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Research article

Conflation of Technology and Language: A Cognitive Artifact

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Abstract

We use concepts to make distinctions. Blurring these distinctions results in conflations. So, they are commonly seen as vicious. The claim here is that, by contrast, conflations are virtuous because they can do cognitive work. They enrich our conceptual resources. It is not conflation *per se* that is destructive but the lack of evaluation. Committing a conflation requires two cognitive acts at once. First, keeping things together and, second, appreciating the gap between them. Conflation thus has a family resemblance with notions like *analogy* and *metaphor*. Despite their apparent difference, a shared trait is recognizable in this family: the *simultaneous* maintenance of similarity and difference. This is not a bug, but a feature. The cognitive work is done *because of* it not *despite of* it. Consequently, we should evaluate conflations not by appealing to their being conflations *per se*, but by appealing to *what they have done and can do* according to our cognitive *goals* and our cognitive and cultural *resources*. Throughout history, many have conflated technology and language—most notably Socrates who conflates tools and names. A recent conflation is the case of „computer languages." I exhibit the virtuous cognitive work of this conflation in at least three respects: the historical development of computers, their real-time workings, and the incommensurability between computer and human language.

Keywords: Conflation; Analogy; Metaphor; Computer language; Incommensurability; Machine Learning; Artificial Intelligence

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Научная статья

Слияние технологии и языка: когнитивный артефакт

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Аннотация

Мы используем понятия, чтобы проводить различия. Размывание этих различий приводит к смешениям. Таким образом, они обычно рассматриваются как негативные. Утверждение здесь состоит в том, что, напротив, смешения позитивны, потому что они могут выполнять когнитивную работу. Они обогащают наши концептуальные ресурсы. Деструктивно не смешение само по себе, а отсутствие оценки. Совершение смешения требует двух когнитивных актов одновременно. Во-первых, держать вещи вместе, а во-вторых, ценить разрыв между ними. Таким образом, смешение имеет родственное сходство с такими понятиями, как аналогия и метафора. Несмотря на кажущуюся разницу, в этой семье узнаваема общая черта: одновременное сохранение сходства и различия. Это не баг, а фича. Познавательная работа совершается благодаря этому, а не вопреки ему. Следовательно, мы должны оценивать слияния, апеллируя не к тому, что они являются слияниями сами по себе, а к тому, что они сделали и могут сделать в соответствии с нашими когнитивными целями и нашими когнитивными и культурными ресурсами. На протяжении всей истории многие смешивали технологию и язык, в первую очередь Сократ, который смешивал инструменты и имена. Недавнее смешение относится к “компьютерным языкам”. Я демонстрирую позитивную когнитивную работу этого смешения, по крайней мере, в трех аспектах: историческое развитие компьютеров, их работа в реальном времени и несоизмеримость между компьютером и человеческим языком.

Ключевые слова: Слияние; Аналогия; Метафора; Компьютерный язык; Несоизмеримость; Машинное обучение; Искусственный интеллект

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INTRODUCTION

Conflation is usually a negative thing that should be avoided. If you don't see subtle differences between concepts, you are conflating them. If you put your money on the *bank* of a river, you have done a clear case of conflation. If you do not distinguish between "bank" as *the shore of a river* and "bank" as *a monetary system* you will soon suffer the consequences and get poor. Besides these exaggerated cases of everyday life, we have other sophisticated cases of conflation and the business of philosophers is to *un-con-flate* them: We shall not conflate concepts. However, there are many occasions for *committing good conflation*, most notably in metaphor and analogy. So, by dismissing all conflations, we might end up dismissing many good ones.

In a post-Darwinian era, the desire to "carve nature at its joints" has lost steam. However, when dealing with concepts, it seems that philosophers still want to "carve thought at its joints." It is common for us to see concepts as the building blocks of our cognition. If we frame cognition like this, then the defense of conflation would be twofold. First, concepts (the supposedly building blocks of our cognition) are not as rigid and clear-cut as the frame suggests. Concepts are fuzzy, vague, analogical, metaphorical, and as I summarize: all born out of conflations. Second, the working of our cognition (the supposed construction of our cognition with those blocks) is not a formal practice following fixed eternal laws. Rather, the working of our cognition is informal. Our cognition takes advantage of *bizarre conflations*. In other words, what makes our cognition a *working* one is not its rule-following behavior in accordance with rigid laws but, by contrast, its ability to bend laws in order to conflate.

In the first main section, I review Socrates' conflation of technology and language. In the second section, I elaborate upon the notion of conflation and the importance of the *simultaneous* maintenance of similarity and difference. The moral is: we should see conflation as a virtue, not as a vice. In the third section, I examine a special case of conflation between technology and language: the conflation of computer and human language.

SOCRATIC CONFLATIONS

To *see* words *as* tools is widespread in different cultures. However, my review here is very brief and restricted to Socrates. The aim is to show that the conflation of technology and language is nothing new or out of ordinary.

The conflation of Names and Tools

Socrates, in Plato's *Cratylus*, sees names as tools. Names, as Socrates claims, are the smallest part of our statements. The topic of the dialogue is the "correctness of names". The debate is framed as a contrast between "conventionalism" or „nominalism" and "naturalism or „realism." The former argues for an arbitrary designation relation between names and their meanings, or referents. The latter argues for a natural non-arbitrary relation.

