

# Error Occurrence: Successful versus Unsuccessful Unlearning in Individuals

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## Abstract

*Previously, a worker may have been able to learn a set of skills that would last during his occupational lifetime. However, the need for constant skill changes in today's environment has created difficulties for individuals who must unlearn, store and use knowledge in a new process to update the old. As knowledge grows exponentially, today's workers must keep pace with changes. Industry advancements create need for unlearning old competencies. Without changes to maintain competency, the amount of wasted time, additional energy and resources required will continue to increase at an alarming rate. To reduce these impacts, systemic change through individual unlearning is necessary. The challenge is to develop and implement new knowledge. However, the literature regarding the unlearning process and its relationship to knowledge management has not been conceptualized.*

*Confusion regarding the concept of unlearning remains a persistent problem because a clear definition at either the organizational or individual level does not exist. A recommendation for study of open problems may attempt to: 1) investigate and collect descriptive characteristics of individual unlearning; 2) develop and propose a clear definition of individual unlearning; 3) examine the collected characteristics to determine which characteristics contribute to unsuccessful individual unlearning.*

## 1. Introduction

Learning of a new knowledge base to successfully perform tasks without errors has become an important focus for organizations [1]. As knowledge grows exponentially, the ability to maintain competitive advantage becomes difficult for both organizations and individuals alike. Organizations must change rapidly to alter actions, behaviors and "mental models" within employees [2]. The challenge is to develop and implement new knowledge from individual current competencies [3].

According to [4] knowledge is created and maintained within "knowledge organizations" that

results in competitive advantage. Competitive advantage not only requires increase in knowledge but also the ability to modify knowledge. Technological advances and changes in business conditions that increase work pace in environments requires continual updating [5]

Organizations such as Hewlett Packard and Coca Cola are attempting to improve their skills in capturing and sharing knowledge. A survey of fortune 500 companies suggests only 4 out of 200 companies consider themselves "knowledge organizations", and are only beginning to realize the value of knowledge [4]. To have the ability to acquire individual knowledge and use intellectual capital are important resources needed by the organization to survive in changing conditions [6]

### 1.1. Statement of the Problem

As the amount of information within the organization increases, knowledge becomes difficult to manage. "In the global economy, knowledge is king". [7]. "In such an environment, knowledge counts for more than capital or labor. The nations that prosper will be those that create new knowledge best". [7]

The acquisition, refinement and change of basic employee competency present an ongoing problem for organizations [8], [9], [4]). Attempting to acquire and maintain current knowledge involves transmission of knowledge from the organization to the individual employee [2], [8]. Previous behavior and old knowledge is updated [12]. However, a change in the acquisition and management of knowledge is required to develop needed new competencies.

For the individual within the organization, additional processing, retention and modification of their knowledge base to correctly perform tasks is necessary. Undergoing knowledge change and developing competencies with that knowledge is an ongoing problem [9].

Implementation of this process for employees may result in added time to complete new job functions, increased errors in work product resulting in increased operating costs for the organization.

Conforming to numerous procedural changes, the processes to acquire knowledge needs further investigation [10], [13]. With individuals responsible for completing new tasks, the strategy of how to change or “unlearn” previous action and produce new knowledge competencies has been of interest.

Unlearning is defined as, the process of disuse or replacement of an action, procedure or belief in favor of a new one [14]. Understanding of unlearning is a valuable resource in acquisition of knowledge. To acquire knowledge, successful behavioral patterns are solidified into the individual’s unconscious through repetition [11]; [15]. Development of new unconscious actions becomes automatic or habituated through their consistent usage). What the impact of this unlearning change process is on knowledge management remains undefined.

## 2. Relevant Literature

With ever-increasing demands on the retention of knowledge in workplace settings, what to do with unused knowledge presents a problem for systems involving memory, retrieval and storage in the brain [16]. Klein [16] posits that storage of knowledge is a problem central to unlearning. Unlearning is considered a cognitive based process whereby old knowledge may be used or not. The retained information is triggered by the appropriate situation. Knowledge utilized depends on the need or purpose and may be association-driven.

Individual unlearning involved total removal of old knowledge [14]. This suggests that the brain actually erases unneeded information. Newstrom] posits individuals begin with a “clean slate” before adding information. [17]. Clark has discounted this thinking as faulty, suggesting knowledge cannot be added to or erased infinitely [18]. When adding knowledge continuously, the “clean slate” hypothesis would suggest the brain would be expansive enough to store and process vast amounts of data without a suggested capacity.

Hedberg [14] suggests as new knowledge is available, old information is discarded whereas, Starbuck views old knowledge as incorrect information no longer used following organizational change processes. Employees acknowledge previous behavior is now unreliable and stop using it due to this realization [15].

The underlying assumptions or frames of reference of the individual during unlearning and change may impact success of the process. The focus of attention and alterations in the type or amount of unlearning needed may also contribute [19]. When

knowledge is absorbed, it becomes part of the awareness of the individual, but not necessarily utilized

How the brain changes old unconscious behaviors, specifically in the area of retrieval and use, or storage and disuse of into new automatic behaviors may be a function of the unlearning process [18]. When a challenge to brain processes occurs, we may actually not be aware that we have stopped learning. Clark suggests that about 70% of this unconscious or automatic learning makes up all adult learning [20].

