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‘Not for me’:

An exploratory research on the inclusivity and diversity of science communication and public engagement about artificial intelligence in the Netherlands

Master Thesis

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Abstract

Introduction: Over the past years, artificial intelligence (AI) has radically impacted daily life. It has provided unprecedented benefits in terms of efficiency and personalization; however, it has also evoked worries about, for instance, algorithmic discrimination, privacy and responsibility. In order to inform citizens about AI, its benefits and risks, as well as to engage them with decision- and policy making, science communication and public engagement efforts are deployed. However, these efforts have proven to structurally exclude and underrepresent minoritized groups of citizens, even though they are at highest risk of experiencing the negative consequences of the implementation and use of AI.

Objective: Consequently, this study aims to gain insight into the inclusivity and diversity of science communication and public engagement regarding AI in the Netherlands, by exploring and understanding the experiences of citizens in low SES (socio-economic status) neighbourhoods in Enschede. Furthermore, this study aims to gain insight into the wishes and needs of these citizens with regards to future, more inclusive science communication and public engagement about AI.

Methodology: For this research, 19 semi-structured interviews with citizens in low SES neighbourhoods in Enschede, the Netherlands, were conducted. During the interviews, data was collected on participants' perceptions of AI, their information engagement behaviour, intent to join science communication- and public engagement activities – and the underlying reasons – as well as their wishes and needs for future activities.

Results: The findings of this research show that participants were able to give detailed and nuanced accounts of their attitudes towards AI, as well as their experiences with and perceptions of science communication and public engagement initiatives about AI. Generally, AI was perceived to be an important topic about which the participants had strong opinions, that in some cases highly affected their general worldviews. Interestingly, though, only a minority of the participants showed a high level of engagement with information about AI, consuming news media and reading into the topic. This so-called engagement paradox became even more apparent in terms of engagement with science communication and public engagement activities. Overall, participants indicated to support the idea of such activities, however, almost all participants indicated a low intent to join them. It appeared that many participants experience barriers to participate – both material (e.g. financial, logistic) and social/emotional (feelings of alienation and shame, concentration issues, lack of mental space, age). With regards to their wishes and needs for future activities, participants provided various recommendations for more accessible, practical, welcoming and pro-active initiatives.

Conclusion: Overall, the participants were more knowledgeable and interested in AI than scientists, or these citizens themselves, may anticipate. Furthermore, the majority of participants was not opposed to engaging in science communication and public engagement initiatives about AI – in some cases, they were even enthusiastic about it, where there not so many barriers to participate. The findings, thus, contribute to dismantling the outdated – but still influential - beliefs that citizens are an ignorant audience unfit to participate in activities and discussions about science or technology, due to a lack of understanding or interest. However, in order to create equal opportunities for all citizens to engage in activities about AI, more needs to be done in terms of identifying and removing exclusionary structures and creating an inclusive and diverse environment for (underrepresented) citizens to participate.

Keywords: *artificial intelligence; science communication; citizen engagement; inclusivity/inclusion; exclusion; the Netherlands*

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Table of contents

1. Introduction

Work, communication, entertainment, security, health and transportation: artificial intelligence, or AI, has substantially influenced many aspects of human life and will continue to do so in the future (Makridakis, 2017; Yarlagadda, 2018). AI applications such as digital (home) assistants, chatbots and recommendation systems have become well-established tools integrated in many daily activities and applications such as self-driving cars and social robots are developing fast (Nadikattu, 2016). The unprecedented benefits that AI offers provides promising avenues for improving human life. However, its development and use are not without consequences and concerns.

The revolutionary nature of AI gives rise to many technical, ethical and societal concerns that anticipate potential far-reaching and/or unknown negative consequences that may impact society (Bostrom & Yudkowsky, 2014). These include, among others, the perpetuation and enforcement of existing social inequalities (Bostrom & Yudkowsky, 2014; Himmelreich & Lim, 2022), the lack of digital security and potential breaches of privacy (Brundage, 2018; Tucker, 2018; Manheim & Kaplan, 2019), the lack of meaningful responsibility and accountability (Matthias, 2004) and potential humanitarian threats posed by AI (Liu, 2018; Wang & Siau, 2019).

