Is Total Recall Possible?

In the 1990 award-winning movie "*Total Recall*," starring Arnold Schwarzenegger, the story line suggests that memory can be *injected*.

Until memory can be conveniently administered via a syringe, acquiring knowledge to the point of total recall is **easily possible** using TRL's **artificial intelligence** learning algorithm.

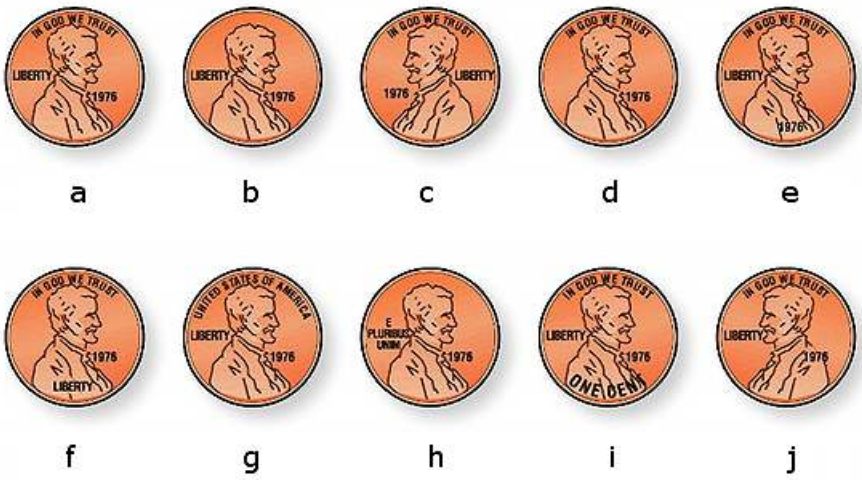
The TRL approach truly allows learners to comprehend and grasp knowledge, and to store the learned information in **long-term memory**…for good.

Learning…and Forgetting

To **recall** means to **reproduce** facts or information. However, this statement assumes that the information has been <u>learned</u> at some time in the past.

In many cases we "*forget*" because a memory was never formed in the first place. We must ask ourselves, "*Have I been storing the information in the first place*?"

Even though you may have handled a penny thousands of times, can you identify the correct penny?



Unless you collect coins, or work at a mint, chances are that you have never stored this information and will not be able to "*recall*" the correct penny. Try it for yourself!

Pennies "g" and "j" were popular answers among students. The correct answer is in your pocket! Adapted from a study conducted by Nickerson & Adams, 1979.

Learning…and Forgetting *(Continued)*

Did you identify the correct penny on the previous page? If you did, you are one of the few who can. The reason why most people do not "*recall*" the correct penny, is that the information has never been encoded in the brain. Students of Psychology identify this phenomenon by the term "**encoding failure**."

Another reason why we forget is referred to as "**decay**." Memory traces (changes in nerve cells or brain activity) fade, weaken, or decay, over time. Information stored in short-term memory seems to initially start a brief flurry of activity in the brain that **quickly dies out**.

(Shiffrin & Cook, 1978)

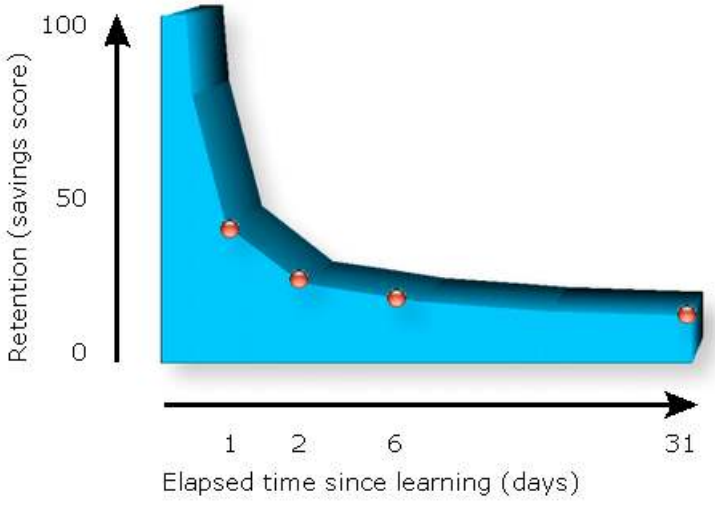
Therefore, short-term memory operates like a "**leaky bucket**." New information constantly pours in, but it rapidly fades away.

