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APPLYING ETHOLOGY TO DESIGN HUMAN-ORIENTED TECHNOLOGY. AN EXPERIMENTAL STUDY ON THE SIGNALLING ROLE OF THE LABELLING EFFECT IN TECHNOLOGY'S EMPOWERMENT

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Abstract: *We transpose ethological and sociological theory on autonomous technology management using two signals: country of origin and security certificate status. Our research shows that to understand the degree of attractiveness of human-oriented technology that has been techno-empowered, we should analyze the natural interspecies interaction taking place in the ecological niche. A 2×4 between-subject experiment on a fictitious brand was designed to test three hypotheses regarding autonomous office assistant empowerment. Two hundred ninety-five people (54% females) participated in the study. We found that people have a higher intention to use autonomous office assistants if their country of origin is unknown but a security certificate is provided. Gender moderates the 'label effect' so that females have a higher intention to allow autonomous office assistant to make independent decisions if they do not know the country of origin but a safety certificate is provided, whereas for males, neither of these labels influences such intention significantly.*

Keywords: *techno-empowerment, autonomous system, technology acceptance, ethology, country of origin, certification, new technology management.*

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INTRODUCTION

Breakthroughs in research on artificial intelligence and its applicability are changing human organizations. Most significantly, non-human agents are appearing that help organizations fulfil their mission. Here it suffices to mention algorithms that collect and process data (Akerkar, 2019) which organizations use to achieve a competitive advantage (McAfee & Brynjolfsson, 2017); digital workforces that perform tasks faster (Kaplan & Haenlein, 2018) while making fewer mistakes than human beings (Makridakis, 2017); and intelligent systems that optimize the internal environment (Cook et al., 2009) and connect various devices in the workplace (Nappi and de Campos Ribeiro, 2020). Intelligent machines may be "complementary" (CIMs) and/or "substitutive" (SIMs) towards the human workforce (Modliński and Pinto, 2020). SIMs replace people fully in the workplace, which generates criticism for potentially causing structural unemployment (Gilbert & Oladi, 2021) and social polarization (Jones, 2013). CIMs, on the other hand, are based on the assumption that humans and machines may achieve more working together than working independently. The desire to achieve such a human-machine synergy effect has driven the development of organic teams (Daugherty & Wilson, 2018); it is readily visible in healthcare (David, 2017), mechanical industries (Maurta et al., 2017), and security (Winn, 2020, Lyons et al., 2020). Although just a few years ago it was the human being who enjoyed a privileged role in such relationships, that status quo is now being altered.

Throughout the first decade of the Twenty-first century, all non-human agents based on artificial intelligence were subordinate to humans. Thanks to the dynamic development of machine learning, however, such agents are now able to make decisions on their own (Endsley, 2016). The process of transferring autonomy in decision-making to technology has been conceptualized as techno-empowerment (Modliński & Skowroński, 2021). Not surprisingly, the consequences of techno-empowering artificial agents to make significant decisions can be ambiguous. People are, for example, opposed to machines making decisions when human lives or an enterprise's condition depends on them (Modliński, 2021a). Nevertheless, current research shows that machines can make decisions as accurately as human beings – or even outperform them, with regard to their rate of failures (Phillips-Wren and Jain, 2006). This is why the concepts of autonomous vehicles (Beecrof, 2019), autonomous assistants (Daugherty and Wilson, 2018), artificially intelligent cybersecurity (Galina & Zarina, 2019), and smart finance (Pettigrew et al., 2018) are dynamically growing. However, a significant restraining force for autonomous machines is the human feeling of insecurity and fear of such technology.

A key challenge for the effective use of intelligent technologies is the low level of trust possessed by their potential users. There exists a plethora of research regarding human trust and acceptance of such technology (see more: Schaefer et al., 2016), and we will attempt to provide a new perspective on this issue, without exhaustively recounting the existing literature in this text. With regard to the more specific question of trust towards fully autonomous technologies, meanwhile, the literature is more scarce. There are two main bodies of research in the field. The first has been developed by researchers following Bohlen and Beal's (1957) model, which assumes that to increase trust, attitudes, and acceptance, the alpha users (innovators) should primarily be identified and targeted. In consequence, there are several user-oriented studies that have found that people differ in their perceptions of autonomous technology depending on culture (Xu & Fan, 2019), gender (Charness et al., 2019), age, educational background (Hudson et al., 2019), and religion (Modliński et al., 2021). Some of the research, however, has provided contradictory results (Tennant et al., 2019). The second stream of research is more machine-oriented, as its authors try to identify what features of machines increase human attitudes and trust towards such technology. Two substreams may be named here: research focused on appearance (RFA), and research focused on behavior (RFB). RFA investigates the role of embodiment in machines' acceptance. Researchers working in this field are highly focused on anthropomorphic cues (Waytz et al., 2014, De Visser et al., 2017), suggesting that the more humanlike an embodiment a machine possesses, the higher the acceptance and trust by its users (Boray et al., 2021). RFB, on the other hand, investigates the influence of a machine's behavior on its acceptance, suggesting, e.g., that a machine's display of empathy (Pelatu et al., 2021) or use of humor (Tay et al., 2016) or persuasion (Fogg, 2003) increases its chances of gaining human acceptance. Although there has been research connected with the natural sciences explaining, e.g., the role of oxytocin on trust towards machines (De Visser et al., 2017), such interdisciplinary approach is extremely rare in the current literature. Inspired by the research lacunas identified by Hancock et al. (2011), we believe that the problem of autonomous machines' acceptance may be considered from yet another perspective: that of natural interactions between actors in an ecological niche. Our paper offers three contribution to current theory and practice. First of all, we show that a country-of-origin label may deter customers from empowering or using empowered technology. Second, we found that a safety certificate serves as an encouraging signal that increases human beings' intention to empower autonomous assistants. Third, we demonstrate that the labelling effect is stronger in females than males, which suggest that companies primarily targeting females should pay greater attention to what signals they are really sending.