Science and technology do not exist in a vacuum, but rather operate in – and are inextricably linked to - a societal context (Foulds et al., 2020). Therefore, it is essential to consider the ways in which the development and use of AI affects citizens, as well as how their ideas, experiences and opinions can be translated into policies and decision-making processes regarding AI. Core to these processes are science communication and public engagement. These efforts in raising awareness and aiding citizens' opinion-forming and understanding of scientific developments and innovations play a significant role in the negotiation of the meaning of, in this case, AI in society (Hu et al., 2018).

Public engagement with science, and the subsequent public discourse, have an important agenda-setting function in terms of identifying and addressing the pressing concerns, desires and recommendations citizens may have (Brosius & Weimann, 1996). Additionally, they serve as a means for citizens to both make sense of and influence political decision-making and societal and technological developments (Woodly, 2015). However, in order for public engagement to be fruit-and meaningful, it is important that those participating have proper access to information (Stiglitz, 1999). Science communication efforts, which aim to both educate and engage citizens with regards to AI and its applications, are essential to bridging this gap between science, technology and citizens.

Based on the notion that citizens should have a say in technological developments that are likely to affect them in the future (Powell & Colin, 2008), it would be expected that within science communication and public engagement about AI, conscious efforts are being made to include and amplify voices from citizens from marginalised communities. That is, citizens who are part of marginalised communities are especially at risk for e.g. losing their job to digitalisation (Frenette & Frank, 2020; Petersen, 2022), falling victim to algorithmic discrimination (Mohamed et al., 2020; Schippers, 2020) and having their right to privacy threatened (Eubanks, 2018; Gupta & Treviranus, 2020), which emphasizes the need for them to easily access information and to be included in public engagement initiatives surrounding AI.

However, in practice, this does not seem to be the case (Dawson, 2014, 2018). Western forms of science communication are shaped by a history of social exclusion and inequality, thereby perpetuating dominant power structures that negatively affect minorities and excludes them from cultural capital and information (Dawson, 2018). Furthermore, the field of AI is seemingly facing a diversity crisis, with the majority of powerful and visible stakeholders being white men (West et al., 2019; Myers West, 2020), leaving the public discourse too narrow-focused and not representative for those who do not relate to the prominent social, cultural and ethical perspectives amplified by the status-quo (Roche et al., 2021). Therefore, it is important to research the inclusivity and diversity of

science communication and public engagement surrounding AI and how this affects citizen participation.

Over the years, an extensive body of literature has been dedicated to citizens' perceptions of AI and how these manifest in the public opinion and popular media. However, little is known about how citizens perceive and experience science communication efforts and public engagement about AI, and specifically those who are part of one or multiple minoritized groups. Considering the fact that those citizens are most likely to be negatively affected by the development and implementation of AI technologies, but, at the same time are often underrepresented in science communication and the public discourse (Dawson, 2018), it is important to understand and take into account their experiences. This research, therefore, aims to bridge this research gap by investigating the inclusivity and diversity of Dutch science communication and public engagement regarding AI, as perceived by citizens in low SES (socio-economic status) neighbourhoods in Enschede. By exploring their perceptions of AI and, more importantly, their experiences with science communication and public engagement in the context of (non)participation, potential forms of social exclusion may be identified.

In order to study the current state of the art, the following research question will be addressed:

How do Dutch citizens in low SES neighbourhoods experience science communication(s) and public engagement surrounding AI in terms of inclusivity and diversity?

Furthermore, in order to formulate recommendations for more diverse and inclusive science communication and public engagement about AI, a second research question will be addressed:

What are the needs and wishes of Dutch citizens in low SES neighbourhoods in terms of science communication and public engagement regarding AI?

In order to provide a solid foundation for this research, the following chapter presents a theoretical framework introducing the most important concepts. Subsequently, the method(s) for this research are discussed, including the data collection and analysis. The chapter after that, the results section, contains the findings from this research, after which these are interpreted and discussed in the discussion chapter. The report ends with a conclusion.