So…How Much do We Forget?

The goal of all training is **performance improvement**, with the **assumption** that learning occurs. Yet, regardless of how training is delivered, the natural process of forgetting is completely **ignored** by trainers.

The German psychologist Dr. Hermann Ebbinghaus (1909) proved that:

- **50%** of studied material is forgotten in <u>one hour</u>.
- **65%** of studied material is forgotten in <u>one day</u>.
- **80%** of studied material is forgotten within <u>one month</u>.



Even though the research by Dr. Ebbinghaus was done many years ago, these findings remain valid today because of the great care Ebbinghaus took in his work.

The "*Curve of Forgetting*" by Ebbinghaus has been **quietly** accepted as the status quo. **Which 80% of training is OK to forget**? There must be a better way!

A Real-World Example

Mike has learned in Psychology class about *memory*, *encoding failure*, and *decay*. He also studied the "*Curve of Forgetting*" by Dr. Herman Ebbinghaus.

Mike also takes a Spanish class. Armed with his new insights on how the human brain works, Mike diligently prepares flashcards for 100 Spanish vocabulary words and learns the words just prior to taking his test.

Mike gets an "**A**" on his test.

But…how well will Mike do in four weeks when he takes his mid-term exam? **Very poorly**! After just four weeks, Mike will only remember **20** out of the **100** vocabulary words he had learned.

Mike, like most other students, has now lost the gateway skills (the foundation) to function well in the class he is taking.

If Mike was not a student, but an employee in your business, or if Mike is training to be a nurse, a soldier, or a firefighter, **which 80%** of the training he received **is OK to forget**?

There is a Better Way!

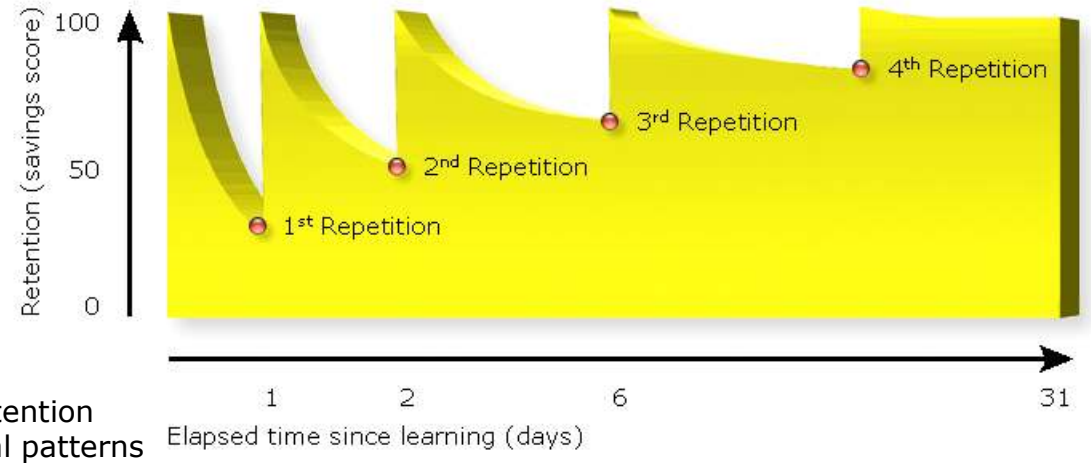
Yes, there is a better way! The TRL pedagogy is based upon the research conducted by Dr. Hermann Ebbinghaus.

Through time-phased and systematically sequenced repetition, the artificial intelligence software counteracts the phenomena outlined in Ebbinghaus' "*Curve of Forgetting*." The TRL database keeps track of **every single student response** and **interaction**, and **customizes** the learning sequence to **each individual user** at <u>every instance</u> the user responds to a question.

Artificial Intelligence

TRL's intelligent software literally "***learns***" what each individual user ***forgets*** (that is why it is called *artificial intelligence*…as the software actually "*learns*"). Therefore, the software automatically guides a user to achieve permanent, measurable recall rates in **excess of 90%**. This is an **increase of 350%** over traditional learning. Yes, you read this correctly! An increase of recall in excess of 350%.

Based on this analysis of student outcomes, the TRL training method would have a similarly dramatic effect on knowledge retention and behavioral patterns in an educational environment with students undergoing K-16 education, or any other type of education (corporate trainees, medical professions, armed forces, firefighters, etc.).



