Cross-cultural timeline of the history of thought of the artificial

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Abstract. The current world landscape in opinions and attitudes about robotics is highly variegated in different parts of the world. This landscape is a result of the sum of the effects of multiple factors, which date from millennia ago, as waves of philosophical thought, religion and historical events overlapped and allegedly influenced the concept of human and of the artificial. This paper provides a survey of such factors, and attempts to trace possible lines between causes and consequences. The analysis seems to indicate the presence of a West/East split which marks the main differences in intending the role of social agents, humanoids, transhumanism and labour automation.

Keywords: history of robotics, culture, humanoids

1 Introduction

Worldwide research in robotics is aware of the different approaches in the development and diffusion of these new technologies. Typically Asia, and in particular Japan, are seen as poles of advancement, especially regarding the realisation of humanoids, whereas Western countries are less akin to the purpose of replicating humans. This is happening despite the origin of the concept of robot came from Europe (the Czech word *robota* meaning "forced labour"). Kaplan [1] debated the reason why the Western world is more afraid of the humanoid, and concluded that Westerners are fascinated and afraid by new machines, while in Japan machines do not seem to affect human specificity."

One limitation of this analysis is that the fear of the humanoid goes beyond the proposed concept, and sometimes touches neurological reasons (uncanny robots appearance) or concrete worries (fear of losing jobs). Therefore, it is necessary to distinguish in which aspects automation is seen negatively.

A vast literature covered comparative studies of human-robot interaction; however, the core of this literature mainly revolves around West v East (where West often means the US, and East typically only means Japan). A more extensive analysis is thus necessary, digging into history in all different parts of the world.

As Nisbett [2] stated, the differences between East and West in cognition, due to differing ecologies, social structures, philosophies, and educational systems, trace back to ancient Greece and China. In fact, some similarities among these ancient cultures are present, involving puppets and automata. Millennia later, the landscape has completely changed as civilisations parted ways of thought. What happened in between is the research question of the present contribution.

In different parts of the world, different lines of thought arrived to opposite conclusions regarding robots, and in particular humanoids. Multiple factors, tracing back to philosophy, history, religion and society, apparently prompt or hinder the development and the application of robots in societies nowadays. The goal of this paper is to connect the threads that lead the past to the present, and understand where are the criticalities.

2 The Part Ways – West to East

2.1 Latin America

While there is no trace of the idea of automation in Aztec, Maya and Inca civilisations, one interesting note in pre-Columbian Americas is the tale of the revolt of the objects (Figure 1), depicted in Moche civilisation (150 to 700 A.D:, pre-Inca civilization present in the northern coast of Peru) [3], which parallels the current view of revolting robots. This odd episode reveals the fear of lack of control of the world order, which is based on fragile balance of nature and is maintained by sacrifices [4].

Mesoamerican civilisations shared many common traits, one of them being the use of human sacrifices, originating from the belief of a pact of blood with gods, who shed blood first for the humanity [5]. The relevant aspect of this fact is the human specificity in sacrifice: it was not possible to spare a human and obtain the same favour from the gods. Sacrifices were most common in Mexico, although also in South America studies [6] mention the taxonomic differentiation of wild and domestic species in sacrifices.

When immigration from other continents began, African Witchcraft and Turanic Shamanism were also imported and blended up with Christianity as well. Through the principle of resemblance, a humanoid doll or a similar representation is believed to generate an impact on a living person, operated by a shaman [7]. These kinds of practices are still executed nowadays. The connection of human figures with spirits slightly resemble animism of Eastern religions.

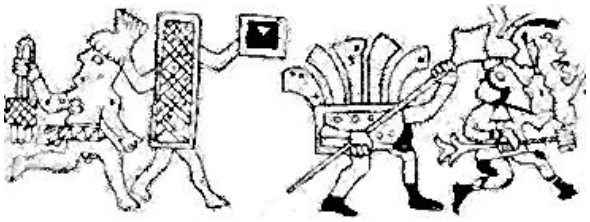

Fig. 1. Detail of the “Revolt of the Objects” from Moche culture.

