of technical terms enables precision in the definition of such terms both as they relate to measurable phenomena and to each other: together they form the set of descriptors fully adequate for the description and analysis of known psychological processes. We read the context for all occurrences of unlearning in the most pertinent sub-literatures, the human experimental psychology literature (126 occurrences) and the learning and memory literature (52 occurrences). We found every occurrence of unlearning in these sub-literatures to be instances of informal usage, occurring in an empirical context where the observed outcome was decreased memory performance, relative to a control condition, and in our view the correct technical term denoting the hypothesised psychological process would have been inhibition, interference, extinction, forgetting or negative transfer.

Some significance should be attributed to the low rate of occurrence of 'unlearning' versus the higher rates of occurrence of these technical terms in the English-language psychology literature: against 439 for unlearning, we find 38,531 on inhibition, 16,901 on interference, 11,934 on extinction, 4374 on forgetting, and 1400 on negative transfer. What is truly significant is the non-technical and colloquial usage of unlearning: therefore, we conclude unlearning is not an accepted concept or process in psychology.

Our second step was to search for psychology review articles that, if they did not use the word 'unlearn', might address the meaning attached to the word 'unlearn' in the organisation literature. We found many such reviews (see (Wenzlaff and Wegner 2000; Wixted 2004; Shanks 2010; Hardt, Nader et al. 2013). Alternative words used included Wenzlaff and Wegner's 'thought suppression' but in all cases the reviews found that there was no evidence that deliberate efforts to remove memory, to deliberately discard knowledge from memory, were successful.

This null result raises the question of how well Hedberg reviewed the psychology literature. Hedberg's book chapter cites 138 sources, but only nine of these are from the peer-reviewed psychology literature. Only two of the latter address topics that could in any way be constructed as instances of unlearning, and so we conclude that Hedberg's book chapter is clearly *not* a review of the psychology literature. The sole authority for Nystrom and Starbuck's assertions that unlearning derives from the psychology literature and that unlearning is an empirically-warranted process that can and should be managed are two peer-reviewed psychology articles that happen to be cited by Hedberg (Postman and Stark 1965; Postman and Underwood 1973). We consider them further here.

The topic of these two papers is retroactive inhibition in a particular type of interpolated learning paradigm in which two lists of paired associates (each consisting of a single letter and a single-syllable adjective) are learned after each other and where recall of the first list is impaired when the stimuli in the second list overlap with the stimuli in the first list. In both papers, the authors clearly define the psychological processes that they assume to be responsible for the phenomenon that they colloquially refer to as unlearning. Postman and Stark even end their paper with the conclusion that their findings are 'consistent with an interpretation of unlearning as continuous with experimental extinction' (Postman and Stark 1965, p315). In other words, while the word unlearning is used in these articles, the authors understand, and make it abundantly clear, that the psychological process they assume to be at work in their experiments is extinction. By manipulating the overlap between old and new learning material, they show that associations in the newly acquired material render associations in the old material relatively less accessible when those associations involve the same items. In the second paper, Postman and Underwood (1973) speculate about two simultaneously operating processes: a response selection mechanism that would today be considered a

component of executive control, and the extinction mechanism referred to above. What is noteworthy in this paper is that the authors clearly state that:

‘The fact that there is an inevitable interaction between first-list unlearning and second-list learning does not entail the conclusion that the latter depends on the former. Such an assertion could not be, and has not been, made by proponents of two-factor theory on both logical and empirical grounds’ (Postman and Underwood 1973, p20).

In other words, there was no evidence to suggest that the learning of the second list is facilitated or aided by what is here called the unlearning of the first list of items. This is precisely the opposite understanding to that expressed by Nystrom and Starbuck (1984, p58) when they cite Hedberg’s book chapter.

There is a more fundamental objection to the use of these experimental psychology papers as authorities in support of the assertion that unlearning is an empirically-warranted process: we cannot see a logical link between retroactive inhibition processes in paired-associate learning experiments (as investigated in these papers) and a phenomenon so vastly more complex as learning in organisations: the former concerns split-second cognitive processes in individuals; the latter often involves tens to hundreds to thousands of individuals in complex organisations acting over months to many years in conditions of incomplete or misleading information.

After 125 years of research on learning and forgetting psychologists have still not found any evidence for the hypothesis that there is the psychological equivalent of a delete key on a computer keyboard. Our conclusion is that the authority of a review of the psychology literature was incorrectly attached to Hedberg’s book chapter by Nystrom and Starbuck. Hedberg presents

unlearning as an empirical process but has apparently misunderstood the conclusion of just two articles in his review that *used* the word unlearning. Further, the idea that reversal of learning facilitates learning is not supported by these cited psychology articles, but is explicitly asserted to be possible and manageable by Nystrom and Starbuck, and Hedberg as in the quotes above.

Unlearning in management research

Having established an absence of empirical support for the Hedberg-Nystrom and Starbuck unlearning assertions in the psychology literature we next sought critical reviews and empirical tests that should have incorporated such findings in the management literature. We made an ISI topic search on the stem ‘unlearn’ within the 801 ISI articles and reviews that cited to Hedberg (1981) and Nystrom and Starbuck (1984) (September 2013). We obtained 45 records with ‘unlearn’ in the title, abstract or as keyword and rank-ordered these by number of ISI cites in Table 1 (Appendix). We discuss review works, then empirical works.

ISI-Categorised ‘reviews’ of unlearning

None of the 9 reviews re-evaluate the alleged origin of unlearning in the psychology literature. Most of them treat unlearning as a subtopic within a larger topic such as organisational learning and uncritically rehearse the Hedberg, Nystrom and Starbuck model (Appendix, Table 1). There are two exceptions, discussed below.

