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Teaching computing and experiencing grief in the year 1 AC (after ChatGPT)

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1 Introduction

It is not an exaggeration to say that the "connected" parts of the world are going through a revolution that has nothing comparable in history. Many people feel naked fear about being replaced in their jobs on shortest notice by ChatGPT. Comparisons most likely invoked are with the industrial revolution, the invention of the personal computer, and the popularization of the internet through the world-wide web and the first web browser. Yet none of these comparisons captures what has happened. The Industrial Revolution took roughly 80 years, from 1760 to 1840 (National Geographic, 2023). The PC did not get commoditized until a decade after its introduction in 1981 (The Editors of Encyclopedia Britannica, 2023). The world-wide web did not become popular in the living rooms and offices of the wider population until about 2000 (Mozilla, 2023), even though the first web browser had been introduced in 1990 (Mozilla, 2023), also indicating a lag of a decade.

ChatGPT, on the other hand, has become known and widely used in a matter of weeks. In this opinion piece, we draw comparisons to two previous revolutions during the lifetime of this author and to the five stages of grief that practitioners using the "old" technologies seem to have experienced because of these revolutions.

2 Obsolete tools

2.1 The slide rule

In 1974, when this author was a freshman in an engineering school, the first Texas Instruments scientific calculators became available. Using a currency calculator (Historischer Währungsrechner, 2023), we found that the Texas Instruments calculator cost about $1000 in 2023 currency, a substantial amount for a poor student. Previously there had been HP scientific calculators, but they used postfix operators, thus they were not very popular with freshmen. To add 4 and 5 one had to go through a sequence of key strokes involving a storage function and in essence type the operation as 4 and 5 +.

At the time, the tool of the trade was the slide rule. The engineering school instructors had achieved remarkable dexterity with them and demanded the same of their students. Here is a brief introduction to slide rules for millennials who never saw one (Figure 1).

It is intuitive that two sliding rulers can be used to add numbers (Figure 2).

But the genius of the slide rule is based on reducing multiplications to additions by using logarithms, based on the formula:

$$Log\ (A * B) = Log\ (A) + Log\ (B)$$

Even though the numbers on the scales of a slide rule may say 2, 3, etc., they are positioned at distances of log 2, log 3, etc. from the origin. Thus, no explicit translation from a number to its logarithm and back has to be performed. Precision is typically limited to about three

digits. The range limitation requires a bit of additional arithmetic, by decomposing each number into a "mantissa" and an exponent. Thus, e.g.,
12345 * 6789 is reduced to $1.2345 * 10^5 * 6.789 * 10^4 = 1.2345 * 6.789 * 10^9$

After rounding, the multiplication of 1.23 * 6.79 is performed with the slide rule and the powers of 10 are multiplied by adding the exponents, resulting in 10^9.

3 The five stages of grief

What do slide rules have to do with grief? The five stages of grief – denial, anger, bargaining, depression and acceptance (Kübler-Ross, 2014) – are commonly invoked when a person confronts the death of a parent, partner, or child, a cancer diagnosis or another traumatic loss. With hindsight, these stages are what the instructors in the engineering school (anonymized) attended by this author seem to have experienced at the loss of their slide rules. This is instructive, because the introduction of ChatGPT will lead to a similar loss experience in substantial parts of the population and the educational community. Here is the approximate progression of what happened.

The instructors went immediately into Stage 1 – denial. They came up with reasons why the slide rule is superior to the pocket calculator. "By the time you type in the numeric problem, I already have the solution," was an often-heard quote.

They also held on to the idea that they were teaching an important skill that would somehow come in handy, maybe "when we did not have access to a calculator." In truth, they were just in denial that a skill that they had perfected over years had become worthless almost overnight.

When the student union demanded that we be allowed to use calculators during our exams, the anger (Stage 2) of the professors was evident by their behavior.

The term "bargaining" (Stage 3) in relation to grief usually refers to a person bargaining with God, "fate," or another higher power. In this case, the bargaining was initiated by the student union with the professors.

Whether the professors felt depression (Stage 4) is unknown to this author, but eventually acceptance (Stage 5) came and calculators were permitted on exams.

3.1 Obsolete "tool" 2 - the electromagnetic relay

This author worked in his first fulltime job after college at a phone company in a department for developing switching circuits. This was the time when central phone offices where going through the replacement of electromechanical relays consisting of moving parts by solid state integrated circuits and transistor switches.

An electromechanical relay consists of a coil that attracts a "tongue" of metal when a current flows through the coil. A spring moves the "tongue" back to its original position when the current through the coil stops. During the state of attraction, the tongue closes a secondary circuit or even several secondary circuits (and frequently the new position of the tongue interrupts a third circuit). The advantages of this transition were painfully obvious. Any device with moving parts will wear out much faster than a fully electronic circuit. Furthermore, relays were hundreds of times larger than transistors, and thousands to millions of times slower.

There was one group of developers in the phone company whose members were not happy about this development. They had invested a lifetime career into developing relay circuits that minimized the currents drawn by the coil systems, by developing smart and sophisticated circuit schemas. The experience and wisdom of those developers went the way of the horse-drawn carriage in a short period of time. They went through a period of collective grieving.

4 What does ChatGPT mean for education?

It is already apparent that the worlds of school, professions, and even the arts will experience the stages of grief at a historically unprecedented level over the next several years, giving up old tools and old ways of doing things, as these will appear as outdated as slide rules compared to the advanced calculator that ChatGPT is.

As much as there are major challenges, there are also opportunities for harvesting low-hanging fruits. The faster one overcomes the first four stages of grief and settles into acceptance, the faster will it be possible to be a pioneer in the use of ChatGPT. This also applies to Computer Science education.

