Haziq's Paradox - The hidden genius

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Abstract

In this paper I will discuss a paradox in problems in learning, a group of students who have all the making of a genius but are unfortunately labeled as poor learners as a result of their missing the crucial memory retention power. I call it a paradox because such students are able to learn extremely difficult and new concepts quickly and with relative ease as compared to others. Even during the short span of learning a new concept they are able to delve deep into its insights and form an elaborate concept map, much more concrete and in depth than a normal learner. However, over a relatively short time span, ranging from less than a week, they completely find themselves unable to retrieve the map from memory. Therefore, when faced with an assessment that has a stringy time constraint, as is common in most undergraduate course assessments, they perform poorly. However, where the causes for this diminished retention ability forms the basis for another discussion, what is extremely interesting is that when faced with an assessment where time constraint is not a major concern, these people are interestingly able to recreate their concept maps. Notice the emphasis on recreate instead of retrieve. Studying the organization of the knowledge base in such people renders a fascinating result. These people being aware of their limitation maintain a separate long term knowledge base. What is interesting is that the layout of this knowledge base is extremely similar to that of experts, their knowledge is centered around core ideas and concepts and is extremely conditionalized. What is even more interesting is that during learning of a new concept and forming a concept map, these people, at the same time, keep adding extremely select information, the "gist" of a concept, to this separate knowledge base, and contextually conditionalize it for later facilitation of recreation. In this paper we will seek to identify the schemas and scripts these people have adopted to expedite learning and recreation. At the same time we will seek to propose methods of teaching that may aid such people. We will also discuss why identification of such people is necessary and why and how better assessment methods are required for such people.

Introduction

Memory retention is a gift that is taken by most of us for granted. The vital role it plays in our ability to learn is therefore, underestimated. The fact that is inadvertently often overlooked is that following knowledge creation, as humans our ability to retrieve information and traverse and link concept maps is dependant upon our ability to previously store these created knowledge maps. Our capacity to meaningfully learn and extend learning, it can then be argued, shows considerable dependency on our ability to retain in and retrieve from memory. In fact, in most cases we can only proceed as far as we can remember or in simpler terms we can only proceed once the relevant prior or basic knowledge maps, previously stored, are retrieved. Note the emphasis on previously stored. Our research has led us to believe that there those among us who strongly lack this capacity to store durable information. The reasons for this diminished capacity, unfortunately, form the basis for another entire paper, but briefly stated they stem from a myriad of psychological, social, hereditary and other realms, even quite often an intertwining of these fields.

Coming back to this special case with diminished memory storage and retrieval capacities, we are in particular fascinated by a subset of these people. The people in this subset exhibit a unique and sparkling pattern of learning and for someone interested in identifying and suggesting solutions to problems in learning it is truly an exciting endeavor to study their knowledge creation, storage, traversal and retrieval schemas, and how they have adapted and tried to overcome their shortcoming and the challenges they face in traditional academic institutions and assessment due to the non realization of this fact by those imparting education.

The title of this paper is Haziq's Paradox. The reason for the use of the word paradox is the underlying fact that the

subset we are studying puts to test the very meaning of the word genius. As we discussed in our opening paragraph, memory storage and retrieval are core processes in meaningful learning. The question we might ask is that how then, can we classify someone underprivileged in this regard as a good learner let alone a genius. However, on the other hand, we take into consideration someone, who, when faced with an entirely new concept, over the short span of learning the concept or during the knowledge creation phase, is able to build an extremely detailed and elaborate concept map, quickly and effortlessly branching the links in this map to a much greater depth and breadth, all the while able to infer insights only visible to experts of that concept or to more knowledgeable and experienced persons in the particular field, by traversing this newly created concept map to much more iterative levels than is the normal case, and all this during the short span of knowledge creation of a new concept. One would undoubtedly be tempted to label such a person as a genius. Interestingly though, and this is where the paradox arises, is that we have come across people who when taught a new concept exhibit the latter behavior, however, when after a period of time, they are asked trivial questions about the same concept, they are unable to answer correctly in a timely fashion. Puzzling isn't it? Note my insistence on adding "timely fashion" here, as I'll come back to this in a bit.