To argue for "naturalism," Socrates appeals to an analogy with tools: if you want to cut something you should "cut in accord with the nature of cutting and being cut and with the natural tool for cutting" (Plato, 1997, p. 105, 387a). Here "natural" is not contrasted with "artificial." Rather, it is contrasted with "arbitrary" or „contrived." We cannot use tools as we wish. The use of anything as a tool, found in nature or built by humans, is enabled and, at the same time, restricted by the "nature" of the tool, or – to put it in contemporary parlance – by its "affordances." Socrates conflates tools (like "drills" and "shuttles") with names. Once the conflation is established, interesting corollaries follow.

By using the analogy, Socrates is enabled to discern *inferential patterns* of the source domain (weaving) and transfer them to the target domain (thinking). Socrates observes that as good weaving needs good shuttles, good thinking needs good names: "So just as a shuttle is a tool for dividing warp and woof, a name is a tool for giving instruction, that is to say, for dividing being" (Plato, 1997, p. 107, 388c). Socrates believes that a mark of good thinking is being able to "divide" being and this needs a good dividing tool.[1] In more familiar words, to carve nature at its joints we need good carving tools.

Another *inference pattern*, which is transferred from weaving to thinking, is this: any tool should be designed and built by experts, so naming should be done by experts who know "the craft of grammar." Another *inference pattern*, which is transferred by Socrates from tool use to naming, is this: as one can reverse-engineer tools in order to find rational reasons behind their construction, one can do etymology by reflecting upon the letters and syllables of names in order to find the rationality behind them. This leads Socrates to a tally of amusing etymological speculations.[2] Socrates is following his conflation wherever it leads.

It is clear that Socrates is conflating words and names. However, he commits another conflation related to the discussion in the next section of how conflations become productive. At some point, Cratylus challenges Socrates' account of the "craft of grammar" by pointing to a difficulty. By doing etymological speculations, Socrates is presupposing that the working of our tools (names) are very sensitive to their working parts (syllables and letters). It has a corollary: if we just change a letter in a name it might stop working! If we play too much with them they might break! If we play too much with the letters and syllables of a name – as Socrates is doing by his speculative etymology – the name ceases to be a name at all. How can Socrates play with syllables and letters without breaking the names?

Socrates claims the problem arises because Cratylus has made a conflation between numbers and names. The sensitivity to internal parts is true of numbers not of "sensory

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[1] The irony is that he is arguing for the importance of "dividing" by blurring the divide between names and shuttles!

[2] For example, heros are called "heros" either because they were borne out of love ("eros") or else because they were sophists ("rhetores"). Humans are called "anthropos" because they reflect ("anathron") upon what they see closely ("opope") and because they are the only animal doing this (Plato, 1997, p. 117-118, 398). Socrates' examples might seem preposterous. Some contemporary interpreters say Plato wants to mock etymological practice. At some point, Socrates says there are "serious" explanations and "playful" ones and analyzes "Dionysos" and "Aphrodite" playfully because "even the gods love play" (Plato, 1997, p. 124, 406c). However, Sedley (2020) rejects this interpretation and claims his etymological efforts are seriously meant. It looks weird to us because we now know much more about their language than the Greeks themselves.

qualities." Socrates suggests another conflation: paintings and names. Socrates compares colors and shapes with syllables and letters. In this new conflation, the relation between a name and what it means remains stable *despite of* subtle changes in the internal composition of the name. Why? He transfers an *inferential pattern* from the realm of painting to the realm of naming: an image of Cratylus would remain an image of Cratylus *even* if patches of colors or shapes are changed slightly. In other words, the workings of names are sensitive enough to their syllables and letters to enable etymological speculations, but they are not so sensitive as to make those speculations meaningless.

Take Courage in Committing Conflations

There are two points in regard to the conflation of painting and naming which are related to the discussion in the following section on the work of differentiation. First, Socrates is using his cognitive and cultural resources to commit conflations. However, he is discriminating against conflations: one is good (paintings and names) the other is bad (numbers and names). He prefers one because it works better for his cognitive goal – which is here etymological speculations. Second, Socrates knows that something is eerie but insists that one should overcome the fear. Socrates says to Cratylus:

> "Take courage then and admit that one name may be well given while another isn't. Don't insist that it have all the letters and exactly resemble the thing it names, but allow that an inappropriate letter may be included" (Plato, 1997, p. 148).

In other words, Socrates is claiming that an image represents Cratylus not *despite of* its inability to perfect imitation, but *because of* this inability. Socrates is acknowledging the importance of imperfection: it is risky but we should take courage. If an image imitates perfectly, it results in two exact things. But nobody wants another exact copy of the world. One is already too much! The next section can be read as an exposition of this *simultaneous* maintenance of similarity and difference.