This author teaches advanced database topics, such as programming with PL/SQL for Oracle databases and the Cipher language for the Neo4j Graph Database system. During his own denial phase, this author told himself that both PL/SQL and Neo4j are not widely used languages, and ChatGPT could not possibly know them well enough. To prove the point, this author gave ChatGPT a question from the first homework: Write a program that computes the first 100 prime numbers in the PL/SQL programming language. The result came back in seconds and was almost correct. The only problem was that ChatGPT used a variable called "count." This is a reserved word in Oracle and therefore the program did not work. However, after regenerating the code minutes later, a perfect result was obtained. The experience with a homework problem in the Cipher language of Neo4j was similar. ChatGPT solved a simple problem within seconds and did so correctly.

The changes forced on educators are so monumental, that BC and AC will now come to mean Before ChatGPT and After ChatGPT. How should educators accept and live with ChatGPT in the year 1 AC?

In the Fall of 2023, this instructor made a few exploratory changes to the class which will now be explained.

1) Instead of going *back to the future*, we went forward to the past. The weights of homework assignments/projects were downgraded. Midterm and Final were paper and pencil exams, with cellphones taken away at the beginning of the Final and returned at the end. The tools used extensively during COVID-19, such as lockdown browsers, were not used, as students seem to have found ways around the restrictions of the browsers (Peachyessay, 2023). While this reintroduced problems solved by electronic quiz administration, such as ambiguous or plainly

FIGURE 1
A slide rule (Source: Pixabay royalty-free images. https://pixabay.com/photos/slide-rulecomputing-device-3499408/).

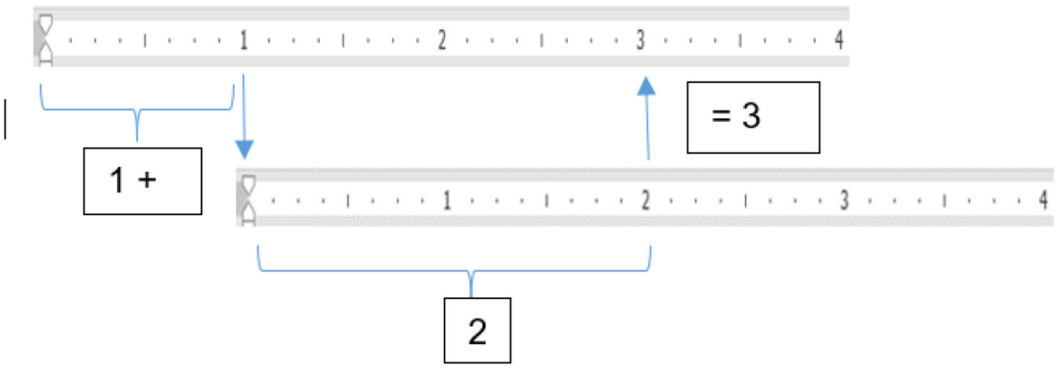

FIGURE 2
Addition by using two rulers.

bad handwriting and difficulties with testing "obscure" programming solutions with a real compiler, it increased the integrity of the exams.

2) A closed book "pre-midterm quiz" early in the semester heavily recycled questions from the first homework/project, to make the point that "you will pay for cheating" even if you don't get caught.

The three proposed overall principles for dealing with the ChatGPT age are:

1) The students have access to a more powerful tool, so they should solve more difficult problems and longer assignments.
2) More emphasis is put on understanding and explaining code than on writing it.

3) In the future, this instructor will use ChatGPT to defeat ChatGPT. As just one example, this author asked ChatGPT to generate four outwardly different looking programs that generate prime numbers and that do not mention the word "prime" anywhere in the code. ChatGPT took two prompts and a few seconds to do so.

Students will be given printouts of these programs on their midterm exam and will have to hand-simulate the resulting output, showing intermediate values of local variables. Having four different versions will make cheating harder, because intermediate values will be different in each of them. Nevertheless, the first cut of grading will be manageable, as it can be easily determined whether the output consists of prime numbers or not.

5 Discussion

There is no reason for despair or premature retirement among Computer Science educators. Efforts will be required to adapt to the new reality of students having access to a "superior tool" such as ChatGPT, but by skipping the first four stages of grief and getting to acceptance as soon as possible, there will be plenty of low-hanging fruits to be harvested in teaching methodologies. Assignments will have to factor in the existence of the new tool, and be made harder. But in the end, the new tool is available to everybody, teachers and students alike, and will open up whole new opportunities.

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References

Historischer Währungsrechner (2023). Available online at: www.eurologisch.at https://www.eurologisch.at/docroot/waehrungsrechner/#/ (accessed May 24, 2023).

Kübler-Ross, E. (2014). *On Death and Dying: What the Dying Have to Teach Doctors, Nurses, Clergy and Their Own Families. 50th Anniversary Edition*. Foreword by Ira Byock. Scribner.

Mozilla (2023). Browser History: Epic Power Struggles that Brought us Modern Browsers. Available online at: https://www.mozilla.org/en-US/firefox/browsers/browser-history/#:~:text=British%20computer%20scientist%20Tim%20Berners (accessed May 24, 2023).

National Geographic (2023). *The Industrial Revolution and National Geographic Society. education.nationalgeographic.org*. Available online at: https://education.nationalgeographic.org/resource/resource-library-industrial-revolution/ (accessed May 24, 2023).

Peachyessay (2023). *How to Cheat Respondus Lockdown Browser in 2023?* Available online at: https://peachyessay.com/blogs/cheat-respondus-lockdown-browser/ (accessed May 24, 2023).

The Editors of Encyclopedia Britannica (2023). *Personal Computer and Technology. Encyclopædia Britannica*. Available online at: https://www.britannica.com/technology/personal-computer (accessed May 24, 2023).