2. Theoretical Framework

The most important concepts, themes and theories from existing literature are discussed in this section. Firstly, a closer look is taken at the technology of AI itself, as well as its associated ethical concerns. Secondly, the concepts of science communication and public engagement are discussed more in-depth, as well as the existing literature on science communication about AI. Thirdly, the most important theories surrounding inclusion and exclusion are addressed and the importance of inclusivity and diversity in science communication and public engagement is discussed. Lastly, the state-of-the-art of inclusivity and diversity in science communication and public engagement about AI is explored.

2.1. Artificial Intelligence

The earliest mention of Artificial Intelligence (AI) dates back to 1955, when the concept of AI was first conceptualized around the premise that "every aspect of learning or any other feature of intelligence can in principle be so precisely described that a machine can be made to simulate it" (Dick, 2019, p. 2). This notion of mapping out and applying processes of thinking to technology flows, as argued by Haugeland (1989), from the idea that thinking and computing are essentially the same. Consequently, the goal is not to merely reproduce or mimic human intelligence but for technologies to possess a 'mind of their own', which allows them to address complex problems in a way that includes, but is not limited to human cognition (Haugeland, 1989; Dick, 2019). That is, as argued by McCarthy (2007), AI can be used to understand and reproduce human intelligence, but does not confine itself to methods that are biologically observable. Developments in AI are expected to surpass human intelligence in the future, in a sense that they are not restricted by limitations in time, cognitive capacity and data transfer/communication (Griffiths, 2020; Chowdhury & Sadek, 2012). However, what is considered intelligence is fluid, rendering the definition of AI subject to changes over time.

Due to the fluidity of the concept of intelligence, no commonly accepted definition of AI has been established yet (Wang, 2019). However, the various working definitions do share similarities and therefore highlight the main aspects of AI. Importantly, in many cases AI still refers to technologies that execute tasks that require human intelligence, in line with the initial notion that AI aims to mimic human thinking. Sadiku (1989), for instance, uses AI as an umbrella term to describe the use of technology to complete tasks that require human abilities and assets such as knowledge, perception, understanding and cognitive reasoning.

Recently, focus has shifted more to the specific features of AI, regardless of whether these fit into the notion of human intelligence. Samoili et al. (2020) formulate four main features of AI, which include perception of the environment, information processing, decision making and achievement of specific goals. Even more specific are Kaplan and Haenlein (2019), who refer to AI as "a system's ability to interpret external data correctly, to learn from such data, and to use those learnings to achieve specific goals and tasks through flexible adaptation" (p. 17). The processes of analysing, processing and producing output to achieve certain goals, thus, seem core to the purpose of AI.

In their definition, The High-Level Expert Group on Artificial Intelligence (AI HLEG) of the European Commission specifically adds the notion of autonomy, by stating that "Artificial intelligence (AI) refers to systems that display intelligent behaviour by analysing their environment and taking actions – with some degree of autonomy – to achieve specific goals" (AI HLEG, 2018a, p. 1). AI reduces, to varying degrees, the necessity of a human actor to analyse and interpret data as well as to act upon this to achieve goals (Chesterman, 2020) – i.e., it operates autonomously, a feature that characterizes the novelty and significance of the technology. Consequently, the AI HLEG definition will be referred to in the remainder of this research.

Various different types of AI can be identified. One of the most fundamental distinctions is that of weak and strong AI, which refers to the perception of AI owning a 'mind'. That is, weak AI is merely

perceived as a tool to model intelligence, whereas strong AI is perceived to be intelligent, as actually possessing a mind (Flowers, 2019; Martinez, 2019). Consequently, weak AI excels in specific tasks, while strong AI can perform a broad range of tasks proficiently (Wang & Siau, 2019). Ultimately, strong AI is expected to develop an intellect equivalent to that of its human counterparts, or potentially exceed it; however, this level of superintelligence has not been reached yet (Wang & Siau, 2019). Still, the distinction between weak and strong AI provides an interesting lens through which new developments within the field of AI can be put into perspective.