For these reasons, we – first of all – refer to ethology and signalling theory to provide a general picture of the so-called "labelling effect" and then transpose it to autonomous technology management. We presume that labels may be compared to the signals that living organisms detect in nature and use to estimate risk. Two such labels are frequently provided in the case of advanced technology: country of origin and safety certificates. Second, we describe the country-of-origin (COO) label in the context of autonomous technology's empowerment. We found that although the COO effect is one of the most described concepts in marketing literature, there is not yet any research suggesting how it relates to technology making autonomous decisions. Third, we describe the certification effect in the high-tech industry, suggesting that it may serve as an encouraging signal for potential users. We then refer to differences between males and females in the receiving of signals and contextualize them with the aid of cultural and ethological theories. Finally, we construct the model which we test in the experimental study.

CONCEPTUAL BACKGROUND

Labels and signalling theory

Each organism on Earth lives in some ecological niche and has specific functions within it. While for Grinnell (1917) a niche is a specific physical place of an organism in an ecosystem, for Elton (2001) a niche indicates an organism's particular place in the structure and in interspecies interactions. These interactions can be antagonistic or non-antagonistic (Krebs, 2008). Non-antagonistic interactions mean that neither side of the interaction is harmed but sometimes may benefit. Such interactions include symbiosis (mutual benefit) and commensalism (one-sided benefit) (Krebs, 2008). Antagonistic interactions, on the other hand, mean that the relationship will prove unfavorable for at least one side. Examples of such interactions are competition (the fight for a common resource), parasitism (where the coexistence of organisms benefits only one of them), and predation (where one side of the interaction is killed and consumed). As it is presumed that the primary function of any organism is survival and development, it enters into various relationships with representatives of its own and other species in order to achieve that goal. Examples include mating in order to pass on genes to the next generation (reproduction), forming a herd (protection), creating tools (more efficient access to resources), or struggling for territory (maintaining a place in a niche).

Practical example 1 – Rethink Robotics and the idea of cobotics

One of the more popular emerging ideas related to industrial technology that is based on a commensalistic relationship between machines and humans is that of 'cobotics.' Cobotics is a combination of the words 'collaborative' and 'robots'; it presumes that e-synergy can be achieved by designing friendly cooperation between agents. One of the pioneers in this area has been the organization Rethink Robotics, which designs solutions that are based on close cooperation between humans and machines and that make use of their unique skills. Moreover, in their model, a robot is designed to send positive signals to employees. As part of this concept, we can meet machines with screens that use facial expressions and voice modulation, that initiate conversations, and that learn the preferences of employees.

To survive and develop in a niche, organisms must somehow be able to recognize the forms of interaction they enter into. According to this logic, they generally attempt to engage in non-antagonistic interactions and avoid antagonistic interactions that are unfavorable to them. They are able to do this thanks to signals that have developed through the process of evolution. Living organisms send signals that allow another party to enter into interaction or avoid it; each animal species uses specific signals that, thanks to natural selection, are continually changing. It is crucial for a living organism to recognize such signals, as this allows it to take advantage of opportunities or avoid dangers. Some animals have even developed mechanisms for "cheating" other parties of the interaction (e.g., mimicry or camouflage) in order to achieve their main objective. Within the biological niche, we are dealing with signals that deter or encourage. A deterrent signal warns recipients against becoming the victim of a predator and/or proclaims the signaller's advantage over competitors. An example is aposematism – e.g., the production of vibrant colors that indicate an organism's possession of a deadly poison (Santos et al., 2003) – or long tusks that suggest physical strength. An encouraging signal, meanwhile, is meant to persuade another party to get involved in a relationship. It may be used in relation to mating or the obtaining of food. When forming pairs, a female looks for signals that a male has genes that might allow her offspring to survive (Kirkpatrick, 1982). Peacocks are an example of this: insofar as a large peacock tail is less susceptible to parasites, the bigger its tail, the greater a male's reproductive chances will be (Hamilton and Zuk, 1982). The relationship of sharks and pilot fish constitute an example with regard to the obtaining of food. A shark tolerates pilot fish, which protect it by eating parasites and cleaning its mouth. The shark recognizes pilot fish by characteristic signals in the form of their colors (Magnuson and Godding, 1971).

Practical example 2 – Boston Dynamics and their 'predators'

The American company Boston Dynamics is a pioneer in creating autonomous robots that mimic certain features and abilities of real animals. In one of their experiments, participants expressed confusion and unease caused by a robot that, in many ways, looks and moves like a dog. Interestingly, people watching the robodogs had problems with reading the signals sent by this machine, and they were concerned by the lack of reference points that people look for in live dogs (e.g., the emotions displayed through a dog's eyes or the sounds it makes). In the case of these zoomorphic machines, the lack of certain reference elements turned out to be a deterrent signal that worried the research participants.