Like I indicated in the beginning, this is undoubtedly a gem in problems in learning. However, as we delve deeper into this mystery, we cannot help but make another extremely interesting observation. When given more than ample time, these people are able to not only answer the same trivial questions they were unable to answer previously in a "timely fashion", but also show remnants of their prior deep understanding, and with little or no hints or pointers they begin to again show an intuitive feel of the concept. However, this time their knowledge map lacks the prior depth and elaboration. Furthermore, when a simple primer or refresher of the concept is repeated their insight and the depth in the concept map return. And this happens recursively. Now you may well be asking the question, "Well isn't that what happens to all of us?" If I had been content with agreeing to this question statement I would have undoubtedly skipped the observations that led to the crucial discovery of this paradox. Truly, a layman's intuition may be tempted to simply accept the last argument at face value. The astute observation made here however, is that in fact this is not the same behavior exhibited in a normal everyday learner. The normal learner understands a concept, submits all or parts of it to memory, and is able to retrieve these concepts. He normally would not have an extremely elaborate concept map and extraordinary memory retention and retrieval and some degradation in the map may occur over a significantly long time. An expert on the other hand has a much more elaborate map accompanied by relatively effortless memory retrieval. This provided the starting point for my research and my refusal to accept the "happens to all of us argument". Two of my prior observations edged me to further research. Firstly, the subset under study tends to create concept maps remarkably similar to that of experts, instead of normal learners. Secondly, there was an enormous difference in time for the degradation of the normal learner's map and that of the subset under study. Coming back to the normal learner and the expert, the process taking place in both cases is knowledge creation, storage and retrieval. However, and this is the crucial point I observed, this is not the case in the subset I came across. In their case, knowledge creation does take place, but then the diminished memory storage capability disallows adequate durable retention. When the same concept is required after a relatively short time period the immediate retrieval returns an almost null value. The person exhibits a complete lack of comprehension of the consistencies and even the overall general understanding of the concept. At this point, upon the person's inability to answer a trivial question, even if he is provided with the solution he is unable to comprehend it. Similarly, if he is asked the meaning of the simple names and terminologies of the concept he is seen to respond blankly, as if they hold no meaning for him. In contrast, after an generous time interval to think, the person is able to give an intuitively correct description of the concept and its consistencies. However, he still is unable to give correct terminologies. Well the question then becomes, "if retrieval is occurring then why are the terminologies completely missing, and if retrieval is not occurring then how did the intuitive feeling come about again? Is it partial retrieval from a degenerated concept map? Or maybe something else?" My research actually proved something remarkable: the actual process taking place in this subset is not retrieval but recreation. Now this concept and the following results I am next going to discuss may prove to be difficult to digest at first. However, I will first provide you with my conclusions and then guide you through a case studies in support of this conclusion for you to better understand the processes of creation, storage and recreation in this subset and I implore you to bear with me patiently just for a little while longer.

The interesting conclusion that I drew after my studies is that most of these people are in fact aware of their limitation. After studying their knowledge bases, the organization of their knowledge shows an amazing and wonderfully unique layout. The remedial measure they have adopted, perhaps even unconsciously sometimes, is that they maintain a separate unique long term knowledge base. This second knowledge base is quite different from a regular knowledge base. The layout of this knowledge base is, in a weird way, remarkably similar, even though in a limited sense, to that of experts as in the knowledge is extremely conditionalized to facilitate lucid retrieval and is centered around core ideas and concepts. However, it is also quite different from the knowledge base in experts. The core ideas the knowledge is centered around are abstract in the sense the terminologies and labels are omitted instead the gist or intuitive feeling of the concept is stored. Similarly the maps are seen to omit terminologies and rather are seen to contain conditionalized triggers arranged in patterns that are seen to lead to discovery instead of retrieval. During the learning of a new concept, the knowledge creation phase would imply the creation of a new concept map. Where these people do create a concept map like everyone else, although a bit more elaborate as we previously discussed, the really amazing fact is that at the same time, they keep adding select information to the separate knowledge base, the gist as we said, of the concept and create and add extremely contextually conditionalized triggers to expedite later recreation. A crude, perhaps even over simplified analogy would be that of a person stuck with living the same day over and over again, unable to both remember the events of the previous day or to leave himself adequate complete information of what is going on, however, since he is aware of the fact that the day repeated everyday, knowing his own thinking process he leaves himself little clues to eventually come to the right conclusion and reasoning.