A more contemporary distinction concerns rule-based and machine learning AI. Rule-based AI typically follows a pre-determined set of rules (i.e., conditional statements) encoded by a human actor, which allows the computer to provide certain output for different situations (Davis & King, 1984; Grosan & Abraham, 2011). The computer, thus, uses the encoded rules as the representation of human knowledge, which allows it to mimic human reasoning and draw conclusions based on the data it is presented with (Grosan & Abraham, 2011). Consequently, rule-based AI provides a relatively simple way to model human reasoning and enables straightforward interpretation of conclusions, as explanations can easily be found by backtracking the inference steps (Prentzas & Hatzilygeroudis, 2007). However, rule-based AI is also static and therefore prone to error when confronted with changing information or exceptions not expressed by the rules (Prentas & Hatzilygeroudis, 2007).

Machine learning AI, on the other hand, has proven to be more effective in this regard: by instilling learning processes in the AI itself, the technology is able to learn through examples and improve its abilities based on previous activities (Michalski et al., 2013). As explained by Alpaydin (2016), instead of functioning based on a fully pre-defined algorithm, machine learning AI processes data which allows the computer to modify itself in such a way that better matches the requirements for the task at hand. That is, the learning algorithms in the machine learning AI build their own models from the data, by searching for patterns and drawing subsequent conclusions (Zhou, 2021). Due to its contextual flexibility, this type of AI is known to be more widely applicable and is able to process more complex and ambiguous data (Khanzode & Sarode, 2020). However, in order for the AI to learn and improve, huge sets of training data are required (Dhall et al., 2020) and in case any errors occur, it is difficult to establish where these originate from; this is due to the complex learning algorithms that operate independently, also referred to as the black box (Castelvecchi, 2016).

Other important distinctions can be made with regards to the concept of autonomy: i.e., different types of AI operate with varying degrees of autonomy. Luck and d'Inverno (1995) describe autonomous AI as "an agent with motivations and some potential means of evaluating behaviour in terms of the environment and these motivations" (p. 258). Core to the notion of autonomy is thus the ability to generate internal rather than external goals. Autonomous AI, therefore, is expected to create and act upon self-determined goals, based on the environment and context it is operating in (Luck & d'Inverno, 1995; Bryson & Winfield, 2017).

Machine learning AI, which adapts its goals and actions based on the data it is being fed, is often ascribed a higher degree of autonomy than rule-based AI, which is bound to the externally pre-determined set of rules it is programmed to follow (Martinez, 2019). The various levels of AI autonomy may range from full human dependency to supervised autonomy and, in some cases, even the complete removal of human interference in the decision-making process (Lawless & Sofge, 2017). Although in the latter case the AI application is considered to be fully autonomous, it should still be noted that human input was inevitably present during the initial programming phase (Bryson & Winfield, 2017; Martinez, 2019).

2.2. Ethical concerns and AI

For years now, AI has been widely implemented in various industries for a multitude of different purposes, providing governments, industrial actors and consumers with unprecedented benefits

(Smith & Eckroth, 2017). However, the revolutionary nature of the technology has also raised ethical concerns and questions, of which some of the most prevalent ones will be discussed.

2.2.1. Algorithmic injustice

One of the main drivers behind AI development is the notion that algorithms provide more objective predictions and decision-making as compared to their human counterparts. However, the western world's history of oppression and systematic social injustice inevitably complicates the development of truly objective and fair AI and arguably, renders it impossible (Himmelreich & Lim, 2022). AI interacts with and operates in a societal context and, as a consequence, often upholds and even enforces already existing inequalities and power structures in terms of race, gender, class, ability and origin (Zimmerman et al., 2020; Himmelreich & Lim, 2022). Pursuing algorithmic fairness, which refers to "the application of the same impartial decision rules and the use of the same kind of data for each individual subject to algorithmic assessments" (Zimmerman et al., 2020, p. 3), therefore, is not enough to develop AI applications that promote equality and social justice. That is, although an algorithm is programmed to be neutral, the data it is being fed usually is not. Therefore, AI may still perpetuate social injustice by reproducing the biases present in the data, even when algorithmic fairness is implemented by design (Manheim & Kaplan, 2019; Zimmerman et al., 2020; Himmelreich & Lim, 2022).