SEEING CONFLATION NOT AS A VICE BUT AS A VIRTUE

One of the findings of cognitive science is that the majority of our cognitive work is done backstage and we are not conscious of them.[3] So are the conflations. Ordinarily, we make exaggerated out-of-context conflations just to ridicule them: "where do fish keep their money? At the river bank." Here, a conflation is supposed to make us laugh[4] and, at the same time, it is supposed to belittle itself. We come to see how ridiculous is to conflate. But even this ridiculous conflation can do some "work": it can make us laugh if it is well-said[5], and at the same time it can warn us against conflations. However, contrary

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[3] For a good exposition of three revolutionary findings of cognitive science (cognition is metaphorical, unconscious, and embodied) see Lakoff and Johnson (1999).

[4] This joke is overused and the funny part is broken, but I hope at least it is *imaginable* how funny it could be.

[5] Baird and Nordmann (1994) use a well-said-joke to clarify the notion of a well-put-thought and finally the notion of a well-put-fact. Their focus is on how well-put-facts, produced and sustained by technological toys, can anchor us in a "sea of linguistic and theoretical confusion." Here I have this analogy in mind, but I do not see one (fact) as the savior of the other (thought). I look into their mutual relation: sometimes a

to the moral of this joke, conflations can do much more than make us laugh or belittle themselves. Their life is not restricted to jokes. They are active in our most cherished cognitive works. Our cognitive work is done *because of* doing conflations not *despite of* it. Conflations are *cognitive artifacts*[6] having a productive life of their own.

The Shared Trait of a Family

What is *conflation*? Its *intension* is vague. Instead, we can look at its *extension*. But, spotting conflations is not easy because many of them are *established* and we do not *see* them *as* conflations anymore. A working strategy would be to look at similar notions in order to find a "family resemblance."[7] By so doing, we would have a better grasp of the notion of conflation.

Opposition: In opposition, first, there should be some kind of relevance and, second, this relevance should be challenged. Entities should be related *but* against each other. Oppositions are celebrated in different cultures. Lloyd (1966) explains, in *Polarity and Analogy: Two Types of Argumentation in Early Greek Thought,* how "pairs of opposites" were crucial for Greek thought: left and right, male and female, etc. Opposition or polarity is also obvious in the Chinese "yin and yang." The ancient book of *Tao Te Ching* is a poetical glorification of opposites.[8] Also in Islamic mysticism oppositions are celebrated in the saying: "Things are known through their opposites."

Contradiction: In logic, two propositions are contradictory if they share everything *except* the truth. For any contradiction, as with opposition, there should be a high degree of similarity *except* a decisive difference. Formal contradictions are almost identical *but* different.[9] Contradiction can be less formal and be called informal contradiction which is famously the hallmark of Hegelian philosophy. Here, again, we have the *recollection* of both similarities and differences.[10] In both, formal and informal, there is a *simultaneous* contrast between similarity and difference at work.

Mistake: If we wrongly take something for another, it is a "plain mistake." An entrenched philosophical derogatory term for this blunder is "Category Mistake." We shall not mistake a robot for a person. However, Dennett (1996) writes, arguing for attribution of intentions to things, "There is no taking without the possibility of mistaking" (p. 37).[11] Inversely, as the word "mis-take" already shows, there is no mistake

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well-said sentence can anchor us in a sea of practical confusion. Seeing facts and sentences in this way is a good example of conflating technology and language.

[6] Explaining a pun might ruin its fun. However, it should be noted that "artifact" can be understood in two ways. First for its negative meaning: false observations. For example, Galileo's discoveries were dismissed by some as artifacts of his telescope. Second, for its positive meaning: tool.

[7] Wittgenstein's "family resemblance" celebrates *the missing* of any single shared property for grounding the resemblance. Here, we can see this *missing* as a *shared trait*.

[8] For an English translation of Tao Te Ching see Chen (1989).

[9] In the logic of sets – dealing with sets of objects – a negation is a "complement". A term that clearly has positive connotations.

[10] See Brandom (2019), chapter 3, "Representation and the Experience of Error" for how the process of experiencing errors (incompatibilities and negation) leads to truth.

[11] This is what Dennett calls an "Intentional Stance". One can (mis)take almost *anything* as an intentional system and attribute intentionality if there is a cognitive or biological payoff.

without the possibility of taking. In sum, "making mistakes" can do cognitive work and it needs a *simultaneous* maintenance of similarity and difference.

Metaphor: We *see* something *as* another thing and we celebrate this conflation by calling it a "metaphor." Some see the conflation as a reason for rejection: metaphor is decorative and "just a metaphor." Others see it as a reason for appreciating metaphor's cognitive work. In either case, we are *simultaneously* maintaining similarities and differences. Metaphor has been celebrated by many, old and new, thinkers as the fundamental element of our cognition, most notably by Lakoff and Johnson's *Metaphors We Live By,* first published in 1980.

Analogy: Analogies are so similar to metaphor that drawing a line between them seems arbitrary. Conflation is also explicitly at work in analogy: the maintenance of a *simultaneous* similarity and difference. It has also been celebrated by many thinkers as the base of our cognition, like Hofstadter's (2001) *Analogy as the Core of Cognition*.