Klein. Klein is the only critical work, narrowly-focused on the argument that it is not *necessary* to unlearn existing knowledge before the acquisition of new knowledge. His review concludes that much learning occurs with a necessary context of existing knowledge (‘parenthetic learning’) and his title expresses its significance: ‘Parenthetic Learning in Organisations: Toward the Unlearning of

the Unlearning Model' (Klein 1989). We investigated citations to Klein, the only critical work. From its publication in 1990 to September 2013 Klein obtained 14 ISI article cites compared with 175 additional cites to Nystrom and Starbuck (1984) in the period. Klein's paper has been all but ignored. Furthermore, of those papers citing Klein that also indicate that unlearning is a significant topic (by having unlearning in the title, abstract or keywords; see Table 1) we identified seven papers that rehearse the Hedberg, Nystrom and Starbuck unlearning thesis and yet ignore Klein's critique of that thesis (Bettis and Prahalad 1995; Akgün, Lynn et al. 2006; Akgün, Byrne et al. 2007a; Becker 2008; Tsang and Zahra 2008; Becker 2010; Wong, Cheung et al. 2012).

Tsang and Zahra. The only work that explicitly has as its primary aim to 'define and clarify' the verbal compound 'organisational unlearning' (Tsang and Zahra 2008, p1436). Yet it begins by stating that Hedberg's (1981) book chapter is 'seminal' (Tsang and Zahra 2008, p1435) and Hedberg's definition of unlearning is quoted in full (see: 'Knowledge grows') and so apparently endorsed for there is no critical comment or analysis. Tsang and Zahra do begin by compiling a table of 34 definitions of 'organisational unlearning' in published work but do not evaluate how these varied definitions were generated or assess their empirical standing, only noting some commonalities such as that many definitions 'discard something' (Tsang and Zahra 2008, p1439-1441).

On first reading, Tsang and Zahra's own definition of organisational unlearning might mistakenly be understood to have dropped the 'deliberate discard of knowledge'; for them, organisational unlearning is 'the discarding of old routines to make way for new ones, if any' (Tsang and Zahra 2008, p1437). However, they arrive at this definition by reference to Feldman and Pentland (2003) and the idea that knowledge about routines is distinct from the routine in use (Feldman and Pentland 2003) in (Tsang and Zahra 2008, p1443). They

then add that, 'both aspects [knowledge of the routine and use of the routine] are necessary to constitute a routine... Thus, a routine is successfully discarded only when both aspects of the routine are removed from the organisation' (Tsang and Zahra 2008, p1444). It surely follows that discard of the routine from practice but retention of the knowledge of the routine would not meet their own definition of organisational unlearning. What then to make of Tsang and Zahra's illustration of the difference between individual and organisational unlearning;

'...a company hires an accountant from another company. The two firms use very different accounting systems. When the accountant joins the new firm, he or she may have to cease implementing some of the accounting practices of the previous employer. This is individual, not organisational unlearning. Only when the organisation *changes its accounting system* [our emphasis] does organisational unlearning begin.' (Tsang and Zahra 2008, p1444).

Here the definition of individual unlearning is clearly stated to be the discard of a practice and not the discard of knowledge of the practice. This contradicts their theoretically-derived notion that the routine is not discarded if knowledge of the routine is retained – which we imagine it is in this case. Nor can we see how 'organisational unlearning' is any different in this matter; 'changes its accounting system' clearly indicates a discard of practice but not a discard of knowledge of that practice. Without the illustration of that necessary element of their definition that there be 'successful removal' of knowledge of the routines we are at a loss to understand how this thought experiment illustrates Tsang and Zahra's definition of organisational or individual unlearning.

If we reconsider their thought experiment afresh we find we need no more complex idea to understand it than the obvious 'discard of old routines' to

describe both the change in practice of the individual accountant and of the organisation. We therefore disagree with these authors' conclusion that they have strengthened the 'conceptual foundation of organizational unlearning' and disagree that this should serve as a basis for future empirical work (Tsang and Zahra 2008, p1456).

If a function of a review is to steer the field away from unproductive research avenues and towards productive ones it has not happened here. Klein's critique is ignored while Tsang and Zahra are steering the field into an unproductive path. Yet if we are correct one may ask why there is a growing body of alleged empirical work on unlearning.

Assessment of claims to present empirical work on unlearning

Our preferred assessment criteria for articles claiming to present empirical work on unlearning were drawn from our review of unlearning and related concepts in the psychology literature. This suggested that as a minimum, a research design that has the aim to show the existence of unlearning should satisfy three conditions: (a) the design must be able to show that the knowledge known by the members of the organisation at an earlier point in time T_0 is not known by the members of the same organisation at a later point in time T_1 ; and (b) the design must distinguish unlearning from forgetting, so that the knowledge known at T_0 that is lost at T_1 is shown to be the result of an active intervention and not merely the result of passive forgetting, for example because of lack of use and after the discard of practice; and (c) the design must distinguish unlearning from the discard of practice so that if a practice is in use at T_0 and discarded at T_1 this is not sufficient to demonstrate unlearning: it must be shown that the members of the organisation do not have any memory of the relevant discarded skill or practice at T_1 .

None of the 45 articles identified by our ISI search satisfied such criteria. Yet

some explicitly claimed to have made empirical investigation of the Hedberg, Nystrom and Starbuck unlearning assertions. We review five to illustrate what these articles actually do, this number allowing sufficient depth in each case but an appreciation of the variety in research design and method used. Selection was from Table 1 (see appendix) and beginning with consideration of articles with the most ISI cites and then on the following criteria:

1. Clear rehearsal of at least one of the Hedberg, Nystrom and Starbuck unlearning assertions.
2. A declared intent to provide empirical evidence of these assertions.
3. A minimum of 4 ISI cites.