To illustrate, Eubanks (2018) lays out how government assistance programs in the US discriminate against citizens from socio-economic minorities. Their research has shown that generally, disproportionate amounts of data are gathered from poor and working-class citizens as compared to other socio-economic classes. Consequently, predictive risk models are more likely to target these socio-economic minorities, for instance by directing investigative efforts (e.g. for fraud) towards them or by upscaling police patrol in their neighbourhoods. This deepens the already existing inequalities and automates the discrimination against these minorities in a sense that "the data acts to reinforce their marginality when it is used to target them for suspicion and extra scrutiny" (p. 7), a process facilitated by the algorithm (Eubanks, 2018). Another important example of algorithmic injustice was laid bare by Noble (2018). Their research explains how search engine algorithms perpetuate harmful stereotypes and biases against women of colour. As a consequence of search engines being driven by commercial interest, the Google search algorithm featured pornography as the main representation of Black women for years (Noble, 2018).

The harmful effects of algorithmic injustice become even more daunting when considering that AI is implemented in many important social and political institutions and domains, such as education, health care and criminal justice systems (Zimmerman et al., 2020). Thus, rather than merely pursuing algorithmic fairness, it is essential to invest in AI that promotes equality and justice. This starts at the root of AI development, with developers and tech practitioners; their choices will influence the ways in which people will be affected, and those holding the current positions of power may not have the experiences needed to understand and account for the effects of structural injustice (Himmelreich & Lim, 2022). Important, therefore, is to promote diversity and inclusivity at the earliest stages of AI development. Although recently more attention has been brought to this issue, the field of AI is still far from inclusive: Freire et al. (2021), for instance, have demonstrated a persistent lack of diversity in the context of scientific events about AI.

2.2.2. Privacy

Most successful AI applications, and specifically those who use machine learning techniques, require large amounts of data to learn and operate. This has brought attention to a variety of privacy-related issues. The fundamental right of privacy, as argued by Manheim & Kaplan (2019), refers to "the right to make personal decisions for oneself, the right to keep one's personal information confidential, and the right to be left alone" (p. 116). Timan and Mann (2021) add to this that privacy is about preserving meaningful human control; i.e., the right and ability of an individual to make informed decisions about

their data. Privacy is, thus, not merely concerned with data protection but is, above all, a matter of consent (Stahl & Wright, 2018).

The use of big data in AI applications potentially poses dangers to the right to privacy. Tucker (2018) identifies three main themes with regards to privacy and AI that are particularly challenging, including data persistence, data repurposing and data spillover. Data persistence refers to the fact that, due to the low costs of storing data, shared data may persist longer than anticipated by the data provider, even though their willingness to share this data may change over time (Tucker, 2018). Data that was once shared is difficult to erase, thereby withholding people the possibility to opt out when their privacy preferences change (Tucker, 2018). Data repurposing refers to the possibility that once shared, data may be indefinitely re-used for different purposes (Tucker, 2018). This becomes especially harmful when, by means of e.g. knowledge extracting tools, different data fragments are combined and used to identify individual behavioural patterns and/or personal characteristics (Li & Zhang, 2017; Katyal, 2020). Data spillover refers to the idea that privacy preferences, rather than being an individual matter, may generate spillover between individuals or economic agents (Tucker, 2018). That is, one person's privacy-related behaviour may impact the privacy of another, which is especially apparent when the lines between what is considered the public and private realm are blurry.

As argued by Manheim and Kaplan (2019), the right to privacy is essential to upholding other rights and freedoms, including "political participation, freedom of conscience, economic freedom, and freedom from discrimination" (p. 118). Data persistence, repurposing and spillover, in many cases, result in algorithms being able to draw inferences about individuals' characteristics and preferences (Whittlestone et al., 2019), which enables them to both target and exclude certain groups of people. This may, indeed, uphold discriminatory practices and algorithmic injustice (Tucker, 2018), erode democratic values through manipulation and on a more general level, erode freedom of choice (Manheim & Kaplan, 2019).

2.2.3. Humanitarian threat

AI is already affecting many aspects of human life and will inevitably continue to do so in the future (Wang & Siau, 2019). The many apocalyptic and dystopian representations of AI in Western pop culture reveal some of the most fundamental concerns people have about the future of humanity and the relations between humans and technology (Geraci, 2010). Popular tropes such as the 'AI uprising' or killer robots emphasize the fear of AI transcending the limits of human intelligence and power, thereby forming an existential threat to humanity and human dignity (Goode, 2018). Today, AI does not seem to form a direct threat to human existence; however, such concerns are not invalid. AI affects the ways in which we conceptualise the world and interact with technology, which may, albeit unconsciously, pose potential threats to human autonomy and the lifeworld as we know it (Barn, 2019).