Error: Errors have a double life. On the one hand, they are something passive that should be avoided. Measuring units should be as precise as possible to eliminate any errors. On the other hand, they are something active that can do work. The paradigmatic case is the error signal in a feedback loop. A feedback loop can do extraordinary feats by incorporating the error as an active part of the system. Mayr (1989) makes explicit the role of "feedback mechanisms" in modern thought. The active role of error in feedback loops is borne out of a *simultaneous* maintenance of similarity and difference between the output and the setpoint.

Abstraction: Abstractions are celebrated as the ultimate feat of the human mind. However, they are nothing but *established* conflations.[12] To see two red edible spheres as "apples" is to abstract from their differences and conflate them.[13] We usually do not *see* abstraction *as* conflation. We realize only if their establishment is challenged, for example by a fake apple. Abstraction and conflation are two sides of the same coin: they need a *simultaneous* maintenance of similarity and difference.

We can conflate "conflation" with these notions and see if this conflation can do cognitive work. One might object that even if we accept conflation as legitimate, we need similarity in the first place to begin with. The response would be that similarity is the product of conflation not the ground of it. Similarity is something we construct. It is not a given.

What Do Cabbages Share With Kings?

It is ancient wisdom that everything is similar to everything else. In many cultures,[14] Gentner and Jeziorski (1993) write, "The alchemists' willingness to heed similarities of all kinds derived in part from their belief that all things above and below are connected, and that similarity and metaphor are guides to those connections" (p. 464). Carnap, who wanted to unify everything in a deductive formal system, tells a "dialectical" story of the

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[12] We nowadays use "rock" to refer to celestial bodies as well as terrestrial ones. This is, in the eyes of the ancients, a clear case of conflation.

[13] A Platonist would reject this.

[14] For example, Ibn Arabi and Rumi, and many other Islamic mystics, claim that everything in the world is similar and related because they are manifestations of God, the Unit.

struggle between "critical intellect" and "imagination" which led the "critical intellect" to make a discovery in antiquity, "That is the discovery of *one* [single] *comprehensive space*. All things are in space; any two things are always spatially related to each other. So there is also a path from me to any [given] thing" (quoted in Leitgeb & Carus, 2023). Sellars (1962) writes in a similar way:

> The aim of philosophy, abstractly formulated, is to understand how things in the broadest possible sense of the term hang together in the broadest possible sense of the term. Under 'things in the broadest possible sense' I include such radically different items as not only 'cabbages and kings', but numbers and duties, possibilities and finger snaps, aesthetic experience and death. (p. 1)

I do not want to put cabbages and kings together here. However, encouraged by this old wisdom, I claim despite the apparent diversity within the family (opposition, contradiction, mistake, metaphor, analogy, error, abstraction, etc.), they resemble each other in this respect: the *simultaneous* maintenance of similarity and difference. This is what can be called *the shared trait* (some might consider it a defect) of the family.

Committing a conflation requires two acts at once. First, keeping things together and, second, appreciating the gap between them – recall Socrates. These are two sides of the same coin. The derogatory meaning of "conflation" is the result of seeing conflation as one-sided: appreciating only the gap. But, there is another side which is as important: keep things together while aware of the inellinimalble gap. Is it rational? Does it pay off?

When analyzing literary metaphors, Black (1962) explained his "interactionist view" of metaphors by appealing to the "interaction" of "distinct ideas" or "primary and subsidiary subjects" and the need for "simultaneous awareness of both subjects" which should not be reduced to a "simple comparison" between the two, because then the "cognitive content" would be lost (see Black, 1962, chapter 3). Black restricted his analysis to literature, despite his willingness to extend it to philosophy. But the accumulation of empirical evidence in Cognitive Linguistics throughout the years has revealed the importance of this *simultaneous awareness of distinct ideas* not only in language but in *every* cognitive activity. Fauconnier and Turner (2002), after reviewing many examples of what they call "conceptual blending", write "We have now seen a wide range of cases in which there is *a need to be able to maintain simultaneously what looks like contradictory representation*" (p. 84, emphasis added). The point is that there is something contradictory, *but* it should be entertained not avoided. Because "… blends are efficient at many levels of cognition" (p.85). In other words, we should conflate because our cognition works by it. The moral is that conflation – in the two-sided meaning of the term – can do cognitive work *because of* being a conflation not *despite of* it.

However, it is not easy to conflate! Conflation needs a lot of work. Keeping things together while appreciating their distinctiveness needs different amounts of work. It needs a lot of work for radically different things like cabbages and kings. It is effortless for two ordinary apples. We *see* these established conflations *as* conflations only when they *do not function as always* and our relation with them changes from *ready-to-hand* to *present-at-hand* (Heidegger's tool analysis). Only then can we *see* these cognitive artifacts *as* cognitive artifacts. Conflations work under the threshold of our consciousness. They do not require our conscious effort. We are not aware of them. However, we can make them explicit, evaluate them, and make improvements.

There are similar claims in cognitive science.[15] However, if we abstract from the differences between their theoretical nomenclature (Metaphor, Analogy, Conceptual Blends, etc.) we would end up with a very abstract notion of conflation: conflation as a *useful defect*, a *cognitive artifact*.