De Holan and Phillips. Review the ‘dynamics of organisational forgetting’ in which they argue that ‘the fourth mode of forgetting identified involves *voluntarily* [our italics] forgetting established knowledge – what we call managed unlearning’ (De Holan and Phillips 2004, p1611). Forgetting in psychology and common use is an involuntary process and by making it voluntary, De Holan and Phillips arrive at the Hedberg-Nystrom and Starbuck unlearning assertions. They suggest that “...a necessary condition for new knowledge to emerge is the adequate management of the process of forgetting’ (De Holan and Phillips 2004, p1611) and immediately ‘for example’ offer two quotes from their interviews:

‘Canadians [managers of the hotel] act as if this were some suburb of Montreal, they still have to understand that we are in Cuba and that certain things cannot be done their way. They want us to use their system, and that system does not work here, we need new ways of doing things that take into account the specificities of the country’ (Resident manager, Cuban, male, Montelimar Hotel, quoted in (De Holan and Phillips 2004, p1611).

‘[The Cuban employee’s behavior] is normal. They treat customers just like they are treated when they are customers themselves, except that our customers are foreigners and have much higher expectations. Here it is service a la Cuban and that does not work’ (Front desk manager, Canadian, female, Belltolls Hotel quoted in (De Holan and Phillips 2004, p1611)).

De Holan and Phillips now give an interpretation of the quotes as follows:

‘In both of these situations, groups of organizational members *needed* to forget schemas and routines to make room for new knowledge. They *needed* to discard knowledge that had once been functional in the organization but was later seen as a hindrance’ [our emphasis] (De Holan and Phillips 2004, p1611).

By use of the word ‘needed’ in both sentences, de Holan and Phillips leave it unclear whether they intend the quotes to (a) illustrate a problem soluble by managed forgetting or to (b) be understood as (they introduced them) examples of managed forgetting. Whichever of these they intend, we find otherwise, that the plain English of the quotes suggests commonplace understanding is sufficient. The first quote illustrates nothing more complicated than a wish that the managers should ‘understand’ and adopt ‘new ways of doing things’, the second an opinion that established practices do not work. In neither case can we see – and nowhere do de Holan and Phillips explain - how this evidence can be construed as empirical support for managed forgetting/unlearning as they define it.

It is clear that De Holan and Phillips write *as if* ‘managed unlearning’ occurs in organisations and *as if* they have provided evidence of it in the form of exemplary quotes. But since the two quotes in their paper are their choice from

many to illustrate managed forgetting, and we find neither of the two provides evidence for the existence of managed forgetting, we see reason *not* to accept their conclusion regarding their unreported examples in their larger study that ‘managed forgetting’ was empirically-warranted and had *a causal relationship to organisational performance*:

‘Again, an interesting contrast between organisations which managed to perform satisfactorily and those that could not, was the degree to which processes of forgetting were actively managed. In instances where processes of forgetting did not precede learning, and where there was some conflict between existing knowledge and new knowledge, we observed a reduction in the magnitude of learning rate, an impact on its longevity, and an increase in the efforts needed to avoid dissipation’ (De Holan and Phillips 2004, p1611).

Starbuck. Unlearning continues to be this author’s leitmotiv appearing in the title, abstract and keywords of ‘Unlearning Ineffective or Obsolete Technologies’ (Starbuck 1996) where we expected a development of the earlier work for this topic. Yet while Hedberg (1981) and Nystrom and Starbuck (1984) are cited they are not discussed – or repudiated – and unlearning is defined first in the abstract as

‘Often, before they can learn something new, people have to unlearn what they think they already know. That is, they may have to discover that they should no longer rely on their current beliefs and methods.’ (Starbuck 1996, p725).

We no longer find this definition of unlearning clearly distinct from our starting position, that upon receipt of new evidence people may ‘set aside’

established understanding as part of a process of theory change. What is retained by Starbuck is the idea that the process can be *managed* since the principal section is headed 'How people can foster unlearning' and consisting of illustrative anecdotes (Starbuck 1996, p728).

The principal anecdote is given no source (Starbuck 1996, p725-727) but we found it to be essentially identical to a report in the New York Times (New York Times 1995). Its elements are that the Swedish Navy bombed for years what it alleged were Soviet submarines that had made incursions into Swedish territorial waters. Then the Navy acquired new sonar equipment in 1992 and in 1995 Sweden's defence chief announced that the Navy had found that minks give off sounds similar to submarines, admitted that many of the purported submarines had been minks but insisted that that at least 5 Soviet submarines had been correctly detected.

Starbuck concludes that the story illustrates that 'learning cannot occur until after there has been unlearning' (Starbuck 1996, p726). By his new definition of unlearning all Starbuck means is that first comes new evidence (from new equipment) which encouraged a reassessment of the early theory that the Navy had been bombing submarines. If that is all that is to be understood by 'unlearning' we are unpersuaded that the word is necessary or useful to describe a well-understood process of theory change. Nor is there evidence or reason to believe any specific management intervention would have changed events; since the new sonar equipment is causally related to the Navy's acquisition of new evidence and consequent reassessment of its understanding we should like to know how that equipment came to be acquired, but the stories say nothing about this. It may have been routine renewal with an unforeseen consequence. In other words, the anecdote does not illustrate the *manageability* of the process, the distinguishing and general feature of 'unlearning' in this paper.

It now appears this 1990s newspaper story was not a reliable source: a re-evaluation of the Swedish anti-submarine bombing story based on interviews, service diaries of Swedish naval officers and archival evidence advances the thesis that there was an ‘ambitious Western deception operation’ to fabricate evidence of Soviet submarine incursions into Swedish waters for political reasons (Tunander 2004, p8). In short, the newspaper story used by Starbuck is only a fragment of a deep and complex political story in which the possibility of deliberate deception by one or more parties is the problem to be analysed and unlearning is completely irrelevant.