In connection with the evolutionary process that has found human beings living in a specific niche, a human being also becomes a sender and receiver of signals. The recognition of signals between humans and other animals is considered paradigmatic and need not be demonstrated here in detail. However, it turns out that in the emerging era of artificial intelligence, signalling also applies to machines, which is suggested by several examples. First, people fear and avoid humanoid machines that do not seem to fully imitate humans (Mori et al., 2012). Thus, imperfect imitation is a deterrent signal. Second, people engage in relationships with machines when they match their aesthetic tastes (Kuntsevich, 2018). In this way, their appearance becomes an encouraging signal. And third, when a machine bears a resemblance to a known predator, humans avoid it (O'Brien, 2018). Thus, its appearance may also be a deterrent signal. A few years ago, in their groundbreaking article, Nass and Moon (2000) indicated that human beings apply similar heuristics to both humans and computers. Their research initiated development of the CASA (Computer Are Social Actors) theory and provided a plethora of examples in favor of its assumptions. Since then, however, the advances made in artificial intelligence and autonomous system are quite considerable. Subsequent generations of humanoids, technomorphs, and androids have emerged that resemble already-living creatures or that seem to suggest completely new groups of entities. Such machines are increasingly gaining autonomy in learning and decision-making processes – and doubts are arising regarding how to classify such autonomous entities that use intelligence and learn. Are they still merely "tools," or do they constitute some sort of para-species? The more interdisciplinary the discussion becomes, the more differences of opinion appear. In this text, we do not propose a definitive answer to this question. Rather, we stress that the reasoning developed by Nass and Moon (2020) in CASA theory may be extended even deeper – crossing the social border and reaching, at least partially, into the context of natural environments. The three signal responses that we noted earlier in this paragraph suggest that humans might behave towards an autonomous machine as if it were a natural subject capable of interaction – constantly seeking signals that might forecast the outcome of such interaction (i.e., antagonistic or non-antagonistic). Using the experimental method, we attempt to show that the *labels* that a machine has been given can serve as a kind of deterrent and/or encouraging signal that human beings rely on when determining whether or not to become involved in interaction.

Practical example 3 – The humanoid Sofia and its ambiguous signals

A remarkable example of a signalling effect was noticed among some people who had the opportunity to personally interact with the humanoid robot Sofia. Clear hesitation and anxiety were noted in the initial interaction. The fact of incomplete mimicking feedback and uncoordinated movements meant that observers did not know what to expect from such a creature. They thus had to look more deeply for answers in the signals sent by Sofia, in order to intuitively understand whether the interactions with this technology would be antagonistic or peaceful. It is believed that in the future, it will also be possible to explain Mori's 'Uncanny Valley' phenomenon, which has been studied since the early 1970s, through an understanding of interspecies interactions.

Country of origin effect (deterrent signal)

The country-of-origin (COO) effect is among the marketing concepts most widely described in the literature: it asserts that people evaluate products according to the country in which they were produced (Roth and Romeo, 1992; Koschate-Fischer et al., 2012). COO labels help customers differentiate between products, especially when they have little information about their features (Lusk et al., 2006); this suggests associations with subconscious signals received in nature. Such an effect also applies to advanced technology (Sevanandee and Damar-Ladkoo, 2018). The more advanced (Ahmed and d'Astous, 2001) and complex (Laroche et al., 2005) a technology is, the more significant the country of origin is to customers who purchase and use it. People appear to cluster countries into "developed" and "developing" ones, preferring high-tech goods from developed countries that are supposed to provide higher quality (Gaedeke, 1973; Mostafa, 2015). This is due to the fact that people feel a fear of technology and attempt to reduce it by making more rational choices. Higgins and Shanklin (1992) proposed four types of such fears: a fear of complexity, fear of obsolescence, fear of being physically harmed, and fear of being socially excluded. It seems, however, that in the era of artificially intelligent autonomous technology, a fifth type is appearing, which is the fear of being replaced by a machine (Modliński, 2021). Translating this to previously used ethological reasoning, a human being may perceive autonomous technology as a competitor and seek signals that can suggest the degree of danger.

People and other animals form herds for various reasons, and there is no clear consensus on why this happens. Some contend that it is animals' attempt to protect themselves (Hamilton, 1971), while others have found that living in groups helps animals to achieve more (Bourke, 2011). In either case, living in groups leads to the emergence of group identification. In the case of human beings, its foundations are shared values, norms, and behavior. When the members of various groups meet each other, they seek signals to assess whether the opposite group will involve them in antagonistic or non-antagonistic interaction. When foreigners appear, they must meet specific criteria to become included in the group (e.g., by receiving the right to vote in elections). One of these is eliminating former affiliations (Blais et al., 2001).

Practical example 4 – Huawei and its 'deterrent signals'

The forms of government possessed by countries and their involvement in international conflicts significantly influence the perception of technology. One of the most notable examples is the case of the Chinese company Huawei, whose technology has raised concerns in the United States over reports of its use in espionage. In many Western countries, China is seen as an authoritarian country that uses technology to track citizens. It is clearly noted that this belief is beginning to affect the perception of Chinese technology. In other words, while the technology itself appears to be deprived of nationality, the country of production seems to have a strong influence on the collective imagination.