On the other hand, Spanish conquest has added the cultural layer of Christian Catholicism in its most strict form (the Inquisition). The use of actuating a crucifix to help confirming a defendant guilty [8] represents the only real precedent - a negative one - of automation in Latin America.

2.2 Europe and Western culture

The idea of machines traces back to Ancient Greece: artificial servants like Hephaestus's helpers, made by the gods to serve the gods [9], autonomous ships, the legendary bronze giant Talos, and the myth of Pygmalion [10]. Some automata were actually built: such as the "magic" opening of temple doors when a fire was lit in an altar: their purpose was to surprise and amuse [11]. Besides automata, from the writings of Herodotus [12] we also know about puppets moved by strings being used in religious festivals in Egypt and later in Rome. One famous episode: in 44 B.C., at the funeral of Julius Caesar, Marc Antony made use of a puppet actuated by a mechanical device. It was rotated to show the knife wounds and incite the emotional reaction of the angry mob.

The advent of monotheism view brought concepts borrowed from Judaism, like the desacralisation of nature [13] and the rejection of magic, which tend to make robots and automated objects appear like mere machines, which should be seen suspiciously for their autonomy. This might be the background that leads to the tale of the golem, present in Jewish folklore since only the 16th Century. The golem, a man-made creature built from clay or mud, went out of control and had to be destroyed. This story represents an example of hubris, is allegedly at the origin of the fear of man-made creatures called Frankenstein complex [14], which was reproduced in similar stories (Figure 2). A first attempt at regulation of machines autonomy, however, comes from Europe, with the famous Three Laws of Robotics by Asimov [15].

While Israel developed in its own peculiar way (see the set of rules existing about the Sabbath, prompting the need of home automation), Christian countries developed on the top of the pre-existing beliefs. The production of automata related to the concept of "enchantment of technology" [16]. Though the Middle Ages and later, mechanical angels and fire-breathing devils were designed, patronised by the Catholic Church [17].

Conversely, while the Church never prohibited the advancement of technology and the realisation of machines, some aspects of the faith may be interpreted in opposition to the concept of intelligent machines. The dualistic view of soul renders a machine "soulless", and the concept of body as a gift from God, in common with the other monotheistic religions (e.g. "body is a gift from Allah/God"). This may lead to more conservative views regarding the possibilities of "enhancing" the human body.

Nevertheless, Western culture was influenced by concepts present in Genesis (1:26–28): "mankind is created as an "image of God" and receives the mission to "fill the Earth and subdue it" and to rule over the animals. As a consequence, the study of the created nature itself was a legitimate way of understanding God [13].

After the Renaissance, the power of creation has "shifted from gods to humans" [17], and anthropocentrism became a central thought also in philosophy. It is worth to mention the influential role of Descartes: his passive mechanical thoughts of the separation

between body and soul, in which the body is regarded as soulless. In the res *cogitans* / *res extensa* dualism, animals are mere machines unable to think, while man masters and owns nature [18].

The emphasis on science led to the Industrial Revolution, in which we can find the episode of Luddism in the UK, in which protesting groups destroyed textile machinery. The fear of losing jobs was based on concrete evidence, although new jobs were eventually created.

The advent of the two World Wars, which particularly hit Europe, left a deep trace that is visible in Western philosophy and arts, in a pessimistic view of man's tendency to go against his self-interest with an immense destruction power [19]. Science-fiction arguably reinforced the Frankenstein Complex with this new awareness.