Akgün et al. *Akgün et al.* (2006, 2007a, 2007b) distinguish their work as an empirical investigation that uses structural equation modelling to analyse the role of ‘unlearning’ in (several hundred) new product development teams (Akgün, Lynn et al. 2006, p73). The hypotheses are expressed in terms of possible relationships between ‘unlearning’ and other variables, such as environmental turbulence, new product success, team anxiety and team crisis and so the precise meaning of unlearning is important (Akgün, Lynn et al. 2006). We did not find there to be any significant differences in the treatment of unlearning between these articles. We take the 2006 article as representative; here the principal authorities on unlearning are Hedberg (1981) cited five times and Starbuck (1996) cited four times but neither source is used as to present a precise definition of unlearning. When this is given it is just prior to its operationalization, as follows;

‘Research indicates that organisational unlearning and memory are closely related concepts, leading researchers to conceptualize unlearning in the first instance as (1) eliminating memory by disconfirmation; (2) disassembling of the connections and mechanisms of memory; or (3) changing how memory is

manifested (Akgün, Lynn, and Byrne, 2003; Moorman and Miner, 1997). Reviewing both individual and organisational unlearning studies, Akgün, Lynn, and Byrne (2003) pointed out that unlearning, understood as eliminating organisational memory in general, is viewed as the changing of beliefs, norms, values, procedures, and routines and is operationalized as changes in beliefs and routines in organisations.’ (Akgün, Lynn et al. 2006, p75).

We observe that the first of the itemised elements of their definition of ‘unlearning’ contained within the first sentence, ‘eliminating memory by disconfirmation’ appears to us to capture the Hedberg, Nystrom and Starbuck definition, but the second and third itemised definitions read to us as euphemisms for a change in memory and we are at a loss to see how the three items together make ‘unlearning’ distinct from learning since the acquisition of knowledge i.e. learning, would change memory. However, all three itemised sub elements of their definition concern memory and so the second sentence appears a non-sequitur because unlearning is operationalized as ‘changes in beliefs *and routines*’ (our emphasis). This operationalisation of unlearning is found in other work by these authors (Akgün, Byrne et al. 2007a, p207) and since it is not distinct from learning or from changes in practice/routine their results cannot shed light on their definition of unlearning as ‘elimination of memory by disconfirmation’. Nevertheless they report standardised effects of ‘unlearning’ on knowledge implementation and new product success of $\beta = -.05$ and $\beta = -.02$ respectively (p219), which clearly indicates that ‘unlearning’, as measured in their study, is empirically unrelated to knowledge utilisation and new product success. Yet they conclude that ‘team improvisation and unlearning provide team flexibility in turbulent environments and impact new product performance via knowledge utilization and implementation’ (Akgün, Byrne et al. 2007a, p225).

These authors provide no empirical evidence either of unlearning as they define it conceptually or of the quite distinct meaning of unlearning that they operationalize.

Becker. Becker has the interesting object to identify ‘specific factors that facilitate unlearning’ (Becker 2010, p255) and unlearning is her central concept with seventy eight instances of the stem ‘unlearn’ and her definition the same as in her earlier review:

‘Unlearning has been defined as the process by which individuals and organisations acknowledge and release *prior* learning (including assumptions and mental frameworks) in order to accommodate new information and behaviors’ (Becker 2005, p661; Becker 2010, p252).

Becker has substituted ‘acknowledge and release’ for Hedberg-Nystrom and Starbuck’s use of ‘discard’ and Becker notes in her review article the possibility that the established knowledge ‘is not destroyed, but remains’ (Becker 2005, p661). What she appears to retain is the idea that unlearning is a manageable process, distinct from learning and with the utility that it helps accommodate later learning (Becker 2010, p252). However Becker places an important caveat on her independent unlearning process:

‘Sustaining change means relinquishing old ways prior to, *or at least at the same time as* [our emphasis] learning the new practices and procedures, a process referred to as unlearning’ (Becker 2010, p252).

Here Becker has dropped the idea that unlearning ‘must precede’ learning and included in her definition the discard of old practice for new. Defined this way we cannot understand how unlearning can perform its remaining distinguishing function, the ‘release’ of established knowledge to aid later

learning. We can no longer see that this greatly amended definition of unlearning is distinct from our orthodox understanding of theory change as it now includes learning something new, changing one's understanding and then changing practice.

Becker identifies the specific factors that facilitate unlearning through a survey of employee attitudes. She identifies as important factors eg. positive prior outlook, feelings and expectations, positive experience and informal support, understanding the need for change, and organizational support and training. We find the survey questions typical of a survey of employee attitudes to new technology implementation and not related to a distinguishable concept of unlearning. Likewise, Becker's recommended management actions are reasonably directed to preparing for a new technology; for example, managers should be 'vigilant in establishing the case for a new system early in the change process' (Becker 2010, p259).

We cannot see the added value of the amended unlearning framework, which if dropped would leave this work as a straightforward survey of employee attitudes to new technology implementation with sensible recommendations for management.

Tsang. Tsang's empirical paper claims to use an 'organisational unlearning perspective' (Tsang 2008, p5). The first sentence declares Hedberg (1981) to be 'seminal' and quotes Hedberg's definition 'Knowledge grows' but this is not discussed, serving only to justify an empirical article on 'organizational unlearning' (Tsang 2008, p7). Nor does Tsang use Tsang and Zahra's (2008) definition discussed above, instead referring to Levitt and March (1988);

'...who regard organizational learning as the process of 'encoding inferences

from history into routines that guide behaviour'. Based on this definition, organizational unlearning refers to the discarding of old routines to make way for new ones... By contrast [to organizational learning] our definition of organizational unlearning emphasizes the *discarding* of existing *routines*' (Tsang 2008, p7).