Evaluation of Conflation

Appraisal of conflations might be seen as opening the door to chaos. This is a false impression. It is not conflation *per se* that is destructive but the lack of evaluation. As in evolutionary biology where it is not the mutation that is destructive, but the lack of selection and inheritance mechanisms. As in a feedback loop where it is not the error that is destructive but the lack of a set point and negative feedback. Similarly, to be constructive, conflations should be domesticated. Imitating Kant we can say, "Conflation without evaluation is blind, evaluation without conflation is empty."

There are at least two ways of evaluation. First, we can evaluate conflations against how they satisfy cognitive goals. This can be done by analyzing conflations that have already done great cognitive work in everyday life, science, art, technology, etc. History has already sifted out good ones from bad ones and we, by hindsight, know a lot about their merits.[16] Second, we can evaluate them according to the effort they need. For example, putting cabbages and kings might do substantial cognitive work but at the expense of very sophisticated mental gymnastics. In other words, the success of a conflation is constrained by the cognitive and cultural resources we have. So, for making a new conflation, it is better to build upon *established* conflations.

We can summarize this section by building a *mental model* for thinking about conflation. We are experiencing the world as a 3D space *thanks to* the *errors* our eyes are making in front of our eyes. Our vision conflates, in real-time, two *similar* but *different* sensory inputs to produce a stable 3D vision. We can manipulate this error. On the one hand, we can eliminate it by closing one eye. On the other hand, we can increase the error by moving our eyeball with a finger (be cautious!). In both cases, we would ruin our 3D experience. Our 3D vision works *thanks to* an *optimal error* which is determined by our *goals* plus our bodily and cognitive *resources*. The same goes for our cognition and conflation.

In sum, a strange inversion of morals is needed: we should appreciate conflation as a virtue, not as a vice. However, we should evaluate conflations according to our *goals* and *resources*. In the final section, I will now scrutinize a special case of the conflation between technology and language, and follow the conflation where it leads.

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[15] Most notably Lakoff and Johnson's (2011) "Conceptual Metaphors", "Analogies as the fuel and fire of thinking" by Hofstadter and Sander (2013), and "Conceptual Blendings" by Fauconnier and Turner (2002), to name but a few.

[16] Thagard (2012), chapter 9, reviews 200 inventions in science and technology to show how they are borne out of combinations of mental representations. His account is *mental* and *representational*. For a *non-mental* and *non-representational* account see Hutchins (2005).

THE CONFLATION OF TECHNOLOGY AND LANGUAGE

We can discern, analytically, at least three "clusters of issues" in regard to the relationship of technology and language.[17] First, their definitions. How do we define technology and language: etymological, essential, prescriptive, linguistic, or pragmatic? Second, our interest: in which way are we interested in their relationship? (a) empirical: interested in their actual and historical engagement, (b) conceptual: interested in our conceptions of them, or (c) evaluative: interested in judging them according to epistemic, social, moral, or other values. Third, their relationship balance: which one is superior? We might see their relation as: (a) bilateral independence: having their own identities and living their own lives, (b) unilateral dependence: one is superior, prior, primary, more valuable, higher in rank, more meaningful, more human, etc., or (c) bilateral co-constitution: they are shaping each other in substantial ways.

Addressing all these issues is beyond the scope of this paper. However, we can situate our discussion according to them. First, our aim here is not *defining* technology and language. Second, our interest is not *evaluating* them in terms of social, epistemic, or other values. Our interest here is *empirical* and *conceptual*. Third, we see their relationship as a bilateral co-constitution. In sum, we are conflating them: keeping both in mind, reflecting upon their similarities and differences, and allowing them to blend and shape each other through the course of analysis and synthesis. In what follows, the focus is on a special case of technology (and language): computer language. I would scrutinize the *empirical* aspect of the relation between human and computer languages, and how our *conceptions* of both *are* and *should* be affected by this engagement.

Computer Language: An Oxymoron or A Platitude?

The *notion* of computer language is less commonsensical than the *notion* of human language. After all, human language is more widespread and a subject of reflection for a long time. Despite this reflection, however, our conception of human language is far from being established and standardized. On the one hand, there is a long history of failed attempts for purifying the human language and building an ultimate formal rational one: from Leibniz's dream of "let us calculate" for settling all philosophical debates to Carnap's ultimate formal language for unifying all knowledge. On the other hand, there is a parallel history of successes: from the language of "punched cards" for playing music and weaving complex textiles to the modern programming languages of computers. We wanted an ultimate rational language for ourselves (humans) but ended up with a robust language for them (computers). Philosophers wanted a robust language for settling debates effectively. However, while philosophers are still under the curse of Babel's Tower, computers are collaborating so effectively that they are now playing the role of the old wise philosopher who is answering all the questions.[18] Have computers found the ultimate language? What is the relation between our language and theirs?

[17] I am inspired by Radder's analysis of the relationship between technology and science. See his intro to part one in Meijers et al. (2009).

[18] ChatGPT is the newest and maybe the most successful achievement. It is so authentic that some try to list it as an author of scientific publications. See van Dis et al. (2023).