Liu (2018) describes three levels of power challenges posed by AI, which gradually undermine human autonomy and rights. The first level describes how the involvement of AI in discrete decision-making undermines human autonomy. Human autonomy, as conceptualized by Calvo et al. (2020), encompasses a) a feeling of willingness, volition and endorsement, b) the lack of pressure, compulsion or feeling controlled and c) the lack of deception or deliberate misinformation. The decisions and acts flowing from this, thus, can be considered as conscious and deliberate reflections of one's own free will (Ryan & Deci, 2006). Liu (2018) argues that AI impedes this human autonomy in a sense that "algorithms are exerting considerable power over individual lives either by directly deciding or indirectly influencing important decisions which open or close possibilities or opportunities… while remaining immune from requirements to explain itself or its processes and which is insulated from appeal and oversight." (p. 9). That is, algorithms may unconsciously influence human behaviour and decisions, rendering the individual a subject to a decision rather than allowing them to exert their free will and make decisions themselves (Liu, 2018).

Additionally, the opacity of algorithms prevents humans from being able to understand and reflect on AI processes and outcomes, thereby limiting their access to information and, thus, impacting their ability to make informed decisions (Wang & Siau, 2019). To illustrate, personalisation strategies in advertising algorithms may unconsciously influence buying behaviour, which undermines human autonomy in a sense that one is unconsciously deceived and, to some degree, controlled in their decision-making (Barn, 2019). Moreover, personalisation strategies also tend to reduce the diversity of information one encounters, thereby withholding them the broad range of information needed to make informed and deliberate decisions (Barn, 2019).

The second level concerns the strains AI may impose on both human rights and values (Liu, 2018). That is, contemporary notions of power and the resulting human rights laws are not equipped to adequately address the new challenges posed by the use of AI. As argued by Liu (2018), "AI power is subtle and generally unrecognised because our ways of identifying power focus upon its political manifestation in the historical context" (p. 14), an approach which fails to recognize the new ways in which AI exerts power, given there is no precedent.

Human rights issues may be inherent to the AI technologies themselves; for instance, the fact that AI technologies are fully dependent on the generation and processing of vast quantities of data fundamentally poses threats to the right to privacy (Raso et al., 2018). However, the context in which AI technologies are implemented and applied also influences the ways in which the systems relate to human rights; i.e., "situating big data and algorithmic processes within certain political or ideological frameworks yields distinct types of human rights challenges" (p. 17), as for instance can be observed in the case of the Social Credit System deployed in China, which uses AI applications to influence and constrain citizen behaviour (Liu, 2018).

In addition to the dangers posed towards contemporary human rights laws, AI may also affect and change societal and human values. That is, "changing the constraints within which individual action takes place can be effected in aggregate, with each bias tilting the system microscopically until the value system itself shifts" (Liu, 2018, p. 18). AI, thus, has the ability to change contemporary value systems and landscapes by reforming existing societal structures. To illustrate, widespread use of AI applications is expected to greatly transform the future job market and result in technological unemployment, especially affecting those working skilled manual jobs (Agrawal et al., 2017; Rajnai & Kocsis, 2017; Liu, 2018). As a result, people may not only lose their job and with that, their source of income, but they are also, to some extent, robbed of their opportunities for personal development, fulfilment and giving meaning to their daily activities (Liu, 2018). The implementation of AI, therefore, may have unforeseen impact on contemporary value systems and the meaning of life.