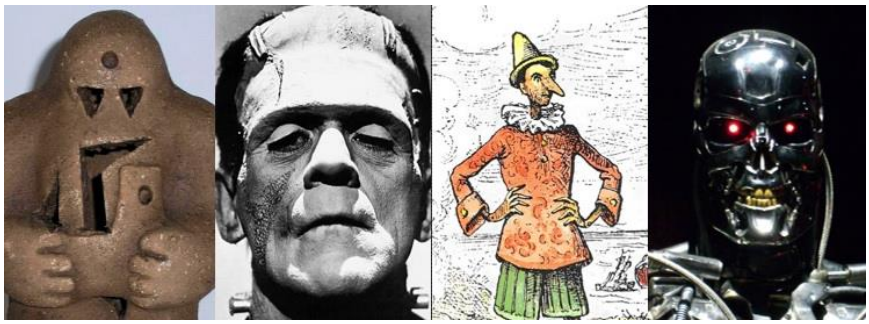

Fig. 2. Four creatures which went out of human control: from left to right the Golem, the Creature from Frankenstein, Pinocchio and Terminator.

2.3 Middle East

The peculiarities of this area as opposed to the Ancient World take place with the rise of Islam. It's the Arabian golden age that had a world-wide impact on science. Ismail al-Jazari, a scholar who lived in the 12th Century in present day Turkey, described fountains and musical automata [20]. Rosheim [21] stated that the Arabs were interested not only in dramatic illusion but also in manipulating the environment for practical applications.

The Middle East is characterised by the traits of the monotheistic religions, and the philosophical thought evolved in the same direction of distance between man and God. For example, Islamic scholar Mohammad-Ali Taskhiri also discussed the concept of dignity, intended as a state to which all humans have equal potential, as long as they live a life pleasing to the eyes of God [22]. The consequence is that a robot should be able to tell right from wrong, matching its dignity to the one of a human and complying the religious laws [23].

The most peculiar issue with Islam is due to iconoclasm. Islam prohibits the depiction of living beings, either animal or human, especially in sacred spaces, as depicting them would be considered same as adopting the role of creator [24].

In the Middle East, society rules and state laws are often blended with religious beliefs, and the understanding of cultural norms of the country is particularly necessary

for ensuring technology acceptance [25], as the attempt to take power over nature by science or techniques could be seen as an offense against Allah's omnipotence [26]. Iconoclasm, however, is not necessarily a common issue to all the Islamic world and shall not be generalised: even in Persia, depiction of humans has been widespread in certain historical periods, and the Middle East does not represent the most populous area of Muslims.

2.4 India

The Indian subcontinent, one the largest Islamic areas by population, has always had a completely opposite approach regarding the embodiment of the sacred compared to the Middle Eastern Islamic approach. This can be seen in theology in the mystical symbolism of the traits of the human face [27]. The Bhagavad Gita scripture states a God with a form is necessary due to the human use of senses.

Since ancient times, puppet shows have been a tool to convey stories regarding Hindu gods and Puranic legends [28], and the use of Murti is widespread. The construction of automata with human/animal figures is documented (the tiger of the Islamic ruler Tipu Sultan [29] in Figure 3, left).

In the ancient Vedic civilisation, there were already references of machines in ancient texts (the Sanskrit term Yantra may be translated as machine). In particular, in Yoga Vasishta [30] it is mentioned that an Asura named Sambarasura created three robots without sentiments, and in the Mahabharata [31] there is a reference of a gigantic human-like machine named Kumbhakarna.

Hinduism conceives God as a multiplicity and accepts different ways of worship. We argue that this inclusive nature of Hinduism towards other religions) and the multiculturality of the populations in the Indian subcontinent may help acceptance of robots, in particular if employed in a religious application.

Especially in Hindu Tantric, rituals are of preeminent importance, as repetition and chanting of mantra are performed over and over again, while the concept of "vain repetitions" has been bitterly criticised, for instance, by Christian Protestants [32]. Being a repetitive action, it may lead to tedium [32]: we argue that, a philosophy in which the action of ritual itself is more important that the content may prompt the delegation of ritual. The Ganapati Bappachi Robotic Aarti [33] is an example of such delegation to a robotic arm.