This would seem not necessarily to include the discard of 'obsolete knowledge' and this seemed supported when Tsang illustrates his definition of organisational unlearning;

'...our definition [of organisational unlearning] indicates that unlearning can be an isolated phenomenon. For example, an organisation may discontinue its practice of asking for external references when recruiting senior executives because it finds that these references provide little useful information' (Tsang 2008, p7).

Tsang appears merely to have renamed the 'discard of practice' as 'organisational unlearning'.

Tsang's method was to report on eight Sino-foreign joint ventures with data collected through 37 semi-structured interviews with foreign and mainland Chinese managers at two points in time. The three greenfield joint ventures were intended to provide a contrast to inform the research of the organisational unlearning 'encountered by the foreign partners' in the five acquisition joint ventures (Tsang 2008: 10). The results of the interviews are selectively reported by Tsang under a series of headings that describe with anecdotes issues or problems encountered by the Chinese firms engaged in implementing new practices. We found that in the empirical section we could read without loss of intellectual value 'discard of practice' in place of 'organisational unlearning.' Had the latter been dropped in its entirety the empirical work

would read as a straightforward and interesting study of the implementation of new practices in established Chinese enterprises.

Conclusions: forget unlearning

Our review of purported empirical work on the Hedberg-Nystrom and Starbuck model of unlearning found no evidence that there existed an independent, precedent process to learning that deleted knowledge and aided the acquisition of new knowledge. We found also that despite repeated efforts in psychology to find evidence of such a process under a variety of names no such process had been empirically warranted.

In the unlearning literature Hedberg's definition was thought to derive from the psychology literature but we showed that it was not. The two psychology papers Hedberg reviewed used the word unlearning but addressed the concept of extinction. Hedberg's definition is used metaphorically in common English and we suggest that Hedberg erroneously reified the common English metaphorical usage of unlearning on the spurious authority of his review of the psychology literature.

The imposition of the unlearning framework obscured what our selected authors were trying to do. In the cases of De Holan and Phillips, Nystrom and Starbuck and Starbuck the underlying process that these authors were addressing was conventional theory-change where new knowledge that did not fit an established theory stimulated a change in understanding. In the cases of Tsang and Tsang and Zahra the process these authors wanted to address was the discard of practice. Becker wanted to understand which factors facilitate a change in practice – the implementation of a new IT system. The Hedberg model of unlearning has no explanatory value across these works and is unnecessary because clear alternative and less problematic concepts better frame the research, such as learning, theory-change, discard and adoption of practice and extinction. These and not 'unlearning' should be the subject for future work.

We did not find the rigour in unlearning definition and usage throughout individual works that we argued was a precondition for theory development. Lack of rigour in unlearning definition and usage was rather a characteristic of the unlearning literature and a principal reason why this literature only had the appearance of a scientific literature.

Given the lack of an empirical warrant for the Hedberg-definition of unlearning in any literature, the availability of less problematic framing concepts for the work reviewed and the lack of rigour in the scholarly development of unlearning reviewed here we see good reason to drop unlearning from scholarly discourse. This case may be a useful reminder that publication and high numbers of cites are not necessarily identical with a 'contribution to knowledge' and that while metaphor may be a source of ideas these ideas may sometimes mislead research into dead-ends.

Considered alone (and with hindsight) it seemed reasonable to classify this case as unique and aberrant in the time that passed and number of works that were written before the appearance of a critical review i.e it might be assumed that ordinarily a sceptical editor would have made much earlier use of the editor-commissioned critical review. Yet there are other cases of the reification of a metaphor in an extensive derivative literature and without empirical evidence (see the critiques of 'absorptive capacity' and 'holdup' in contracting (Lane, Koka et al. 2006)(Casadesus-Masanell and Spulber 2000; Coase 2006). It may be more often there must be a substantial body of work of perceived and perhaps rising intellectual significance before there is motivation to commission and publish critical work. We recommend more frequent editor-initiated critical reviews.

References

- Akgün, AA, JC Byrne, G Lynn and H Keskin, (2007a), 'New Product Development in Turbulent Environments: Impact of Improvisation and Unlearning on New Product Performance', *Journal of Engineering and Technology Management*, 24, p 203-230.
- Akgün, AA, G Lynn and JC Byrne, (2006), 'Antecedents and Consequences of Unlearning in New Product Development Teams', *Journal of New Product Development*, 23, p 73-88.
- Antonacopoulou, Elena P, (2009), 'Impact and Scholarship: Unlearning and Practising to Co-create Actionable Knowledge', *Management Learning*, 40, (4), p 421-450.
- Becker, K, (2005), 'Individual and Organisational Unlearning: Directions for Future Research', *International Journal of Organisational Behaviour* 9, (7), p 659-670.
- Becker, K, (2008), 'Unlearning as a Driver of Sustainable Change and Innovation: Three Australian Case Studies', *International Journal of Technology Management*, 42, (1/2), p 89-106.
- Becker, Karen, (2010), 'Facilitating Unlearning During Implementation of New Technology', *Journal of Organizational Change Management*, 23, (3), p 251-268.
- Bettis, RA and C K Prahalad, (1995), 'The Dominant Logic - Retrospective and Extension', *Strategic Management Journal*, 16, (1), p 5-14.
- Casadesus-Masanell, Ramon and Daniel F Spulber, (2000), 'The Fable of Fisher Body', *Journal of Law and Economics*, XLIII, (April), p 67-104.
- Coase, Ronald, (2006), 'The Conduct of Economics: The Example of Fisher Body and General Motors', *Journal of Economics and Management Strategy*, 15, (2), p 255-278.
- Cornelissen, Joep P, Cliff Oswick, Lars T Christensen and Nelson Phillips, (2008), 'Metaphor in Organizational Research: Context, Modalities and Implications for Research - Introduction', *Organization Studies*, 28, (1), p

7-22.