If – as supposed in the previous paragraphs – people perceive autonomous technology in the natural-social context, then they should be less inclined to give it autonomy in decision-making (i.e., a privilege of being part of their own group) when such technology sends signals about its origins (through possession of a label indicating its place of production) that suggest that it belongs to a different social group (i.e., a foreign country). That is, we suppose that in the case of an autonomous machine, a label with a country of origin automatically ascribes such an object to an already existing, socio-political picture; this serves as a deterrent signal that discourages human beings from empowering it. For this reason, the following hypothesis may be proposed:

H1a: People have a stronger intention to allow autonomous office assistants to make independent decisions when the assistants' country of origin is unknown than when it is known.

Safety certification (encouraging signal)

In the era of stakeholder empowerment, consumers have greater access to information about a company, its particular offer, alternatives in the market, and other customers' experiences. In accessing such data, they are actively seeking information that they need to make a purchase. Insofar as a "certificate" is a signal sent by the certifying entity that an object meets certain criteria and possesses certain qualities (Kim and Kwon, 2015), companies may apply for one and display it to customers in the form of labels. This trend is particularly evident when it comes to eco-labelling and innovation labelling. Eco-labels are signals that provide clear information to customers that a product meets certain standards of sustainability that correspond with customers' values (Sörqvist et al. l., 2015). The innovation labels used in some countries indicate that a particular company has a reliable technological background and should continue to develop in an above-average manner the upcoming years (Kim et al., 2020).

The high-tech industry is sensitive to labeling, due to the fact that the greater the uncertainty regarding a type of offered product, the stronger the certification effect (Puri, 1996; Kim and Kwon, 2015). Current research shows that people may display higher trust in AI if the device manifesting it possesses a certificate (Bedué and Fritzsche, 2021). Moreover, announcing certification correlates positively with abnormal market value creation and greater-than-average market returns (Deane et al. l., 2019), which suggests that this label fulfills its market function.

As human beings apply similar heuristics to robots and other humans (Nass and Moon, 2000), the possession of certificates by a human employee and autonomous robot may have similar outcomes. When it comes to people, certificates emphasize their skills and competencies. In high-tech businesses, such individuals have greater chances of being selected by a company during the recruitment process (Félix Rodríguez et al. l., 2011), even if experience is valued the most. As companies prefer to hire already competent employees than to invest in employees' education from scratch (Toh et al., 2008), recruiting and maintaining a person possessing a certificate may reduce the risk linked with selection of unqualified candidates. It suggests that a certificate may serve as an encouraging signal for IT recruiters and increase the chances of being incorporated into the organizational community.

Practical example 5 – Greenguard, EU Energy Label and their meanings

People routinely look for certificates when choosing high-tech products. This is evidenced by the existence of over 100 labels that, through their symbols, certify that specific standards and values important for users are being fulfilled. The flagship examples of certification in high-tech industries include GREENGUARD (indicating low chemical emission) and the EU Energy Label (indicating energy-efficiency class). The Edelman 2018 Earned Brand report clearly demonstrates that there is a growing number of people considering certification when choosing new technologies; this is due to the complex language of technological specifications that average users do not understand. A specific certification mark (like GREENGUARD) is a simplified signal intended to give the user a sense of rational choice.

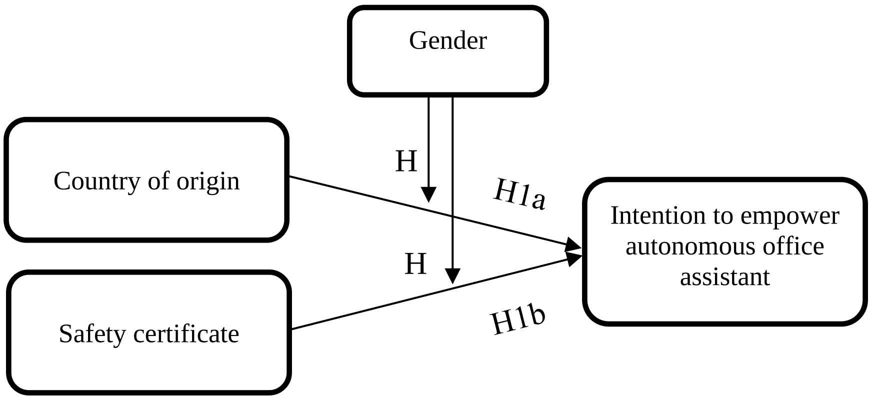
As it turns out that the primary concern in the case of autonomous technology is perceived risk and fear, a certificate proving that such technology is safe should thus serve as an encouraging signal that contributes to greater acceptance of the technology. Thus, we supposed that:

H1b: People have a greater intention of allowing autonomous office assistants to make independent decisions if the assistants possess a safety certificate than if they lack such a certificate.

Gender and the label effect

People attach different importance to the signals they receive, depending on gender. Human males are generally greater risk-takers than females (Turner and McClure, 2003), and this correlation occurs regardless of culture (Zinkhan and Karande, 1991). Females are proven to be more risk-averse, especially when it comes to financial decisions (Suzuki and Avellaneda, 2017) and managing households (Jianakoplos and Bernasek, 1998). Some research suggests that males more often ignore the signals that they receive, for example, when driving a car or engaging in high-risk behaviors (Parker et al., 1995). Females are more anxious about autonomous technology, reporting greater security concerns (Acheampong and Cugurullo, 2019). Males, on the other hand, are more likely to be gadgeteers who use new technology to impress those in their environment, increase their social status, and attract the interest of females (Hrdy, 1980; Wood and Hoeffler, 2013). Such differences may have both cultural and natural reasons. The former involves differences in attitudes and behaviors that occur due to cultural norms imposed on the individual by society (Diamond, 2002). The latter refers to the evolutionary roots of sex differences (Geary, 2021), which suggest that females of a given species are generally more cautious and risk-averse than males, as they bear higher costs than males in reproductive processes (Trivers, 1972). Taking into account that earlier research, we presume that females will be more sensitive to signals than males; we thus proposed the following hypothesis:

H2: Gender moderates the "label effect" so that females have a greater intention to allow autonomous office assistant to make independent decisions if they do not know the country of origin but a safety certificate is provided, whereas for males, neither of these labels significantly influences such intention.