The third level describes how the prospect of AI potentially establishing dominion over their human counterparts in the future poses existential threats to humanity (Liu, 2018). Liu (2018) divides these threats into two main categories. The first is instrumental convergence, which "suggests that humanity or the things it values may obstruct the path for an AI to fulfil its goals" (p. 22). Humans and their needs, in that case, will be rendered subordinate to the tasks the AI is performing and may be put to use in a way that the AI considers beneficial for achieving its goals. The second category is value-divergence, which refers to "a superintelligence discovering some way of satisfying the criteria of its final goal that violates the intentions of the programmers who defined that goal" (Bostrom, as cited by Liu, 2018, p. 22). Thus, in order to fulfil its goals more efficiently, an AI application may develop new sub-goals or perform actions that are potentially harmful to humans and society at large. In combination with the opacity of algorithms, humans losing control over their self-developed AI does not seem to be an unrealistic future scenario (Wang & Siau, 2019). How to properly align AI with human values and moral principles, therefore, is considered to be one of the most fundamental questions of this time (Gabriel, 2020).

2.2.4. Responsibility and accountability

As the use of AI is steadily growing and applications are becoming increasingly autonomous in performing the tasks that they are assigned, questions of responsibility and accountability arise. Such questions concern who is responsible when the use of AI results in undesirable or even harmful consequences and events (Coeckelbergh, 2020). To explore the issues associated with accountability and responsibility in the context of AI, it is important to recognize the difference between the two concepts. Dignum (2020) refers to accountability as the requirement and ability of the AI system to explain and report on its decisions and actions. Responsibility, then, is considered "the duty to answer for one's actions", and refers to the liability of a person or thing in case harmful consequences result from the use of an AI technology (Dignum, 2020, p. 219).

Responsibility can be considered to have two main conditions. The first is the control condition, which refers to the level of control an agent has over an action and the extent to which they have caused it, and the second is the epistemic condition, which refers to the knowledge and awareness an agent has of an action (Coeckelbergh, 2020). That is, in order to be considered responsible for an action or event, an agent should be able to a) exert enough control over the situation to be considered the agent of the action, and b) fully understand the act they are engaging in (Coeckelbergh, 2020).

Although AI technologies are gaining more agency, they are considered not to have a conscience and free will. As a result, Coeckelbergh (2020) argues, they do not pass the epistemic condition and therefore cannot be held responsible. However, leaving the responsibility with humans in the current landscape does not suffice either: the opacity of machine learning algorithms has made it almost impossible for human actors to predict the behaviour of the AI technology. As argued by Matthias (2004), the human operators, thus, cannot be held morally responsible for the actions and decisions of the AI technology, resulting in a responsibility gap that has been proven difficult to close.

Santoni de Sio and Mecacci (2021) differentiate between four different types of responsibility gaps. The first type, the culpability gap, refers to the fact that the opacity of AI algorithms complicates prediction and control, thereby making it difficult to attribute blame and compensate the victims (Santoni de Sio & Mecacci, 2021). The second type is the moral accountability gap, which refers to situations in which the users of AI technologies cannot explain, justify and reflect on the decisions, actions and processes of the technology they are supervising or using (Santoni de Sio & Mecacci, 2021). The third type, the public accountability gap, concerns the duty of public agents to explain their actions to a public forum, which is subject to the 'problem of many hands'; i.e., AI technologies tend to operate in a complex legal and organisational network with many different actors involved in the causal chain, making it difficult to attribute responsibility to a single actor (Coeckelbergh, 2020; Santoni de Sio & Meccaci, 2021). The last type, being the active responsibility gap, refers to the lack of awareness AI developers and users tend to have with regards to their own moral responsibility to prevent harm when creating or using the technology (Santoni de Sio & Meccaci, 2021).

The use of AI, as can be concluded, raises accountability and responsibility issues on different levels. Both the existing guidelines to ethical AI design (Jobin et al., 2019) and contemporary legal frameworks (Cofone, 2018) are currently not equipped to appropriately assign responsibility. Important to note is that these issues may become even more complex in the future, especially when AI develops further to the extent that it matches human intelligence (Johnson & Verdicchio, 2018). As the lines between what is considered man and machine blur, new legal frameworks will be required to assign rights and responsibilities to entities that exist on "a continuum between tools and people", including anthropomorphised social robots and super-intelligent AI agents (Cofone, 2018, p. 167). Coeckelbergh (2020), however, raises the question as to whether it is appropriate to even create and use such systems, especially when there is expected to be little room for human agency and intervention.