- De Holan, PM and N Phillips, (2004), 'Remembrance of Things Past? The Dynamics of Organizational Forgetting', *Management Science*, 50, (11), p 1603-1613.
- Easterby-Smith, Mark, Elena P Antonacopoulou, David Simm and Marjorie Lyles, (2004), 'Constructing Contributions to Organizational Learning: Argyris and the Next Generation', *Management Learning*, 35, (4), p 371-380.
- Feldman, MS and BT Pentland, (2003), 'Reconceptualising Organisational Routines as a Source of Flexibility and Change', *Administrative Science Quarterly*, 48, p 94-118.
- Hardt, O, K Nader and L Nadel, (2013), 'Decay Happens: The Role of Active Forgetting in Memory', *Trends in Cognitive Science*, 17, p 111-120.
- Hedberg, B (1981), 'How Organisations Learn and Unlearn', in *Handbook of Organizational Design*. PC Nystrom and WH Starbuck eds. New York, Oxford University Press: 3-27.
- Hislop, Donald, Sara Bosley, Crispin Coombs, R and Julie Holland, (2013), 'The Process of Individual Unlearning: A Neglected Topic in an Under-Researched Field', *Management Learning*, <http://mlq.sagepub.com/content/early/2013/05/22/1350507613486423>, p 1-21.
- Hounshell, D A and J K Smith (1988), '*Science and Corporate Strategy - Du Pont R&D, 1902-1980*', Cambridge, Cambridge University Press.
- Huber, G, (1991), 'Organizational Learning: The Contributing Processes and the Literatures', *Organization Science*, 2, (1), p 88 - 115.
- Klein, J I, (1989), 'Parenthetic Learning in Organizations: Toward the Unlearning of the Unlearning Model', *Journal of Management Studies*, 26, (3), p 291-308.
- Kuhn, T S (1970), '*The Structure of Scientific Revolutions*', Chicago, University of Chicago Press.

- Lane, P. J., B. R. Koka and S. Pathak, (2006), 'The Reification of Absorptive Capacity: A Critical Review and Rejuvenation of the Construct', *Academy of Management Review*, 31, (4), p 833-863.
- MacFarlane, Gwyn (1984), '*Alexander Fleming - The Man and the Myth*', London, Chatto and Windus.
- New York Times. (1995). 'Sweden Says those Russian Subs were Minks.' *New York Times* Retrieved 26 August 2013, from <http://www.nytimes.com/1995/02/12/world/sweden-says-those-russian-subs-were-minks.html>.
- Nystrom, PC and WH Starbuck, (1984), 'To Avoid Organizational Crises, Unlearn', *Organizational Dynamics*, 12, (4), p 53-65.
- Postman, L and K Stark, (1965), 'The Role of Response Set in Tests of Unlearning', *Journal of Verbal Learning and Verbal Behavior*, 4, (4), p 315-322.
- Postman, L and BJ Underwood, (1973), 'Critical Issues in Interference Theory', *Memory and Cognition*, 1, (1), p 19-40.
- Pratt, Michael G and Carole K Barnett, (1997), 'Emotions and Unlearning in Amway Recruiting Techniques: Promoting Change through 'Safe' Ambivalence', *Management Learning*, 28, (1), p 65-88.
- Shanks, DR, (2010), 'Learning: From Association to Cognition', *Annual Review of Psychology*, 6, p 273-301.
- Starbuck, WH, (1996), 'Unlearning Ineffective or Obsolete Technologies', *International Journal of Technology Management*, 11, p 725-737.
- Thagard, P. (1999), '*How Scientists Explain Disease*', Princeton, New Jersey, Princeton University Press.
- Tsang, Eric WK, (2008), 'Tranferring Knowledge to Acquisition Joint Ventures: An Organizational Unlearning Perspective', *Management Learning*, 39, (5), p 5-20.
- Tsang, EWK and SA Zahra, (2008), 'Organizational Unlearning', *Human Relations*, 61, (10), p 1435-1462.

- Tunander, Ola (2004), '*The Secret War Against Sweden: US and British Submarine Deception in the 1980s*', London Frank Cass.
- Wenzlaff, RM and DM Wegner, (2000), 'Thought Suppression', *Annual Review of Psychology*, 51, p 59-91.
- Wijnhoven, Fons, (2001), 'Acquiring Organizational Learning Norms - A Contingency Approach for Understanding Deutero Learning', *Management Learning*, 32, (2), p 181-200.
- Wixted, JT, (2004), 'The Psychology and Neuroscience of Forgetting', *Annual Review of Psychology*, 55, p 235-269.
- Wong, PSP, SO Cheung, RLY Yiu and M Hardie, (2012), 'The Unlearning Dimension of Organizational Learning in Construction Projects', *International Journal of Project Management* 30, (1), p 94-104.

Table 1. Our Search for Reviews and Empirical Papers on the Hedberg/Nystrom and Starbuck Model of Unlearning.