I will discuss how to shortlist the subset under consideration towards the end of the paper. However, after short listing these candidates we are able to conduct several experiments in which we can observe these people in their everyday academic life, the results of which can later affirm or deny if they truly do exhibit Haziq's Paradox. These experiments firstly consist of us first drawing the concept maps just after their learning of a relatively hard concept. Next, after relatively short time periods (according to normal memory degradation standards) which normally vary between two three weeks to three four months or more, we inquire their understanding of the same concepts. At first we ask trivial questions given a normal or even relatively stringy time constraint. Our relevant subset is unable to provide satisfactory answers to even these trivial questions. We then allow them to take as much time as they require while asking them to use a think aloud protocol which helps us build the concept map residing in their separate knowledge base and also allows us to draw the eventually recreated concept map. And we repeat these experiments till we are adequately convinced that our findings are affirming a true case of Haziq's Paradox. To help you better understand this process I would like to present you with a few observations we made and experiments we conducted while following one of the person we short listed. Hopefully by going through the following you yourself will be able to see the evidence in favor of Haziq's Paradox in this person.

Case study

The person under discussion is an undergraduate computer science major. An astutely observant person would perhaps realize during the course of ordinary conversation that he was a very intelligent student. However, his performance in university was in contradiction with this claim. Upon conducting several experiments and reviewing his performance over a period of time, we realized he was a classic member of our subset.

Experiment 1

In one of my experiments, the student had to build a software system as his course project in "Software Engineering". This student had previously not taken a networking course and was unaware of the theory let alone the programmatic semantics of networking. In under a week he was able to construct a fully functional non graphical Instant Messenger similar to MSN Messenger and Yahoo! Messenger with a central directory, which shows he was able to learn quickly and to a much greater depth than the average student. At this point, after interviewing him I was able to draw the concept map shown in figure 1.1. However, just after about a month, when I asked the student a trivial question, "what are sockets?" he responded with a blank face at first. Similarly, when asked how to program sockets or read or write from a central directory he was unable to respond. When asked to name a few classes his client-server/hybrid

system was using or even their functions he was clueless. However, after this so called rapid fire question session a normal person should have been able to answer quickly, I asked him to try to take his time and answer my questions using a think aloud protocol. What I observed was that he started off at with client and server, the core ideas in his long term map, and some of the triggers he followed were registry, conversation, friends, that led him to gradually and eventually derive conclusion such as the need for some file readers and writers and authentication functions, and registry would mean passwords and another registry for friends and friends would lead to conversations and some form of maintaining P2P connection arrays and so going on forth he was able to come remarkably close to what the classes and functions his actual implementation accomplished, even though he still could not recall their names. Contrast this with a normal case, a student or a person builds a relatively complex software system all by himself he is sure to know after just a month what drives the system and what the requirements were and at least the names if not the implementation of the modules or classes he used. It would be a simple case of memory retrieval. However, this student is unable to retrieve even the terminologies let alone the implementation. Even at the conclusion of this experiment he is unable to recall the names of his classes, although he has traversed his triggers and discovered similar requirements and thought of similar functions, which indicates clearly a creation rather than retrieval. Benefiting from the data from the think aloud protocol, I was able to draw the concept map residing in the separate knowledge base and the recreated knowledge map, shown in figure 1.2 and 1.3 respectively. Notice how elaborate the map in figure 1.1 is and how compact the map in 1.2 is and recall how we said in the beginning that someone exhibiting Haziq's Paradox keeps adding select information and conditionalized triggers to the map in the separate knowledge base, and that's all that figure 1.2 contains, select information and triggers which end up making this unique map extremely compact and probably reduces the load on memory storage considerably. Even more interestingly, note the lack of the terminologies in the newly created concept map, which coupled with the data of the think aloud protocol, clearly demonstrate the creation of a new map rather than the retrieval.