Fig. 3. Tipu's Tiger: automata made for an Islamic Sultan (left); extreme anthropomorphism in Japanese onigiri (right).

2.5 East Asia

East Asia is tied to India for having received the influence of waves of spirituality and ideals [34]. In Asian countries it is possible to encounter different shades of people's religion, as Confucianism, Buddhism, Taoism and Shinto are not reciprocally exclusive, and influenced each other.

Taoism is the oldest among these religions, and is one that encourages people to concentrate on the present real world rather than on the afterlife. Conversely, the dream to become "immortal Taoist sages in a fairyland" is an ultimate goal for the Taoist [35]. Weng et al. debate whether this dream can be helped by the use of robotics. Another interesting aspect of Taoism is the concept of harmony between man and nature, in which "man must control his own conduct without violating the law of nature" [13]. Unlike Europe, dominated by anthropocentrism, this relationship implies that man is born from nature.

From Buddhism originated the concept by Mori [36] that robots have the Buddha-nature and the potential for attaining Buddhahood, deserving the same compassion that all living beings receive. Also related to Buddhism we can find historical traces, in southern China, Korea and Sri Lanka, of the use of shadow puppets [37]. China has a long tradition of shadow puppets, whose connotations were not always positive (like in the case of bringing back alive the spirit of the dead on a shadow screen [28]).

Confucianism then dominated society in Sinosphere, and its approach to science, which emphasises collectivism and pragmatism [38]. This can be seen in contemporary times, as the push to modernisation [39] is also bringing automatisation of labour.

Japan is a special case within East Asia because of the many components that built up its culture and of the prominent role in robotics.

Deriving from the Confucian animistic conception of religion, that ascribes souls to all living and non-living objects, and the harmony of Taoism, Shinto, puts emphasis on nature worship and leads to the belief that inanimate things are sacred objects at its core [40]. Shintoist Japan has an additional peculiarity as anthropomorphism has been a trait present since the 12th Century, proven by the animals depicted in the Chōjū-jinbutsu-giga scrolls [41], and is visible nowadays from the degree of objects that - literally - have a face (Figure 3, right).

3 Discussion and Conclusion

In this last part, we summarise the data collected from all the sources, and try to draw lines between the main factors examined and the criteria of attitude towards robots, which is relevant today as may represent cultural barriers to the concrete application in the societies.

Macro cultural areas are synthesised in Fig. 4. As categorisation of cultural areas is highly inconsistent in Sociology and Anthropology, for our analysis we adapted areas defined in [42]. This representation is necessarily simplified and not inclusive of exceptions within each group.