Which **80%** of learned material is **OK** to forget?

Bloom's Taxonomy of Learning

In addition to the Curve of Forgetting, the TRL learning system also supports **Bloom's Taxonomy of Learning**. Bloom's taxonomy delineates six distinct levels of knowledge acquisition within the cognitive domain, and identifies the attributes associated with each of the learning levels referenced.

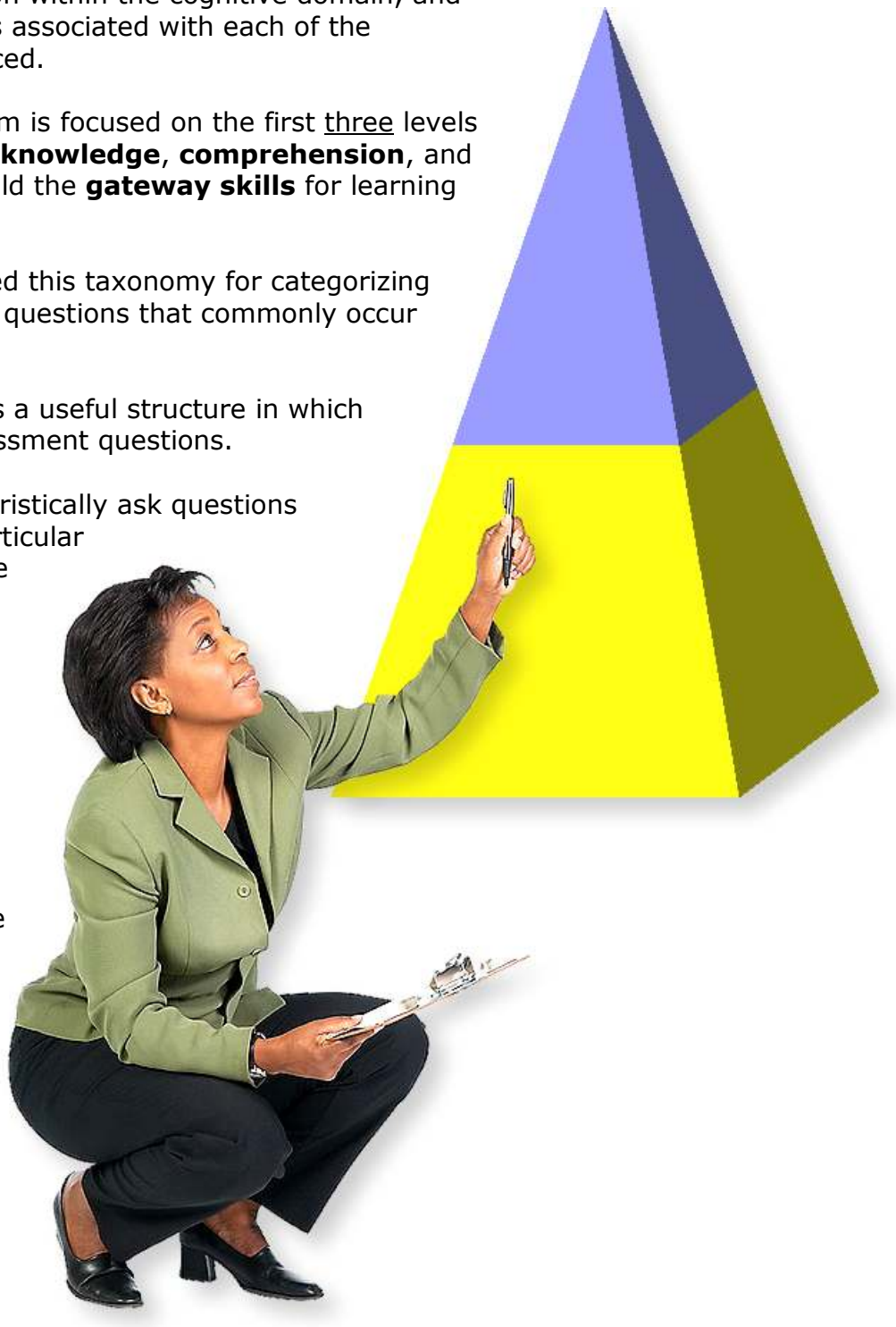
The TRL learning system is focused on the first <u>three</u> levels of Bloom's Taxonomy: **knowledge**, **comprehension**, and **application**, which build the **gateway skills** for learning any subject.

