Informatica per le Digital Humanities
Lecture 2
February 24 2025

Texts

Slide 2

In the past lessons, again with a split trend, we introduced the general problems relating to Digital Humanities, trying to give them a theoretical and methodological definition that would compare the foundations and the differences between the two components.
Now it is up to give a scientific palette to the term DIGITAL, which explores the mathematical, computational and physical foundations that underlie the functioning of the machine.
And this is strictly necessary for DH, remember?
We used a chromatic metaphor to define digital humanities: we must consider this intersection, the relationship in-between, even if not as clear as a defined color, as the true identity of this research field.
It is the structure that we have given to the lessons to fully understand the chromatic metaphor. These Digital Humanities lessons must be understood as a sort of reading with a parallel text, on the one side the technical and methodological bases that underlie the daily use of digital tools and on the other their application to a concrete example to understand better the problems characterizing this production and to look at the technical issues with a historical and sociological gaze.
Today is about the deepening of the mathematical bases, focusing on the fundamentals of the numbers and figures that underlie all these endeavours.

Slide 3

The bibliographic reference for these in-depth computer, mathematical and physical lecture derive in part from this bibliographic source.
In particular, the first four chapters of the book give you the theoretical and philosophical foundations that underlie the term digital and the scientific disciplines that regulate the production of data and their computation.
There will be no specific technicalities in this effort: humanists cannot think of acquiring sufficient computer science knowledge, they don't even have to.
It is also necessary to establish some basic principles, to demonstrate, despite appearances, that this is not magic and that, only by fully understanding the main mechanisms of each language, it is possible to have that state of bidirectional correspondence that is necessary for the co-design work that the DH discipline requires.

Slide 4

Now, focus on the slide: how do you read this image?
How do you read the numbers, the colors, the letters? In truth all these are symbolic codes (where the symbol, as an element of communication, indicates in the mind of the observer a concept other than how the symbol is physically represented, be it a sign, number, gesture, or another entity as in the case that we are going to analyze) that acquire meaning also on the basis of the context.
How do you read this image?

A) archival textual hypothesis: this part of the lesson is referring to items 1 to 4 of a text.
B) mathematical hypothesis: (1 - 4) = -3
To understand a symbol well, as well as life, you need a context: here we are returning to the theme of language.

Slide 5

I take up the problem that we have already posed in the definition of DIGITAL HUMANITIES, and, in trying to identify from the inside what has made the world we are in DIGITAL, we have to deal with the concept of COMPUTATION

It is often implied that computer science began with the first digital electronic computer, which seems to lead to the definition of computer science as the "science of digital electronic computers". Is this a universal definition? The rigorous answer would be no because we can easily find examples of efforts that are fully fledged computer science results but do not have a direct connection with digital electronic computers: Charles Babbage's "analytical engine" was a project started in the first half of the 19th century, that is, an entirely mechanical calculator inspired by Jacquard's loom capable of the four basic arithmetic operations. This clearly shows how one can do computer science without electronic computers and, thus, the definition above seems to be too restrictive. It is more than legitimate then to ask what is the connection between digital electronic computers and Babbage's engine, that is, what enables us to consider indisputably these efforts as part of computer science: the factors creating such connection would be the best candidate for a general definition of the discipline. We are speaking of the concept of computation: the analytical engine performs arithmetic operations, that is, it executes operations on numbers that yield numbers; digital electronic computers are comprised of circuits built insuch a way that they respond to electric impulses with other impulses and such response follows the rules of arithmetic.There is indeed a fundamental, even definitory link between computer science and computation. Let us not forget that one of the pioneers of computer science, Alan Turing, when writing about a "computer" in one of his most important works meant a person who computes, just like "player" means a person who plays. In his article, Turing presents his vision on how to automatize by means of a machine what happens in the brain of a human while they are performing some computation. In the second half of the 20th century,when the pioneering efforts of Babbage and Turing were followed by a number of success stories in the creation of such machines, the term "computer" lost its original meaning and acquired the one we are used to today, and the discipline dealing with computation and how to automatize it was called "computer science"

From *Computer science and art: Contradiction, revolution, evolution*. Available from: https://www.researchgate.net/publication/286269407_Computer_science_and_art_Contradiction_revolution_evolution

Slides 6-9

There are two stops if we go back on the etymological path of "digital".
First stop: modern English *digit* (a sign that we use to express numbers).
Second stop: Latin *digitus* (finger).
The connection is self-explanatory.

Slides 10-13

We've used fingers to count our whole life. It is actually the very first way in which we learn how to count. Fingers provide what we call an *analogy*. An analogy between two entities is that process for which we focus on the characteristics that the two entities share. In this analogy, each finger share the characteristic of being there and being distinct from other things that are there. By exploiting this analogy, we put out one finger for each cat. There are as many fingers as cats; we use fingers to count the cats.
Using digits to count is different: those are signs that have no analogy with the cats, they just carry a meaning we all agree on. '3' means three, and indicates the quantity of fingers or of cats in the first slide; '4' means four, and '5' means five because they are part of an established vocabularly. This is the main distinction between analogue systems (based on an analogy) and digital systems (based on signs that express quantities on the basis of a previously established agreement*).
*You didn't take part in this agreement: you just learned and accepted it when you were a kid and learned words and digits.

Slides 14-18

The meaning of a digit strictly depends on the fact that every person using them shares the agreement around their meaning. With a different sign, those who do not speak Arabic miss the quantity indicated by it (it is still five, only written in a different language).
This is also the fundamental basis of communication: it works only when the speaking parties (the parties exchanging signs) have a common background, also known as shared context, that specifies the meaning of each sign. Only then meaning is transmitted and communication succeds. This is where the "humanities" part kicks in. Since we are speaking of digits, this may be seen as the simplest form of digital humanities.

Slides 19-48

Cats, pipes, watches depicted on a digital screen are not real cats, real pipes, or real watches. Still, the depiction of a text is still a text, because it is about the visualization of signs. From this perspective, images and texts can be put together in the same category.

Slides 49-66

Because of this special characteristics, and because they are a fundamental component of humanities in general, it is worth focusing on texts and starting from them. Of all the activities associated with them, "encoding" is the most important because it acts as foundation to everything else that happens in the digital world.
Encoding means mapping entities onto numbers.
Decoding means mapping numbers back onto the initial entities.
Inbetween lies the computer, a machine that works on numbers.
Encoding, giving the input numbers to a computer, letting the computer crunch those numbers, obtaining output numbers from it, and decoding them is the way in which we use computers (for whatever we want to do with them).

Slides 67-76

Despite some apparent visual similarity, abaci do not have anything to do with encoding.

Abaci are analog systems: there is a bead for every entity that we count. Digital systems use encoding to map entities onto numbers by means of a convention that needs a general agreement (think of when you need to update your emoji set).

Slides 77-78

This does not mean that computers are digital by definition, or they are necessarily so.
After all, Babbage's machine was a computer, but it was analog (based on mechanisms whose rotation steps were analog to numbers). Computers today are digital because they happen to be: some discoveries and inventions in the 20th century enabled us to create digital computers that were much faster and smaller than any analog version.