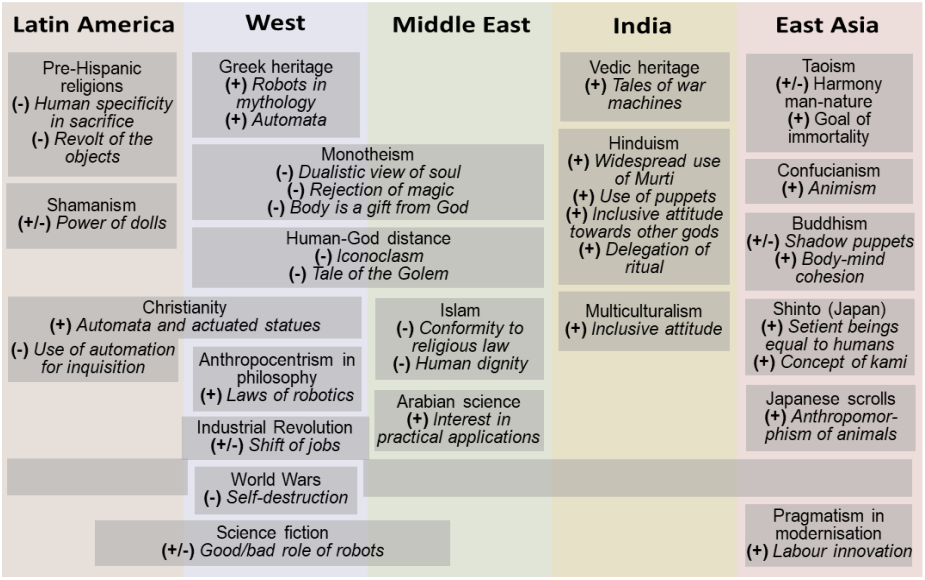

Fig. 4. The cross-cultural timeline. In vertical, cultural groups with each block indicating a topic, and specifically an aspect which may have caused a positive (+) or negative (-) effect into some aspect of attitude towards robots.

We consider four important criteria, partially corresponding to previous research by Dihal [43], on which the approach towards robots is radically different across the world nowadays, and discuss them in 3.1.

3.1 The Four Criteria

A. Social: robots as mere tools v robots as social agents

Factors that influence this aspect of the attitude seem to revolve around the concept of soul: whether it is in every object, or a separate entity from the body, and whether an object with social capabilities would possess a moral, or rather be considered magic, with its possible negative connotations. In other words, in Western perception, a conversational robot who displays emotions may be regarded as a fraud. In these regards, the Eastern philosophies and the Native American connection of human figures with spirits provide a much more favourable terrain for robots to be credible social agents. This can be seen in Japan, where 8 million Gods and spirits exist in natural environments [35], and the leading role of Japan in developing social companions (Aibo, Kirobo, Lovot, Pepper, etc.).

B. Human-likeness: Frankenstein complex v development of humanoids

Two are the main factors: anthropocentrism and the distance from God. In all the cultures where the human being is considered unique (including Mesoamerica), its re-

placement is more difficult, including with an artificial version of it. Moreover, if humans are inferior to gods, their ability to replicate themselves may be insufficient, implying that a man-made humanoid robot will be faulty. These complications may be even more critical when depiction of human figures is associated with a negative perception: iconoclasm should be considered as an additional barrier for the development of humanoids, as their making would be open to a wrong interpretation.

C. Human biology: Bio-conservatism v Transhumanism

The main concept related to the modification of human biology (which is opposed in Bio-conservatism and advocated in Transhumanism) seems to be deriving from the concept of body - intended as a gift from the monotheistic God - which should not be altered, or rather as part of nature, as in Taoism. These opposing stances may influence the boundaries of what is considered "natural" when dealing with Cybernetics. It is worth mentioning the strict stance of the Catholic Church in these matters.

D. Labour: robots as job stealers v robots as job helpers

History may be the main factor that influences this aspect: the concrete change of society caused by new technologies is evident. The fear of unemployment caused by automation is a common concern despite that the original purpose (and etymology) of modern robots is labour. In case of the Middle East and East Asia, the philosophical attitude towards science may as well have a positive impact in the application of modern robotics. However, rather than cultural areas, single countries may adopt different approaches depending on their own pragmatism. Moreover, the attitude of first developers of technologies and the one of late adopters can be different as well. A late adoption of a technology may bring distortions as well as new possibilities. The future employment of robots in the societies will depend on a combination of these factors.

3.2 Overall view

An overall view of the cross-cultural timeline seems to indicate a "West/East split", with the sharpest division occurring between the Middle East and India, considering the many aspects in common within the two sides.

The greatest difference regarding the concept of human, which acts as a underlying factor, could be synthesised with the "metaphysical triangle" [26][44], measuring the distance among the components God/Man/Nature. A greater separation between the profane and the divine, and the active role of man may have fuelled the invention of robots in the West, but at the same time put a limit to the innovation, which application in the most extreme senses was taken over by the East.

This collection of implications cannot be considered evidence, but rather as hypotheses, which contribute to shed some light to the background of the evolution of robotics worldwide. As for the concrete direction of future research, the authors suggest, when designing and employing robots in different parts of the world, to consider case by case the implications within the four criteria A/B/C/D of the new technology, and deduct the risks and opportunities.

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