Picture 1. Conceptual model.

METHOD

Research design

A 2×4 (certificate × country-of-origin) between-subject online experiment was designed. To test the proposed hypotheses, two independent variables were manipulated in the study. The first was the certificate of safety. In the experimental group, it was stated that the autonomous office assistant (AOA) technology had been granted a certificate of safety called "Technosafe," while in the control group there was no information about any certificate. The second independent variable manipulated in the experiment was country of origin. In the control group, no information was provided about country of origin, while in three experimental groups the country of origin was provided; it was China (Ex_1), the USA (Ex_2), and Russia (Ex_3), respectively. Equal numbers of participants were assigned to each of eight experimental cells. This research complied with the American Psychological Association Code of Ethics and (to the extent applicable) was approved by the Institutional Review Board for the CAICR Research Center. Informed consent was obtained from each participant.

Stimuli and pre-tests

The experimental stimuli were a poster promoting an autonomous office assistant with the fictitious name "DX383." We provided no brand name, to avoid transposing already existing attitudes people have towards a company to technology that they are seeing for the very first time. The poster was made by professional poster designers with neutral coloring. There were two photos on the poster, of a computer and modern buildings. At the top middle was the tagline "DX383 is able to make independent decisions… if you just agree." Below was information about the system's functionalities: arranging meetings, finding and storing documents, paying invoices directly from a user's bank account, responding to e-mails, reacting to voice commands, and making real-time conversation with a user. The poster for each experimental cell was based on the same template. There were no differences regarding color, name, photos, size, or functionalities across experimental conditions. In the experimental groups, there appeared in bold the phrases "Made in …" and/or "This technology has been granted the International Safety Certificate TECHNOSAFE."

A pre-test and attention check were employed to control the experimental conditions. The pre-test was made three weeks before the final study to check whether the color or the AOA's name evoked any associations with recognizable brands. We invited 20 students and showed them the poster, asking three questions: (1) do you know this technology? (option: yes/no); (2) who might be the producer of this technology? (open question); and (3) what is unique about this technology? (open question). None of the respondents had heard of the DX383 autonomous assistant before. In the case of the second question, the most common answer was "I don't know" (16 people); other responses included "Elon Musk" (2 people), "Google," and "George Orwell." In the case of the third question, 19 people noted the narrative that the autonomous assistant makes decisions by itself, while one person did not see anything unique in the technology. We thus concluded that the material was sufficiently neutral and did not suggest any associations that could disrupt the experiment. The attention check took place during the experiment. First, the participants were exposed to the poster. Then, depending on the group, they were asked to answer a few attention-focusing questions. Their distribution across experimental cells is noted in the table below. We intentionally did not ask about certification and/or country of origin in some groups, to avoid participants seeking information that does not exist. The questions were designed to concentrate the attention of participants on specific features of the AOA (i.e., country/certificate).

Table 1. Questions used for an attention check during the experimental study (yes = question was asked; no = question was not asked).

Cell number	Cell description	Does autonomous assistant make independent decisions?	Does this technology possess any safety certification?	Is it known in which country this technology was made?	Number of research participant who did not respond to the question as intended
0	No country No certificate	Yes	No	No	1
1	No country Certificate	Yes	Yes	No	0
2	China No certificate	Yes	No	Yes	1
3	China Certificate	Yes	Yes	Yes	0
4	USA No certificate	Yes	No	Yes	0
5	USA Certificate	Yes	Yes	Yes	2
6	Russia No certificate	Yes	No	Yes	1
7	Russia Certificate	Yes	Yes	Yes	1

Experimental procedure and participants

Two hundred and ninety-five people took part in the experimental study and were randomly assigned to one of eight experimental cells. Fourteen people did not complete the questionnaire, and another six were excluded as they did not pass the attention check. Thus, the final sample consisted of 274 participants (54% females). The youngest person in the group was 18, while the oldest one was 82 (M_{age} = 28.09; SD_{age} = 13.49). Participants were recruited via a social media platform and represented different nationalities. There was a predominance of people under 40 years old. Data was collected during two full days (48 hours) and each IP address had only one opportunity to participate in the study. All participants received the poster and set of questions. There was no time limit to complete the questionnaire.

Measures

There were three dependent variables measured in the study. First, the intention to allow a machine to independently make decisions was measured on a 1-item, seven-point scale borrowed from previous experiments on techno-empowerment (Modliński, 2021). Trust in technology and perceived risk were control variables measured respectively by a 9-item, seven-point scale (α = .87) borrowed from McKnight et al. (2011) and 4-item, seven-point scale (α = .88) of Laroche et al. (2005). Data on gender and age were collected.