Title	Authors	Source Title	Year	Vol	Iss	Total Cites	Average cites/Yr	In text?
To Avoid Organizational Crises, Unlearn	Nystrom, PC; Starbuck, WH	Organizational Dynamics	1984	12	4	254	8.47	Yes
The Dominant Logic - Retrospective and Extension	Bettis, RA; Prahalad, CK	Strategic Management Journal	1995	16	1	235	12.37	No ¹
Believing is Seeing - Joint Ventures and Organizational Learning	Inkpen, AC, Crossan, MM	Journal of Management Studies	1995	32	5	117	6.16	No ¹
Remembrance of things past? The dynamics of organizational forgetting	de Holan, PM; Phillips, N	Management Science	2004	50	11	68	6.80	Yes
Unlearning the Organization	McGill, ME; Slocum, JW	Organizational Dynamics	1993	22	2	65	3.10	No ¹
Unlearning ineffective or obsolete technologies	Starbuck, WH	Int. J. of Technology Management	1996	11	7-8	44	2.44	Yes
Organizational unlearning as changes in beliefs and routines in organizations	Akgün, A.E.; Byrne, J.C.; Lynn, G.S.; Keskin, H.	J. of Org. Change Management	2007	20	6	43	6.14	Yes
Organizational learning: A socio-cognitive framework	Akgün, AE; Lynn, GS; Byrne, JC	Human Relations	2003	56	7	42	3.82	No ¹
Antecedents and consequences of unlearning in new product development teams	Akgün, AE; Lynn, GS; Byrne, JC	J. Product Innovation Management	2006	23	1	40	5.00	Yes
Strategic learning: The continuous side of discontinuous strategic change	Kuwada, K	Organization Science	1998	9	6	34	2.12	No ¹
Antecedents and consequences of team stability on new product development performance	Akgün, AE; Lynn, GS	J. Engineering and Tech. Management	2002	19	3-4	33	2.75	Yes
Learning process in new product development teams and effects on product success: A socio-cognitive perspective	Lynn, GS; Akgün, AE; Yilmaz, C	Industrial Marketing Management	2006	35	2	32	4.00	No ²
Organizational unlearning	Tsang, E.W.K.; Zahra, S.A.	Human Relations	2008	61	10	31	5.17	Yes ³
Balancing exploration and exploitation of knowledge through an unlearning context An empirical investigation in SMEs	Cegarra-Navarro, JG; E. Sanchez-Vidal, M.; Cegarra-Leiva, D.	Management Decision	2011	49	7-8	25	8.33	No ⁴
New product development in turbulent environments: Impact of improvisation and unlearning on new product performance	Akgün, A.E.; Byrne, J.C.; Lynn, G.S.; Keskin, H.	J. Engineering and Tech. Management	2007	24	3	22	3.14	Yes
Parenthetic Learning in Organizations - Towards the Unlearning of the Unlearning Model	Klein, JI	J. of Management Studies	1989	26	3	21	0.84	Yes
Knowledge transfer through technological	Carayannis, EG	Technovation	1999	19	3	19	1.27	No ⁵

hyperlearning in five industries								
Emotions and unlearning in Amway recruiting techniques - Promoting change through 'safe' ambivalence	Pratt, MG; Barnett, CK	Management Learning	1997	28	1	19	1.12	Yes
Acquiring organizational learning norms - A contingency approach for understanding deuterio learning	Wijnhoven, F	Management Learning	2001	32	2	18	1.38	Yes
Impact and Scholarship: Unlearning and Practising to Co-create Actionable Knowledge	Antonacopoulou, E.P.	Management Learning	2009	40	4	17	3.40	No ¹
Unlearning as a driver, of sustainable change and innovation: three Australian case studies	Becker, K.	Int. J. of Technology Management	2008	42	1-2	15	2.50	No ¹
Executives' orientations as indicators of crisis management policies and practices	Sheaffer, Z; Mano-Negrin, R	J. of Management Studies	2003	40	2	14	1.27	No ⁶
Historical foundations of organization learning	Mirvis, PH	J. of Org. Change Management	1996	9	1	12	0.67	No ¹
Transferring knowledge to acquisition joint ventures: An organizational unlearning perspective	Tsang, E.W.K.	Management Learning	2008	39	1	10	1.67	Yes
Self-efficacy and organizational change leadership	Pearlmutter, S	Administration in Social Work	1998	22	3	8	0.50	No ¹
The institutionalization of learning organizations	Vollmer, H	Soz. Welt-Zeitschrift	1996	47	3	7	0.39	No ¹
Learning, unlearning and internationalisation: Evidence from the pre-export phase	Casillas, J.C.; Acedo, F.J.; Barbero, J.L.	Int. J. of Information Management	2010	30	2	5	1.25	No ⁷
Facilitating unlearning during implementation of new technology	Becker, K.	J. of Org. Change Management	2010	23	3	4	1.00	Yes
Why open-mindedness needs time to explore and exploit knowledge	Gabriel Cegarra-Navarro, J.; Cepeda-Carrion, G.	Time and Society	2008	17	2-3	4	0.67	No ¹
The Effect of Absorptive Capacity on Innovativeness	Cepeda-Carrion, G.; Cegarra-Navarro, J.G; Jimenez-Jimenez, D.	British J. of Management	2012	23	1	3	1.50	
Compatibility and unlearning in knowledge transfer in mergers and acquisitions	Yildiz, H.; Fey, C.F.	Scandinavian J. of Management	2010	26	4	3	0.75	
Finding the hospital-in-the-home units' innovativeness	Cepeda-Carrion, G; Cegarra-Navarro, J.G; Leal-Millan, A.G.	Management Decision	2012	50	9	2	1.00	
Managing environmental knowledge through unlearning in Spanish hospitality companies	Cegarra-Navarro, J.G; Eldridge, S; Martinez-Martinez, A.	J. of Environmental Psychology	2010	30	2	2	0.50	
The unlearning dimension of organizational learning in construction projects	Wong, PS. P.; Cheung, SO; Yiu, RLY.; Hardie, M.	Int. J. of Project Management	2012	30	1	1	0.50	
Reflexivity, stress, and unlearning in the new product development team: the moderating effect of procedural justice	Lee, LT; Sukoco, BM	R & D Management	2011	41	4	1	0.33	