Benjamin Bloom created this taxonomy for categorizing levels of abstraction of questions that commonly occur in educational settings.

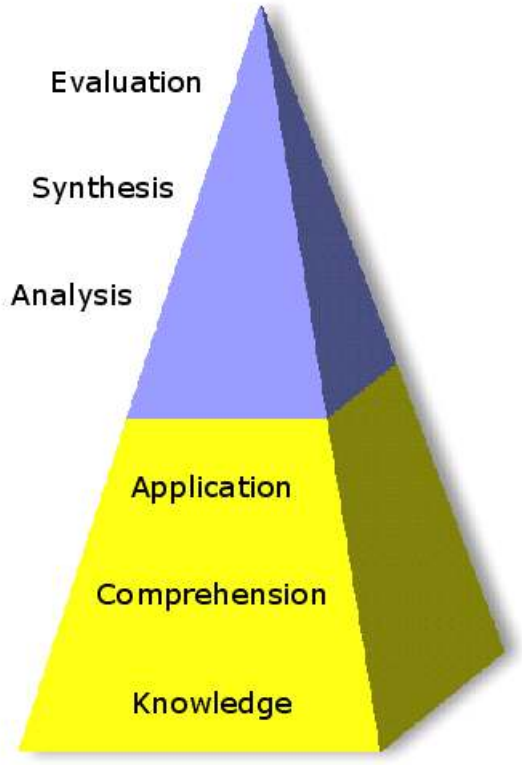
The taxonomy provides a useful structure in which to categorize test assessment questions.

Educators will characteristically ask questions associated with the particular levels delineated by the taxonomy.

If the levels of questions that appear on exams are **linked** to the appropriate segments of Bloom's Taxonomy, the teacher will be able to **apply** learning plans using appropriate strategies to achieve the desired results.



Bloom's Taxonomy…Explained



Evaluation is the highest level in Bloom's Taxonomy and involves reviewing evidence, facts, and ideas, then making appropriate judgments.

Synthesis involves putting together ideas and knowledge in a new way. This is where innovations truly take place.

Analysis means breaking apart information and ideas into their component parts: dissect the subject matter, explain how the parts fit together, find gaps in your understanding, and seek additional information.

Application means using what you know in a concrete (real life) situation. This is the third stage TRL addresses.

Comprehension means understanding the basic information so that it can be summarized and explained. This is the second stage TRL addresses.

Knowledge (**recall**) is the foundation of all learning. Knowledge provides the gateway skills and the basis for all higher levels of thinking. Acquisition of knowledge is rote in nature. Knowledge means the ability to **recall** bits of information, terminologies, techniques, and specific usage. This is the first stage TRL addresses.

Higher Order Skills

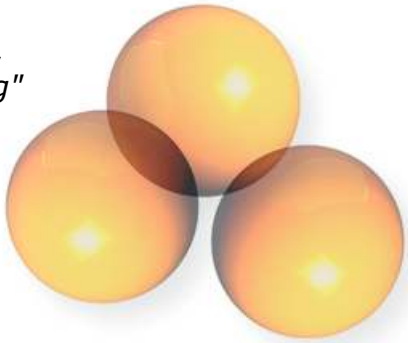
Lower Order Skills *(the focus of Total Recall Learning)*

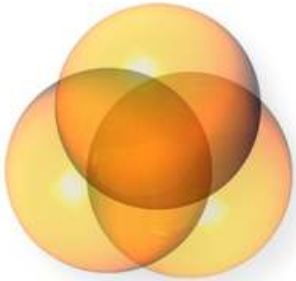
Adapted from: Bloom, B.S. (Ed.) (1956) Taxonomy of educational objectives: The classification of educational goals: Handbook I, cognitive domain. New York ; Toronto: Longmans, Green.

Team Synthesis

Working successfully in a team is only possible when all team members **share knowledge** about a specific subject. The environment may be in an educational institution, a corporation, or in mission-critical settings such as a hospital or the armed forces. Since Ebbinghaus proved that the outcome of traditional learning **barely** reaches **20%** of recall of the learned information, team "synthesis" may be difficult to achieve without TRL.