Due to the vast amount of knowledge added on a daily basis, an individual’s brain must find a way to use the information when needed. Early learning theorists assumed that the brain was the repository of information. One could learn many new skills throughout life by simply adding information. The addition of new knowledge could continue infinitely. This view suggests the brain was a simple chassis that could be added to without exceeding capacity.

The storage system may also involve retrieval according to Klein [16] however others suggest that there are specific storage strategies during the learning process involved. This would suggest that making room for new knowledge and accessing old information would be important to the concept of unlearning [21].

Brain capacity may be finite and specialized processes have developed to handle a variety of functions during knowledge change. Higher-level brain functions involved in executive function, such as decision-making, require task focus and brain energy for completion [(18), {22 de Hamel & Prahalad, [23] suggests that the process of unlearning involves replacement of information, whereas de Holan et al., [24] states that knowledge remains, but is no longer used until a situation requiring previous knowledge presents itself.

One method to circumvent these difficulties is to allow the brain to combine elements of information for ease of use. Cognitive load theory (CLT) introduced the idea that there was a complex relationship between the information and the brain’s ability to acquire knowledge within the learning environment [25]. The brain’s ability to acquire information from sensory experience and store the information into working memory is limited. The maximum number of informational units stored – seven – deteriorates within 20 seconds [25]. The brain’s processing ability challenged by the vast amount of information presented through the learning can be considerable. The change process during unlearning requires the storage and access of the new knowledge within brain process capacity and may occur differently [10].

Another method to deal with storage problems during knowledge change is automation. “Redundant information can be instrumental in speeding up knowledge creation” [7]. It is specifically through the reproduced performance that an activity can become an unconscious task for habit creation

When knowledge becomes automatic or routinized through practice, the capacity of working memory is not needed [10]. Working memory now can focus on other activity. However, automation requires consistency in repetition and specialized brain storage and retrieval systems [26]. The “storehouse” view of knowledge acquisition allowed for identification of the needed information and provision of the training and feedback needed for learning change to occur [26].

Use of a repository within the brain lends itself predominately for use with factual information, declarative knowledge or simple procedures in the introductory learner. This process does not depend on highly complex mental models of previously acquired knowledge [26].

The brain’s knowledge change system from the neuroanatomical perspective during acquisition of new knowledge has yet to be established. When the introduction of a stimulus occurs, resulting actions produce an outcome. This process allows the brain to experience and retain a model of the produced behavior. Encoded knowledge is stored as a pattern or model and retrieved from neural networks for later use [26]. How change in this model occurs has yet to be established.

Other views of the knowledge acquisition process suggest a two-stage model consisting of an early and late stage [26]. It is the late stage of the process that may concern unlearning. The late stage uses brain functions involved in long-term memory storage. This stage assists in retaining acquired knowledge without the use of higher-level executive function. This function processes specifically automatic or unconscious tasks [18], [26]. Clark summarized unlearning by stating,

- 1) Adults are largely unaware of many of the goals they are pursuing and the strategies they are using;
- 2) When change strategies fail, one of the important but largely unexamined causes is the inference caused by automated and dysfunctional cognitive behaviors we wish to change;
- and 3) we know very little about how to unlearn dysfunctional automated and unconscious knowledge to clear the way for new covert and overt behavior. [20].

Research has not determined how unconscious behaviors are processed, managed and stored for later use. Automatic behaviors may be the product of successful knowledge change [35]. If the process is disturbed in some manner, unsuccessful unlearning may result.

Clark [18] suggested unconscious replacement learning and unlearning occurs without awareness. Tasks performed on a daily basis become routine over time. This behavioral repetition within a similar context accounts of approximately 45% of daily actions “This redundancy also facilitates interaction among organizational members and makes it easier to transfer tacit knowledge among them” [7]. When unlearning is incomplete or unsuccessful, errors in actions may result. Employees who perform routine tasks can make errors as a result of a change in habit behaviors consistent with change in the unlearning process [3], [0].

Changes in these routine behaviors from organizational mandates may contribute to an increase in errors. Levels from the low-level close approximation type errors, such as the miss-writing in medical documentation to the highest level with consequences of errors even resulting in death are possible [36].

Another consequence of these errors occurs when machines are used in organizational tasks. By continued use workers develop rote actions in operating equipment. When a newer model replaces the equipment, the old rote behavior may not be accurate in operating the new machine. This change is a source of reduced work output or errors in production. It can even result in breaking the new piece of equipment due to command errors.

Consider the widespread use of computer systems in organizations. They are employed in every facet of business. Computer systems process orders, manage inventory, control banking transactions, make reservations for air travel, hotels and autos, manage the power grid and patient health as examples of the breadth of the use of systems in business operations. In practice these systems are continually upgraded with new software versions or replaced with systems to more closely support business functions. Many of the users develop unconscious or rote behavior when operating equipment. These changes require that operations staff and users continually revise their mental models and operational processes in using new versions.