Figure 1.1

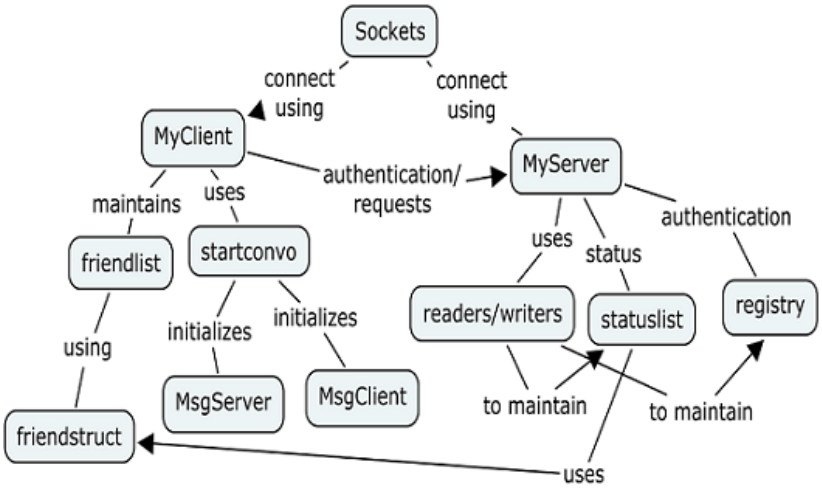


Figure 1.2

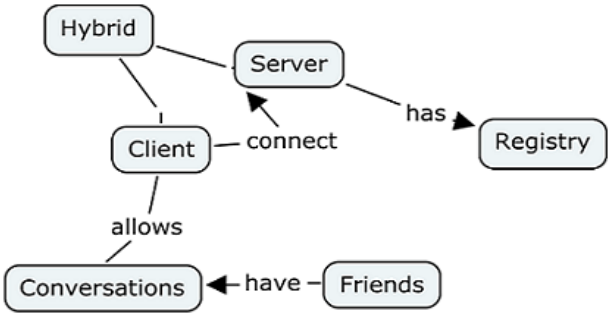
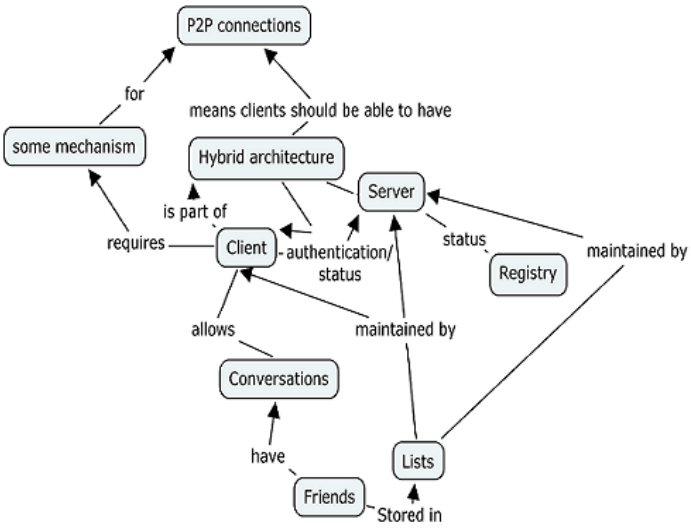


Figure 1.3



Experiment 2

My next experiment started when the student had to give a presentation on a research paper. He was the "devils advocate", someone who points out the flaws or gives the "other side of the picture" while disagreeing with or pointing out the shortcomings or overlooked points in a research paper. The presentation was a considerable portion of the grade, and his fellow undergraduate students were having considerable difficulty giving presentations on research papers written mostly by PhDs and experts with much more in depth knowledge about their fields. Besides the student, there were his two group mates, the presenter who is someone who gives the summary of the paper and the advocate who has to support the paper's arguments. The paper they had been assigned was perhaps one of the most cited papers in computer science "Disconnected Operation in the Coda File System". My interesting observation here was that the student actually read the paper for the first time about two three hours before the presentation, and was able to find the points at which he disagreed with the author or the shortcomings of the system, and he jotted down small points in his presentation of a small number of pages and went on to give an extremely impressive presentation singled out and applauded by the instructor. At this point after listening to his presentation I drew the concept map in figure 2.1. Like I pointed out, the devils advocate is no easy position since one not only has to understand the paper but also go in depth and find the missing links to disagree with the much qualified author. The student showed a remarkable understanding of the Coda File System in this case. However, when just a month later, upon my follow up questioning I found he had no memory of the exact working of the system and terms he used. I then asked him to think aloud and realized that he still had a rough idea of the intuitive feel of the system, but he had to start at the beginning and follow his clues, his triggers to actually remember what the system was about. More interestingly though, at the same time, the people who were present at and had listened to his presentation previously now showed much more understanding of the same concepts they learnt from his presentation and were even able to recall the terminologies used such a server replication and replica control, that the student himself could not recall. In the end we drew the two concept maps, the newly created (figure 2.3) and the one from the separate knowledge base (figure 2.2). Again, notice the difference in size of map in 2.1 and 2.2 and the lack of terminologies in the map in figure 2.3. Also note that during recreation a whole branch that was perhaps not so easy to intuitively recreate using the limited triggers, is missing.