A typical case is when trainees have taken the same class, and have initially achieved good grades (*due to "cramming" right before the test*). However, since every person remembers **different parts** of the material, the **20%** of **retained knowledge** may have little or no overlap with other trainees' retained knowledge.





With TRL intervention, even after partial study with TRL, synthesis becomes quickly apparent. The retained knowledge starts to **overlap more** and **more** as each trainee comes closer to the program's total recall level.

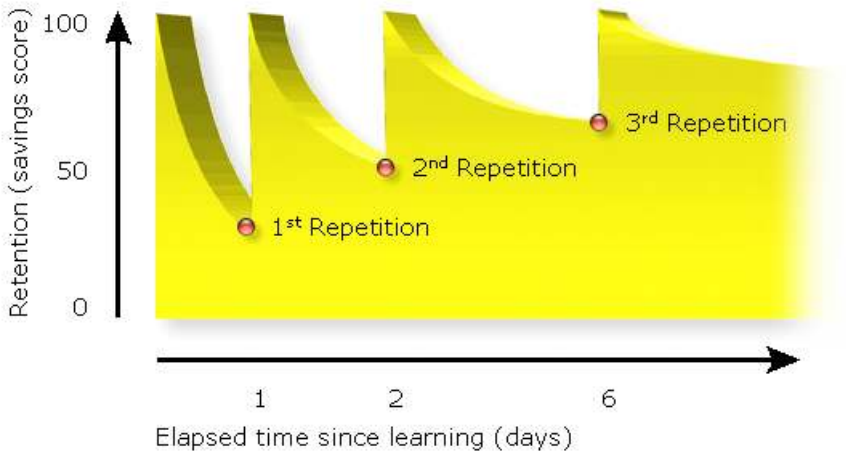
In mission-critical environments, nothing less than complete team synthesis will suffice. Since training with TRL achieves **knowledge retention** in excess of **90%** if the material is taken to the total recall level, all team members recall the **same knowledge** base.

The picture shows a P-3C aircraft, which was a graphic used in the TRL training course for VP-30 (Department of the Navy), entitled "Introduction to the P-3C Aircraft." This course contains mission-critical content material.

How TRL Works

TRL courses contain the **essential knowledge building blocks** and **key terms** for a specific subject area. A typical course may contain 400 questions, resulting in a total study time of approximately 6 to 10 hours.

The AI algorithm continually monitors the learner's retention of the material at precise intervals to eliminate forgetting.



Material to be learned is advanced through a **multi-level** learning process using staggered, time-delayed control repetitions. The intelligent software *learns* what the user forgets, and **customizes** the learning sequence to each user. Forgotten material is systematically repeated (without superfluous repetitions) until the material is fully learned. A representative implementation is shown below.

Day 1: User goes through most of the course material (1 to 2 hours). Unknown material is automatically re-presented until mastered once. At this point, a **traditional learning** approach **stops**, completely ignoring the natural process of forgetting!

Day 2: User **forgot 65%** of learned material from the first day. TRL now systematically extracts the **35%** of **remembered** material for each individual user and advances it in the learning process. **Forgotten** material is re-presented until mastered. Any previously unseen material is added to the pool. Users start to realize the fun-aspect of this learning system and often call the program a "*memory game*." Study time averages 1 hour.

How TRL Works *(Continued)*

Day 3: At this stage, some users report a certain "addiction" to the highly interactive software, often **losing track of time** while studying. The system continues to probe at each instant what the learner **can** and **cannot** do. Material is systematically sorted into multiple short-term and long-term memory retention levels, **customized** to **each specific user**. Average time required is 30 to 60 minutes.

Day 4: The system continues control-repetitions to further distill material that **fails to** "**stick**" in long-term memory. Due to the systematic approach, overall retention of learned material has already increased dramatically. Suggested study time is 30 to 45 minutes.

Day 5 to 10: Study sessions get **shorter** and shorter, as the system automatically shuts down after forgotten material is distilled and processed. The major portion of knowledge acquisition has been completed after Day 10. Study time averages 10 to 30 minutes per session.

Day 11 (and beyond): Since fully learned material is **completely removed** from the learning process, the pool of questions shrinks day by day. Study sessions are limited to a few minutes, while the last remaining questions are **methodically processed** over the next few weeks.

Even though time investment is minimal at this stage, **mission-critical** courses should be fully completed to achieve permanent, long-term recall of the remaining material that does not easily want to "stick" in long-term memory.