It is easy for programmers to see the similarities between them. Because, after all, they are similar! But one might object that they are not *really* similar. Computers work with zeros and ones but we talk with letters and words. Computer language is precise and static. Ours is vague and dynamic. A student in humanities does not know, and does not feel the need to know, very much about computer languages. A computer programmer does not know, and does not feel the need to know, very much about human language. They are not similar because, after all, they are different![19] However, as explained in the previous section on the virtues of conflation, the point is the *simultaneous* maintenance of similarities and differences. This is the working part of any conflation. So, let us follow the conflation: where does it come from and where does it lead?

A Brief History of the Conflation[20]

Mechanical clocks and automata (Ancient Chinese, Islamic Golden Age, premodern Europe) are amongst the oldest "programmed" machines in which an orchestra of toys and gadgets play a short theater thanks to a hard-wired algorithm realized by mechanical and hydraulic tricks. Here, with a little imagination, we can *see* these tricks *as* a from of "language" – a semi-language. There are regularities that craftsmen know how to use for expressing a meaningful theatrical chain of movements: a grammar of things.

One might object that the workings of these mechanical devices are far from the realm of language. They are not even a primitive form of language. Some linguists, most notably Chomsky, believe that our language faculty does not come in degrees. We have no evidence of any intermediate forms of human language – proto-language or semi-language. Humans are endowed with the Universal Grammar, a uniquely human faculty. In other words, human language is *sui generis* and completely different from mechanical chains of movement. However, ironically, Chomsky writes, in 1957, at the beginning of his seminal *Syntactic Structures*, "Syntactic investigation of a given language has as its goal the construction of a grammar that *can be viewed as a device of some sort* for producing the sentences of the language under analysis" (Chomsky, 1957/2002, p.11, emphasis added). One can see how Chomsky's conception of language is already shaped by his conception of a "device". We know that this linguistic "device" shaped the root metaphor of cognitive science, namely seeing the mind as a computer. So, even in the mind of ardent linguists, the supposedly unique human language is already conceived as something mechanical and algorithmic.

The systematic chain of movements in a mechanical device can be considered in more abstract terms like the term "algorithm" which is derived from the name of Al-Khwarizmi, the ninth-century Persian mathematician. With his algorithms, one could follow myopically a finite chain of steps in order to solve arithmetic or geometric problems. The human language was combined with Arabic numerals and geometric

[19] Some might *see* the "human language" *as* the *differentia* between humanities and other sciences. In the human realm we "interpret" but in the non-human world we just "explain". The conflation of technology and language is meant to cut across this division.

[20] The history behind is much richer, but not in a vague way that "history is rich and complex". We know many details. However, for the sake of brevity, I tell a very short and selective story.

shapes in order to instruct – "to program" – ordinary people, other than genius specialized mathematicians, to solve problems. It was a big step toward mechanizing thought, and toward closing the gap between humans and machines.

Before and after, we had also many other "algorithmic" mechanical devices: Mechanical Calendars; Antikythera; Astrolabe; Zaicha which was a Persian diagram for horoscope; Lull's disc diagrams (*Ars Magna*) for reasoning mechanically about God, inspired by Zaicha and similar mechanical diagrams; Pascal's mechanical calculator; Leibniz's mechanical calculator – inspired by Pascal's *Pascaline,* Lull's diagrams, and by the "binary patterns" in Chinese wisdom[21] – in which cogs and wheels were "programmed" to do arithmetic; self-playing musical instruments like carillons, music-boxes, and special pianos "programmable" by a bunch of bumps on a cylinder or holes on a paper; Maillardet's automata "programmable" by highly-detailed indented camshafts for painting and hand-writing;[22] Jacquard's weaving machine "programmable" with punched cards for different textile designs. In all of these device, we can see how a mechanical and algorithmic "language" is emerging with its own vocabulary – cogs, wheels, levers, punched cards, and other mechanical gadgets – and its own grammar – "algorithm" as the abstract norm. This new mechanical and algorithmic language is meaningful because it does arithmetic, plays music, weaves textile, paints, writes, and more. It is universal and anyone can use it effectively.

The rest is history: Babbage's analytical engine for doing complex mathematics which was inspired by camshafts and punched cards;[23] Boole's algebra which was a "translation" of traditional logic to the "language" of ones and zeros which was the "language" of punched cards; Shannon's implementation of Boolean algebra in the electrical circuits which again was a "translation" from the "language" of Boolean algebra to the "language" of electrical circuits. To make a long story short, in the mid of 20th century, at the end of a highly convoluted path, with many conflations and "translations" established throughout the journey, the modern computer was born, idealized as a "Turing Machine."[24]

For running a Turing Machine, which is theoretically the base of all computers, all we need is a very long band of paper, a pen, an eraser, and a very minimally intelligent being who can read and write zeros and ones on the paper band according to the very primitive logical conditions described in the Turing Table of the machine. In sum, the computer boils down to a simple machine that manipulates a bunch of zeros and ones according to some simple *instructions*.