Understanding knowledge acquisition techniques could prove useful to individuals. During change processes where actions are already in a state of flux, such as in organizational transformation,

understanding error production resulting from unlearning may prove useful [14].

A connection between persistent learned techniques and error incidence, especially during periods of organizational transformation, suggests the input of information and knowledge needs to be able to flow from education and training sources to the individual [35]. When the individual allows the new knowledge to be processed, comparison and awareness of the inconsistencies occur. From this point in time, the individual begins the knowledge comparison process with recognition of the gap between previous and current knowledge. This process is not clearly understood.

### 3. Need for further research

There has been limited study regarding the processes of organizational unlearning and the unlearning involved in individuals. Although information regarding organizational unlearning has contributed to innovation processes, the existing knowledge about how unlearning in individuals occurs remains limited [3], [10]. The idea that an individual should ... “eliminate preexisting knowledge or habits that would otherwise represent formidable barriers to new learning” have not been established [18]. Researchers have not utilized the correct design to characterize unlearning according to Clark. [18]. Disagreement within current literature about unlearning in individuals has not been well defined especially in knowledge management of tasks involving unconscious or automatic actions [3], [10],[11],[12].

There is a gap in the existing knowledge about how unlearning in individuals occurs. Whether unlearning has undesired consequences has not been a focus of current study. Examination of open study issues should include: 1) investigation of individual unlearning to determine descriptive characteristics occurring during the process of unlearning; 2) the development and proposal of a definition of individual unlearning; and 3) examine the collected characteristics of successful and unsuccessful unlearning to determine whether patterns exist to add to the knowledge regarding unlearning.

The inherent complexities of unlearning are presently not well understood, supporting the importance of further research in this area [28]. Researchers are unable to agree on a definition of unlearning; no specific definition has been accepted [8], [29]. Alternatives exist that may explain the process of unlearning, however none have gained researchers' acceptance. It is upon this limited

agreement, the existing framework of learning - unlearning is built. It remains difficult to build new theories and understanding about processes based upon inconsistencies.

To answer this issue, qualitative research designs such as case study or grounded theory methodology could provide empirical evidence of perceptions and characteristics and perceptions of the unlearning process [30], [31].

Consequences of unsuccessful unlearning also remain a persistent problem because study in this area has been limited. With additional knowledge about successful and unsuccessful unlearning, organizations will benefit by maintaining the competencies can be achieved.

Characteristics, concepts, the situational context and types of knowledge involved in individual unlearning still need further investigation [32]. With the successful unlearning process in individuals defined, organizations may have the ability to acquire knowledge needed for improvement. To provide answers to this problem, a quantitative study will describe, categorize and measure the phenomenological characteristics of unlearning [33]. With additional information about unsuccessful unlearning, individuals may be able to avoid errors when learning new actions. Problems such as lost productivity and re-work due to errors may be avoided (Starbuck, 1984). With greater understanding of unlearning, new methods of knowledge acquisition developing effective employee competencies can be implemented. Individuals using successful unlearning methods will possess the ability to acquire knowledge needed during change for productivity their job role.

Although these organizational problems are currently identified, there have not substantial, empirical studies to examine unsuccessful unlearning processes specifically in individuals [11]. In addition, the link between unsuccessful individual unlearning and error behavior may be established through quantitative methodology [33].

The scope of the proposed study would assist in the formulation and development of a definition of unlearning in individuals, exploration of the variety of characteristics of individuals during the unlearning process, and unlearning factors that produce errors [34].

As organizations begin to increase understanding of the process of effective unlearning, strategies and support to develop effective skill competencies may be implemented [1]. By understanding the conceptualization of unlearning, organizations may be able to reduce re-work, errors and costs. Factors producing errors and unsuccessful unlearning may also

give organizations strategies for use to develop their employees.

An additional benefit can be improving training in systems and equipment. Understanding of the mechanisms of the learning-unlearning process can be used to make training programs and manuals more efficient. Learning new processes can be improved by matching training materials to the individual's knowledge acquisition systems.

#### Summary

Changing knowledge requires organizations to modify existing knowledge in favor of new skills and competency for the organization and its workers. Competitive advantage is sought by organizations and involves rapid knowledge acquisition [4] Organizations must revise current knowledge, skills and competencies during organizational change. This requires the process of unlearning. Unlearning is the process of disuse or replacement of an action, procedure or belief in favor of a new one [14]. Current knowledge changes by this process to a new knowledge [2] Characteristics, concepts, context involved in individual unlearning still need further investigation [32].

No specific definition has been accepted; researchers remain without agreement on a definition of unlearning [8], [29]. The inherent complexities of unlearning are presently not well understood, making this topic worthy of further study. A proposed study will attempt to address: 1) individual unlearning characteristics; 2) the development and proposal of a definition of individual unlearning; and 3) determine how unlearning contributes to error production.

The benefits of unlearning are in training and education for employees and organizations. This understanding should produce reduced errors during periods of change. Studying unlearning will allow users to adapt more quickly to changing systems and organizational processes..

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