RESULTS

To test H1a, we used the U test of Mann-Whitney, due to the fact that the experimental groups were not equal. In one group (control) no country was provided, while in three groups the country was known (USA, China, Russia). The results show that the differences between the control and experimental groups were significant (Z = -2.024; $p < .05$). Mean ranks in the control group was M_{Con} = 153.81, whereas in an experimental group it was M_{Exp} = 131.90. Also found were significant differences in trust (Z = -2.349; $p < .05$; M_{Con} = 156.68; M_{Exp} = 130.92). It may thus be concluded that people have higher trust and intention to allow an AOA to make independent decisions if its country of origin is unknown rather than known, which supports H1a. Moreover, we found no significant differences between the three experimental groups – which suggests that whatever its country of origin, people have similar trust and intention to empower an AOA.

To test H1b, we ran the student t test for independent samples. There were differences between the control and experimental groups in both trust (t = -2.184; df = 272; $p < .05$) and intention to empower the AOA (t = -2.352; df = 270; $p < .05$). In the group where a safety certificate was provided, trust (M_{Cert} = 5.21; SD_{Cert} = 1.15) and intention to empower the AOA (M_{Cert} = 3.67; SD_{Cert} = 1.82) were higher than in the group where no safety certification was mentioned (trust: M_{NoCer} = 4.91; SD_{NoCer} = 1.16; intention: M_{NoCer} = 3.17; SD_{NoCer} = 1.71), which supports H1b.

To test H2, we split the sample by gender and made two tests: an arithmetic means and independent U test of Mann-Whitney. First, we analyzed the results concerning country of origin. In the group of males, the differences between experimental groups were not statistically significant, which suggests males have similar intention to empower an AOA, regardless of whether the country is known or unknown. In the group of females, however, such differences are statistically significant (Z = -2.398; $p < .05$), as presented in Table 2. Females had a greater intention to allow the autonomous assistant to make independent decisions when they did not know in which country it was made (R_{NoCon} = 88.19) than when the country was specified (R_{Con} = 69.43).

Table 2. Intention to empower an AOA dependent on country among males and females.

Gender	Group	Mean	Rank	p	Z
Male	Country	3.3125	62.96	.762	-.302
	No country	3.4333	65.23		
Female	Country	3.2778	69.43	.016	-2.398
	No country	4.0250	88.19		

Second, we analyzed the results concerning the safety certificate. Once again, the differences among males were not statistically significant, which implies that a safety certificate does not influence their intention to empower an AOA. In females, the differences were statistically significant ($Z = -2.251$; $p < .05$); they declared a greater intention to empower an AOA if it had a safety certificate (R_{Cert} = 82.42) than if it lacked such a label (R_{NoCer} = 66.79), which supports H2. The exact data are presented in Table 3.

Table 3. Intention to empower an AOA dependent on safety certification among males and females.

Gender	Group	Mean	Rank	p	Z
Male	Certificate	3.48	66.12	.414	-.817
	No certificate	3.21	60.88		
Female	Certificate	3.84	82.42	.024	-2.251
	No certificate	3.13	66.79		

DISCUSSION

The article offers three major contributions to previous research on autonomous technology's acceptance. First of all, the article confirms previous reports that the country of origin of a technology affects its acceptance and trust (Gaedeke, 1973; Mostafa, 2015). However, such earlier research focused on differences between particular countries. Our contribution is the discovery that in the case of autonomous assistants, it is better not to emphasize the fact that such technology possesses a country of production at all, if one wants to increase the confidence in its operation. In the case of the experimental groups in which the AOA's country of origin was indicated, it is worth noting that the USA, China, and Russia are not fictional, little-known, or "neutral" countries towards which participants were unlikely to have developed any pre-existing attitudes. Rather, these countries are all prominent geopolitical actors towards which many persons might reasonably be expected to already possess a range of (potentially strong) positive or negative sentiments. Interestingly, this study's results suggest that with regard to developing an intention to empower an autonomous system to make independent decisions, indicating the identity of the *particular country* in which the AOA was produced has less of an impact on persons' intention to empower it than the mere fact that they are being generically reminded of the fact that it must have been produced in *some* foreign country *somewhere*. The interplay of such influences might be further tested in future experiments by, for example, studying differences in the intention to empower between participants who are told that an AOA has been produced in some foreign country and those who are told that it has been produced in their own country – and who, from an ethological perspective, might thus potentially discern a signal that the device is from “their own” group and therefore likely to engage in non-antagonistic interaction. Second, our study confirms previous results that safety certification can be an important factor affecting the trust in technology (Kim and Kwon, 2015; Bedué and Fritzsche, 2021). However, this paper extends a previous research area to include autonomous assistants. The results clearly suggest that it pays for companies offering such technology to invest in the certification process.

Taken as a whole, this study’s findings suggest that as human beings develop increasingly sophisticated artificially intelligent technologies that are capable of making autonomous decisions and engaging with us as intelligent social actors, the manner in which we interact with such technological marvels will, in many ways, inevitably be governed by cultural factors that emerged within human societies thousands of years ago, as well as by even more fundamental biologically based traits and behaviors whose evolution can be traced back millions of years. Rather than representing an unprecedented and qualitatively novel manner of engaging with other entities, our future interactions with autonomous technologies may ultimately just be the latest manifestation of those timeless forms of antagonistic and non-antagonistic interaction through which we engage with other human beings and animals – and through which other species of animals interact with one another. These results significantly contribute to extending the theory of Nass and Moon (2000) by demonstrating that in order to fully understand the human attitudes towards autonomous technology, we cannot overlook the evolutionary and ethological groundings of interactions that have been developing for ages between natural actors. Unfortunately, these aspects are still widely underestimated by persons designing new technologies, which can be seen to impede development of the concept of human-oriented technology.