The Turing Machine looks great. It is mechanical, myopic, almost idiotic, and at the same time can do a lot of intelligent work. It is an idiot savant. However, it is intelligent because it follows *our instructions* implemented in its Turing Table. The

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[21] See Gardner (1983) and Sowa (1999) for more on mechanical reasoning devices.
[22] See the documentary narrated by historian of science Simon Schaffer (Stacey, 2013).
[23] Ada Lovelace, Babbage's friend and collaborator, wrote, "We may say most aptly that the Analytical Engine weaves algebraic patterns just as the Jacquard-loom weaves flowers and leaves" (quoted in Thagard (2012), p. 163).
[24] There are many other prominent figures in the history of modern computers. However, it is customary to use Turing with his abstract machine as the protagonist.

Turing Table is the brain, or mind, of the Turing Machine and its design needs a lot of work – which makes the difference between an expert programmer and a newbie.[25] A good programmer *instructs* the machine *successfully* and *efficiently*.

In the early days, one had to instruct the computer with punched cards (until the 60s). The big difference between our computers and early ones is that now the *instructions* are written with digital zeros and ones in digital registers, not with holes in punched cards. As Hayes puts it succinctly, the paper band of the Turing Machine is now turned into a "magic paper" on which, "writing might spontaneously change, or new writing appear" (quoted in Angius et al. 2021). Thanks to this magic, our computers can bootstrap themselves out of a bunch of zeros and ones into the human world.

Besides many "translations" made and established throughout history, many "translations" take place in real-time in the hierarchy of computer languages: from zeros and ones, to machine code, to assembly language, all over to the high-level programming languages. Nowadays, the computer language is so human that not only professional programmers "speak" it but almost anybody. We "type," "click," and "google" without realizing that actually we are *instructing* the machines through its Turing Table. Computers are now so human that we "speak" with computers *literally* in our own human languages.

I have three observations in regard to this brief history. First, throughout the long process of the evolution of computers, many "translations" have happened. It is thanks to this chain of translations that we have "computer language." These translations took place first on a historical scale and second in real-time in our computers. Thanks to these conflations[26] of different "languages" we now have "computer language." With "computer language" we (collectively) are enabled to speak with machines and even, more dramatically, we are enabled to speak with each other. In other words, even our human language is now mediated thoroughly by computer language.

Second, computers are built upon the paradigmatic case of conflation! They use the simultaneous maintenance of similarity and difference: zero and one. It is not about being "0" or "1." It is about their "opposition." Theoretically, we can realize this opposition in any medium: the direction of an arrow (up and down), the voltage in a circuit (high and low), the being and the non-being (hole and non-hole), etc. What really matters is the *simultaneous* use of two opposing things. This is another way of claiming: computers are born out of conflations.

Third, despite all the similarities, a recalcitrant difference remains. In the above brief history, I glossed over a very important difference. Turing Machines work by *our instructions*. Their work is comprehensible within the human scale: we speak to them through a chain of *tractable* translations. However, today's Turing Machines are hosting new creatures whose language is alien to us – new guests who are transforming their host.

The current hype in AI is a Cambrian explosion of Machine Learning creatures. According to Domingos (2015), we can discern five "tribes": Symbolist, Connectionist,

[25] Saunders and Thagard analyze some creative aspects of being a programmer (see chapter 10 in Thagard, 2012).

[26] For a brief review of recent conflations (analogies) used in computer science see Thagard (2012), chapter 10.

Evolutionist, Bayesianist, and Analogist. These tribes speak different languages, some of them comprehensible to us but some of them not: Symbolists speak using the old familiar notions of induction and deduction; Analogists use similarities; Connectionists use neural networks; Evolutionists use genetic algorithms; and Bayesians use statistics. Computer scientists know the languages of these tribes and they are working to unite them – Domingo's "Master Algorithm" is meant to do this. However, there is a communication problem between Machine Learning language and human language. It is a problem more than just a misunderstanding or a mere difference in speed or scale.[27] The difference is more fundamental, suggesting an ineliminable gap.

The Incommensurability Problem of Human and Computer Languages

There are many different high-level computer languages and they can speak to each other – even if they are substantially different. Virtual Machines are built to translate computer languages into each other. However, sometimes they cannot: either because it is technically too cumbersome and inefficient or because of business conflicts. Either way, there is nothing incommensurable *in principle* between computer languages because at the bottom all of them are *instructions* written by *us* for Turing Machines. However, Machine Learning creatures are different. They are computer programs but they use computer language in a different way. They do not follow *our* instructions. They instruct themselves and solve problems in their own way. As Domingos (2015) writes, "We can think of machine learning as the inverse of programming." They are Turing Machines turned on their heads: they write their own instructions. To put it more precisely, their instructions are so alien to us that calling them "instructions" is just a metaphor! Their Turing Table is just a numerical spaghetti for us. Their thoughts are ineffable, not only in our human language but even in the language of Turing Machines.[28]

Haugeland (1985) coined the term GOFAI (Good Old Fashioned Artificial Intelligence) to mark a shift in the conception of artificial intelligence. With the advent of connectionism and embodied approaches, it was difficult to maintain the concept that intelligence *is identical* with internal symbol manipulation epitomized by the Turing Machine. At best, a Turing Machine could be a *simulation* of intelligence, the way a computer simulation of a hurricane is just a simulation and is not identical to the real hurricane. However, despite this conceptual shift, computers were at the bottom still Turing Machines and one could, at least theoretically, look at their Turing Table to see their instructions.