Corporate social responsibility and individual resistance	Blackman, D; Kennedy, M; Quazi, A.	Management Learning	2013	44	3	0	0.00	
Organisational unlearning, organisational flexibility and innovation capability: an empirical study of SMEs in China	Wang, X; Lu, Y; Zhao, Y; Gong, S; Li, B.	Int. J. of Technology Management	2013	61	2	0	0.00	
Environmental knowledge, unlearning, and performance in hospitality companies	Cegarra-Navarro, J.G; Martinez-Martinez, A; Ortega Gutierrez, J; Leal Rodriguez, AL.	Management Decision	2013	51	1-2	0	0.00	
Facing Turbulence: Driving Force for Construction Organizations to Regain Unlearning and Learning Traction	Wong, PSP; Lam, KY	J. of Construction Engineering and Management-ASCE	2012	138	10	0	0.00	
How an unlearning context can help managers overcome the negative effects of counter-knowledge	Cegarra-Navarro, JG; Eldridge, S; Gamo Sanchez, AL.	J. of Management and Organization	2012	18	2	0	0.00	
Improving the absorptive capacity through unlearning context: an empirical investigation in hospital-in-the-home units	Cepeda-Carrion, G; Cegarra Navarro, JG; Martinez-Caro, E.	Service Industries Journal	2012	32	9	0	0.00	
Balancing technology and physician-patient knowledge through an unlearning context	Cegarra-Navarro, JG; Cepeda-Carrion, G; Eldridge, S.	Int. J. of Information Management	2011	31	5	0	0.00	
How can managers in the hospital in the home units help to balance technology and physician-patient knowledge?	Cepeda-Carrion, G; Cegarra-Navarro, JG; Martinez-Caro, E; Eldridge, S.	Int. J. for Quality in Health Care	2011	23	5	0	0.00	
Relationships among unlearning, knowledge application, and new product development performance	Lee, I; Hsu, Y; Lin, M; James MJ; Chen, DC	African J. of Business Management	2011	5	13	0	0.00	
The effects of challenge and hindrance stressors on unlearning and NPD success: The moderating role of team conflict	Lee, LT.	African J. of Business Management	2011	5	5	0	0.00	
The Process of Individual Unlearning: A Neglected Topic in an Under-Researched Field	Hislop, D, Bosley, S, Coombs, CR, Holland, J	Management Learning	2013	-	-	0	0.00	

Table 1 was produced by the following steps;

1. A 12th September, 2013 ISI Search for sources citing to a) Hedberg B* (1981) yielded 454 articles and 72 ISI-marked reviews (526 records) and b) Nystrom and Starbuck (1984) yielded 209 articles and 43 reviews (275 records).
2. An ISI topic search on ‘unlearn’ on the 526 and 275 resultant records from step 1 located all 45 records with ‘unlearn’ as stem in title, abstract or keywords.
3. The 45 final records are presented in Table 1, rank-ordered by number of ISI citations.

We then selected articles for review on the following criteria and beginning with consideration of the highest cited articles;

1. Clear rehearsal of at least one of the elements of the Hedberg, Nystrom and Starbuck model of unlearning
2. A declared intent to provide empirical evidence of these elements of the Hedberg, Nystrom and Starbuck model of unlearning.
3. Articles must have at least 4 ISI cites

Notes to table 1

¹ No original empirical work on Hedberg/Nystrom and Starbuck’s unlearning.

² Cites to Hedberg (1981) but does not clearly rehearse that author’s definition or state similar definitions of unlearning.

³ The only ISI-categorised ‘review’ article concerned with the evidence for unlearning and organisational unlearning.

⁴ Despite meeting criteria 1-3 above, this work is not reviewed because it uses a scale adapted from Akgün, Byrne et al. (2007b), which is reviewed; ‘The measures relating to ‘the unlearning context’ consisted of fifteen items taken

from a scale designed by Cegarra and Sanchez (2008) and adapted from [(Akgün, Byrne et al. 2007b)]' (Cegarra-Navarro, Sanchez-Vidal et al. 2011, p1106). The results suffer from the same problem as Akgün, Byrne et al. (2007b): the fifteen items comprising the survey questions on the 'unlearning context' listed in the appendix are not an operationalization of the Hedberg-Nystrom and Starbuck model of unlearning; they include for example statements such as 'new situations have helped individuals change their thoughts'; 'managers recognise the value of new information, assimilate it and apply it'; 'employees are able to see the mistakes of colleagues' (Cegarra-Navarro, Sanchez-Vidal et al. 2011, p1119).

⁵ Carayannis' anecdotal empirical work uses the stem 'unlearn' 18 times but nowhere is it defined or made clear from its context what it means. Hedberg (1981) is cited once but not for his definition or work on unlearning (Carayannis 1999, p141).

⁶ Sheaffer and Mano-Negrin's empirical article uses 'unlearn' 36 times but defines unlearning as 'pertains, therefore, to drawing systematically on past lessons in the derivation of new corporate strategies and practices with the aim of discarding 'right-proven perspectives'' (Sheaffer and Maano-Negrin 2003, p581) i.e. we understood this to be a form of learning and not the Hedberg/Nystrom and Starbuck model definition.

⁷ Despite meeting criteria 1-3 above and despite 59 uses of 'unlearn' in their main text, this work is not reviewed for the same reasons given in note 4: the 'scale' used (Casillas, Acedo et al. 2010, p166) is borrowed from Cegarra-Navarro and Dewhurst (2006) and a few examples of the questions used to survey the role of the construct 'unlearning context' follow (Casillas, Acedo et al. 2010, p171): 'The company is ready to change the way it operates'; 'New forms of facing problems are taken into account'; 'Employees wish to work with

one another to solve common problems'. None of these operationalizes their rehearsed Hedberg, Nystrom and Starbuck unlearning model.