LIMITATIONS

Although our study extended the theory of creating human-oriented technology, it also has limitations that should be clearly emphasized. First, a limitation of any experimental study is that its results cannot be generalized to the entire population, and this study was partially conducted under laboratory conditions during the unique circumstances of the COVID19 pandemic. The obtained results should therefore be replicated in the future and included in a broader meta-analytical context. Second, a fictitious brand of autonomous assistants was used in the study, which has both advantages and disadvantages. Proponents of the use of fictitious brands in experimental research emphasize that it makes it possible to avoid combining previous associations with the studied object, thus the effect is ‘cleaner’ and more reliable. Skeptics emphasize that a subject may have limited ability to develop preferences for objects of unfamiliar brands without being able to physically interact with them. Therefore, we recommend replicating the research with existing brands in the future. Third, the study did not control for whether the respondents had known and used autonomous assistants before. Although it is still a little-known technology, there is a chance that some of the respondents have already used it. However, to prevent such differentiation from affecting the results, the respondents were randomly assigned to the experimental groups. Fourth, in the case of one respondent, there was a problem with the operation of the computer the individual was using for the study. Although the hardware problem was successfully resolved, this respondent's results were removed from the total sample to ensure the highest possible reliability of the total outcomes.

CONCLUSION

Attitudes towards autonomous technology may be at least partially explained by observing the natural and social interactions between various agents that occupy a particular ecological niche. Of course, we are not saying that a machine is a "natural" actor; there is no doubt about the fact that it has been artificially created by human beings. However, this study suggests that such an artificial actor may subconsciously be treated like other natural environmental actors. In order to estimate the risks associated with such an artificial agent, human beings spontaneously look for the kinds of signals that have accompanied them through countless years of evolution. If we seek to fully understand human interactions with intelligent machines, it is thus worth referring to interspecies relations.

As this study has found, people have the strongest intention to allow an autonomous office assistant to make independent decisions if its country of origin is unknown but a safety certificate is provided. This is consistent with the fact that a human being seeks signals that suggest the outcome of any future interaction. Signals are also used when it comes to incorporating an agent into (or excluding an agent from) a group. However, gender moderates the "label effect," with females expressing a stronger intention to allow an autonomous office assistant to make independent decisions if they do not know the country of origin but a safety certificate is provided – whereas for males, neither such label significantly influences their intention. This may have roots in both evolutionary and cultural differences between genders.

HIGHLIGHTS

1. A country-of-origin label may deter customers from empowering or using empowered technology.
2. In order to encourage people to adopt it, an autonomous assistant should be presented as something "stateless."
3. A safety certificate serves as an encouraging signal that increases human beings' intention to empower autonomous assistants. For this reason, companies designing autonomous technology should invest in safety certification to increase acceptance of such technology among users. Insofar as the current number of safety certificates available for autonomous technology is extremely limited, new ones should be designed and commercialized.
4. The labelling effect is stronger in females than males, which suggest that companies primarily targeting females should pay greater attention to what signals they are really sending.

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APPENDIX

Appendix 1 – Stimuli

Control group: Certificate: not provided; Country: not provided

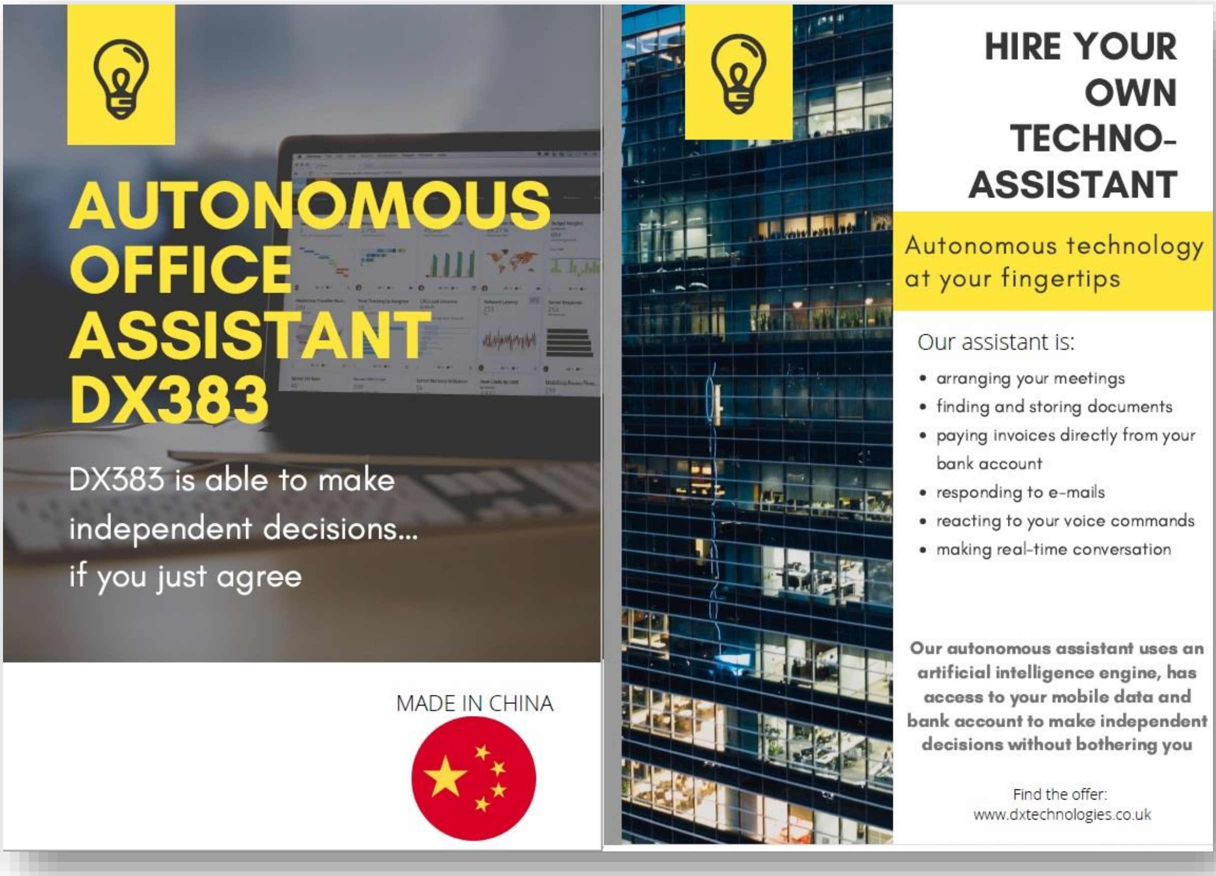
Experimental group: Certificate: provided; Country: not provided