For example, "neural networks" – an imitation of the brain's neural networks – do not need Turing Machines. Anyhow, they are simulated by them and we can look at their *instruction* table. Nevertheless, the promise of "neural networks" has encouraged engineers to throw away this ladder -- after reaching the rooftop. So, "neural networks"

[27] The focus of our discussion is on the linguistic aspect of computers, hence incommensurability. However, there are other *qualitative* differences between humans and computers borne out of the accumulation of *quantitative* differences. As Lenhard (2015) shows, the "iterative" power of computers can result in their epistemic opacity to us. We cannot understand them simply because we cannot iterate as much as they can.
[28] This explains why Machine Learning creatures now are migrating to a new host environment: non-Turing Machines without Turing Tables – e.g. analog and quantum computers. See Haensch et. al (2019).

now can be realized not as softwares on Turing Machines but directly as hardwares. With the advent of these non-Turing Machines, the situation can get more dramatic: there is no table of *instructions* to look at, even metaphorically speaking! Does it mean that the analogy between computer language and human language breaks down? Does it mean that computer language and human language are eventually incommensurable?

To answer this question, let us scrutinize the notion of "incommensurability." The oldest meaning of the term comes from the fact, first revealed in ancient Greece, that there is no "common measure" between the realm of geometrical shapes and the realm of numbers. In other words, there are lines we can measure their length, qualitatively, by a piece of string but we cannot express their length, quantitatively, in terms of numbers. The discovery of this ineliminable gap was a threat to the power of numbers. So, it was swept under the rug by their discoverers. However, as Fauconnier and Turner (2002) show, throughout the history of mathematics, the power of numbers actually increased by incorporating these "gaps" into the very notion of number. Zero, negative numbers, irrational numbers, imaginary numbers, and complex numbers all were first "outsiders" but eventually, they turned into "insiders." They changed our *conception* of "number." They enriched our cognitive resources and contributed to the cognitive power of numbers. So, incommensurability is not necessarily a reason for rejection. Ineliminable gaps, far from being a threat, might be opportunities for revising our old conceptions.

Another important notion of "incommensurability" was developed in philosophy of science by Kuhn and Feyerabend. Scientific theories are incommensurable when their viewpoints are so different that it is difficult to maintain one view and make sense of the other. A holistic shift of perspective is needed. This might be interpreted pessimistically: there is no way for a mutual constitutive exchange. In line with Quine's *indeterminacy of translation* we might suspect that there is no shared ground for meaningful exchange. However, mutual exchange in terms of this formal concept of *translation* is just one way of realizing a bilateral co-constitution. As Kuhn (1962) claimed in his later works, instead of *translating* them one can *learn* both languages. So, another way of overcoming the barrier of incommensurability is to become *bilingual* (see Oberheim and Hoyningen-Huene, 2018). Incommensurability *per se* cannot undermine a meaningful bilateral co-constitution.

In sum, the apparent incommensurability between computer and human languages cannot be a reason for the dismissal of the conflation. By contrast, it is a reason for maintaining it. Because, after all, the problem of incommensurability is an old question and we know a lot thanks to philosophy, logic, and linguistics. Computer languages are just mirroring all kinds of problems we have already within our human languages. Maintaining the conflation between human and computer languages might help us to transfer insights between them in order to know both in better ways. In the end, our conceptions of both might change radically.

CONCLUSION

Whenever we have a *simultaneous* maintenance of similarities and differences, we have a case of conflation. It seems vicious, but our cognition works by conflation through and through. Even in ordinary life, we *see* two apples *as* "apples" thanks to conflating them. Some of these conflations are so established that we do not *see* them *as* conflations. They satisfy cognitive goals by effective use of available cognitive and cultural resources. Hence, they do not look like conflations at all. However, they are present under the threshold of our consciousness. They are at work in analogies, metaphors, conceptual blendings, and alike. In all of these cases, a *simultaneous* maintenance of similarity and difference is at work.

Consider "computer language." At first glance it might be seen as an oxymoron: computers are far from language, and putting them together is a bad conflation. It is at best "just a metaphor." However, a closer look would reveal their similarities: how they have shaped and are shaping each other. Computers are borne out of a long chain of conflations: "translations" between different languages in different media. Moreover, we are using computers thanks to many conflations and "translations" happening in real-time, though under the threshold of our awareness.

Computer languages are so similar to human language that similar problems are arising, like the problem of incommensurability. Machine Learning creatures are part of our everyday life. They solve our problems. But, we cannot ask them for reasons behind their solutions. Their style of reasoning is alien to us. Of course, these are mostly our problems, not theirs. Computers are more active and more productive than us. They are learning and speaking our language fast and fluently. However, the inverse is not true. We cannot speak the language of these new intelligent beings. Like it or not, they are coming to us. We should either speak their language or force them to speak ours. It would be a difficult journey. Meanwhile, we have to speak a *lingua franca*, before the emergence of a proper *technolingua*.

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