Figure 2.1

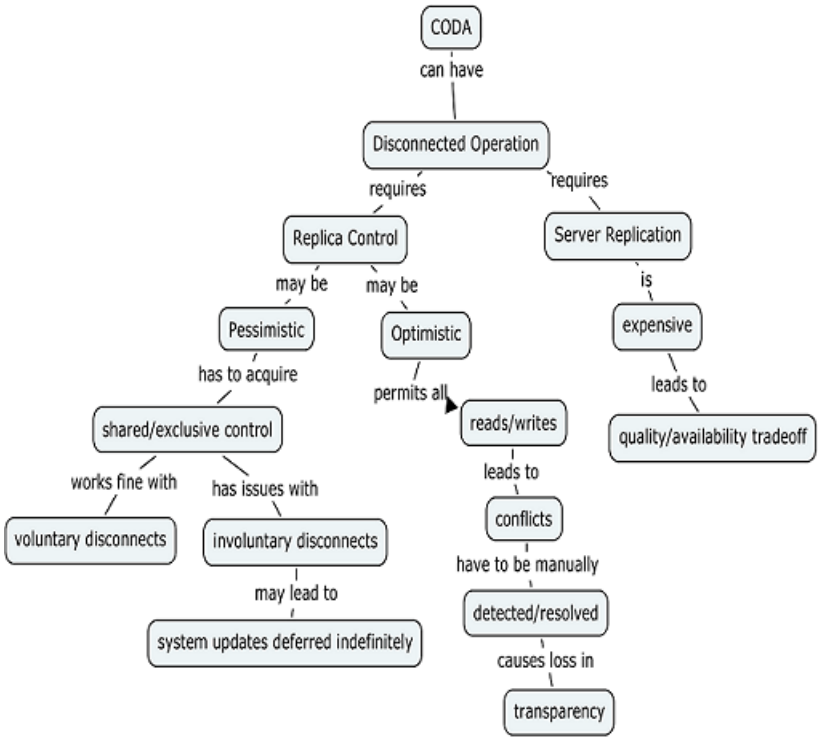


Figure 2.2

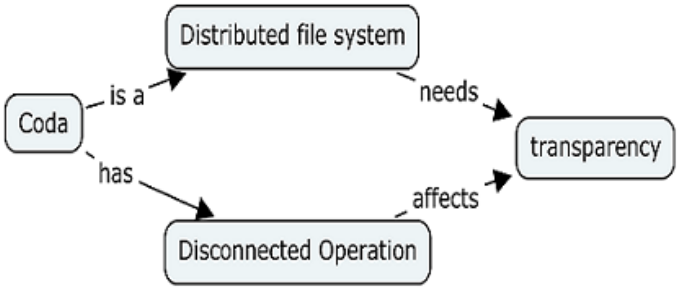
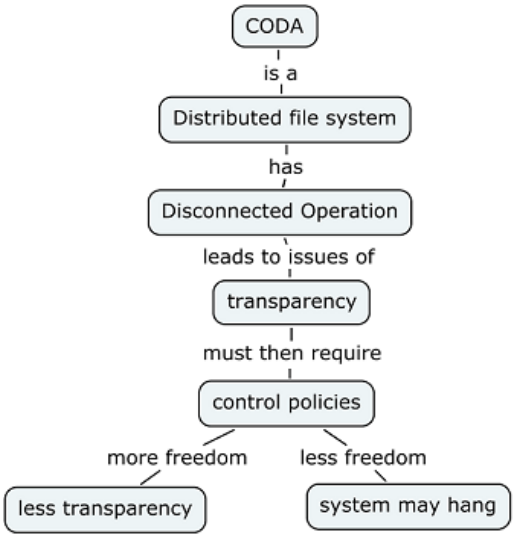


Figure 2.3



Experiment 3

In our third experiment, the student was given a lecture in the theory of relativity. He had no prior knowledge in this field. However, I observed that he showed remarkable depth in his understanding the concepts which most students on average find difficult to digest in just one lecture. However, the behavior I observed in this case was again consistent with the pattern in the prior two experiments. Unfortunately, I will not provide much details of this experiment since relativity is not a topic to be taken lightly and I fear it may end up confusing most of the readers not versed in the field.