Experimental group: Certificate: provided; Country: USA

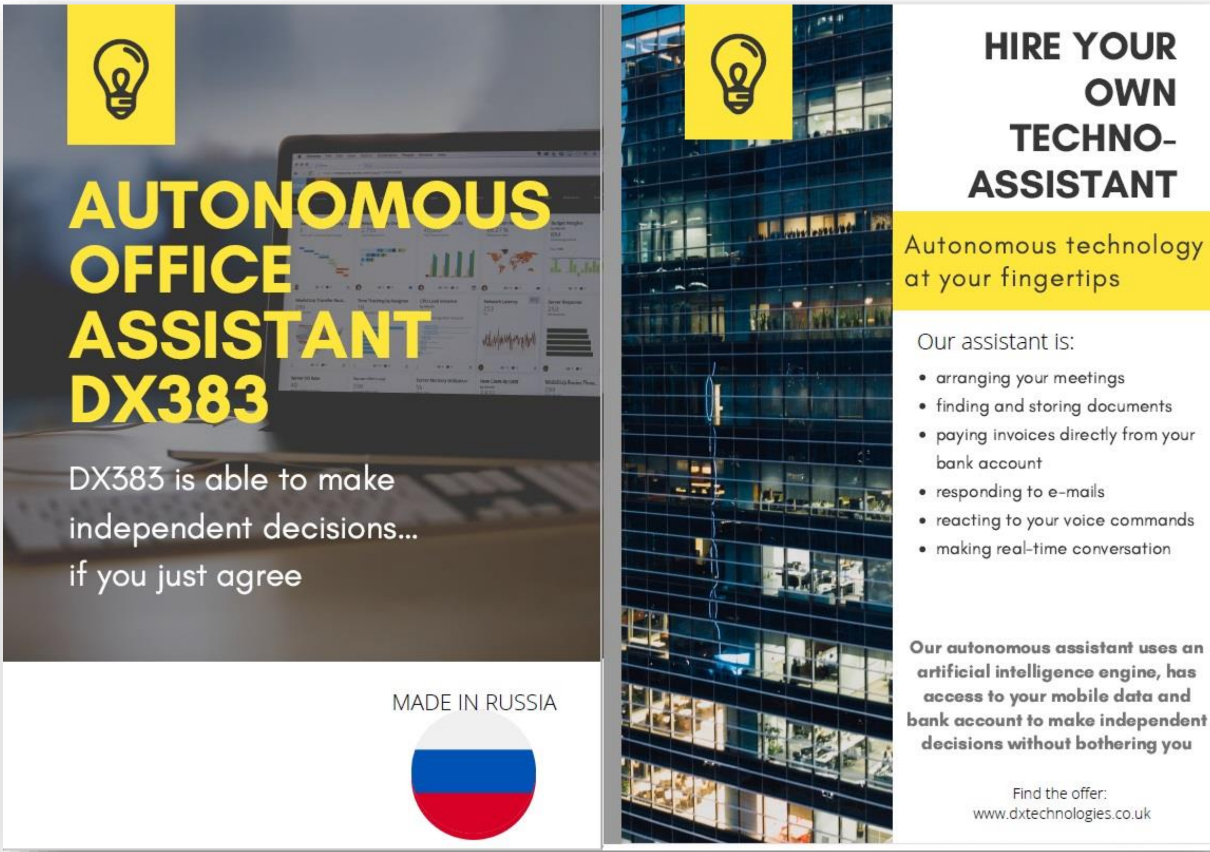
Experimental group: Certificate: provided; Country: China

Experimental group: Certificate: provided; Country: Russia

Experimental group: Certificate: not provided; Country: China



Experimental group: Certificate: not provided; Country: Russia



Experimental group: Certificate: not provided; Country: USA