Importance of identification

In general, while dealing with the students (and for the rest of the paper I would be discussing the student population of this subset only) in our subset of Haziq's Paradox, they are unable to recall the course content taught in a previous quarter, a quarter usually consisting of three months, during their stay in university. However, they are able to recreate some of it. I must now emphasize why the identification of such students is necessary. One question that may come to mind is "well they are unable to retain in memory, isn't the problem psychological and identifying the causes and the psychological treatment is the solution instead of training our teachers to identify and accommodate and help them?" I said in the beginning that the causes for the diminished memory retention form a basis for another paper. Unfortunately, to answer this question I must delve a little into the reasons for poor memory retention and point out some observations of my research. Due to the issue of confidentiality I would not be able to perhaps go into detailed causes but I will give you a general pattern that I noticed. Like I said previously, diminished memory retrieval has a myriad of causes spread over different realms including but not limited to psychological and social. The pattern I noticed while studying undergraduate students is that almost all of the students displaying Haziq's Paradox suffered from, how to put it delicately, some psychological "traumas" for lack of a better terms. Most of them seem to be coming from broken homes and families and in some cases, in their own words the only way to "hold on to rationality" was, or in some cases still is, to start each day afresh and wipe out everything prior. However, the encouraging observation we made is that most of these students seem to be fighters not quitters. They see university as their way out, as a route to eventual self sufficiency and independence, a break for the vicious cycle and in the end, inevitably the ability to start over again. Unfortunately, however, even though they may eventually succeed in this goal if they survive university, some of these students are unable to get the proper help or counseling they need at this moment either due to their inability to be independent or their inability to change their current social or family set up or because of innumerable other causes. In any case, the end result is that they are unable to fix their memory related problems at this point in their life. A little while back I said they may eventually succeed in their goal if they survive university. I mentioned this specifically because the very nature of this paradox causes them to struggle in the assessment of most universities. Their grades and performance as measured by traditional assessment seems to be poor, and therefore they are labeled as poor learners, even though this is in reality a horrid depiction of their true intelligence. The responsibility then falls on us, as teachers, or as compassionate human beings, to identify these students and help them by introducing different assessment methods for them or perhaps just by simply relaxing the stringy time constraints. One way that makes it easy to pick them out from the crowd during a class, that I heavily used to find my subjects, is by sometimes stimulating discovery and encouraging discussions during the lecture and making the class interactive when teaching a new concept. It is found that these students are usually the ones that are able to significantly contribute to stimulating class discussions where they are in fact not taught but asked to discover a new concept. This is perhaps due to their regular practice of knowledge creation, provided a few consistencies or sequential hints they are much more efficient in coming to relevant conclusions. One example I would like to give is of a professor at Lahore University of Management Sciences, Pakistan, Dr Ashraf Iqbal, who while teaching algorithms to computer science students insists on making the students discover algorithms in the class by stimulating interesting discussions among the students themselves, instead of simply providing them with the algorithms and their explanations. In my study I noted that students who eventually formed our study subset for Haziq's Paradox were much more responsive and quicker at finding algorithms and their discussions were quite spirited. Given knowledge of these students, and we already know that the required subset performs poorly when assessed with normal time constraints, the teacher can then find the overlapping population. I said previously that the responsibility for identifying these students falls on us

as teachers and human beings, however even if for some reason that is not sufficient cause for someone then I would say that the responsibility falls on us perhaps, just as mere academics, to identify these students and help them, for how many people do you know that can provide relevant challenging arguments to Einstein's ideas and theories after a single relativity lecture or build Instant Messengers from scratch in a couple of days without any prior knowledge. It would be a shame indeed, if the next Einstein was lost just because we were unable to properly understand this paradox, makes you wonder how many we already have.