2.3. Science communication

Science and society are heavily intertwined and their relationship is important to the functioning of many institutions within contemporary society (Lakomý et al., 2019). For instance, science is an important driver for innovation, education and political decision-making. Furthermore, it delivers crucial knowledge that is needed to find solutions to pressing societal challenges. However, in order for scientific knowledge and developments to be effectively implemented in public policy, broad societal support and participation is required (van Dam et al., 2020). To inform and actively engage the general public, science communication efforts are deployed.

Science communication aims to enhance public scientific engagement and culture by creating and increasing science awareness, enjoyment, interest, opinion-forming and understanding, as well as by connecting the public, mediators and scientists through dialogue (Burns et al., 2003). This includes both science communication efforts in formal settings, for instance in educational institutes, and informal or voluntary science engagement, such as visiting museums or reading science articles in the popular media (van Dijk, 2011). Ultimately, science communication aims to bridge the gap between science as an institution and the societal context in which it operates (Bultitude, 2011). When this fails, severe disconnects between the public opinion and the scientific consensus may develop, resulting in heavily polarized societal environments – as has been the case for climate change and vaccine safety (Scheufele & Krause, 2019). This may hinder the implementation of innovative solutions and technologies in the long term and complicate political decision-making.

Science communication, thus, serves an important role not only in informing and engaging the public with science but also in strengthening the relationship between science and society. This relationship and the resulting science communications have evolved over the years. Early approaches to science communication were usually informed by the set of widely held beliefs that is currently described under the term knowledge deficit model. This approach is grounded in two main assumptions, being a) that public scepticism towards modern science and technology stems from a lack of knowledge, and b) that this scepticism can be resolved by merely providing the public with information about science and technology (Dickson, 2005). Consequently, the communications following from this have a strong focus on the mere presentation of scientific information and facts, which the public, in turn, is expected to process in a rational and objective manner with the aim to achieve a higher level of scientific literacy (Simis et al., 2016).

However, the assumptions on which such communications are built have long been proven flawed. Although knowledge is considered important to realize an informed debate, its presence does not guarantee support for scientific or technological endeavours, and on the contrary, may even give rise to more questions and concerns (Dickson, 2005; Seethaler et al., 2019). Additionally, gathering support for scientific causes and technological innovations may not be the only reason as to why science communication should be deployed (Simis et al., 2016). That is, engaging with the public is increasingly seen as an avenue not only to inform the public, but also for scientists to gather input from citizens and reflect on their work (Bucchi, 2008).

It is such realizations that have brought about more dialogue and collaboration-centered approaches to science communication. Rather than having a top-down, informative design, dialogue-centered science communication values two-way interaction between public and science, with the ultimate aim to facilitate collaborative decision-making and knowledge co-production (Bucchi, 2008). That is, citizens actively take part in defining scientific knowledge, setting priorities and sharing relevant experiences (Bucchi, 2008). This is based on the argument that a) the public should have a say in scientific developments that are likely to affect them in the future (Powell & Colin, 2008), and b) laypeople possess knowledge and have had experiences that can complement those of scientists; it highlights the value of the different types of knowledge and competencies that citizens may contribute (Bucchi, 2008; van der Sanden & Meijman, 2008).

Furthermore, complex societal issues can rarely be solved in a scientific vacuum: the public, thus, can provide insight in how to scientifically address issues while respecting and taking input from the societal context (Bielak et al., 2008). Seethaler et al. (2019), for instance, describe how one's fundamental values and emotions may influence their perspectives towards science and technology, and how science communication can backfire if such social aspects are neglected in decision-making processes. Top down, knowledge deficit approaches generally do not do justice to the complexities of scientific and technological developments in relation to their societal context. Dialogue-centered approaches, however, illustrate the importance of science communication as not only a means to inform the general public, but as a way to collectively inspire and be inspired by science as well (Leeuwis & Aarts, 2011).

Academic literature on science communication has directed plenty of effort towards these dialogue-centered approaches. However, the paternalistic and prejudicial, but deeply engrained, belief that scientists should dedicate themselves to educating an ignorant public largely unfit to participate in scientific discussions appears difficult to reject in practice (Bucchi, 2008). Consequently, the knowledge deficit model is still perceived to heavily influence contemporary science communication efforts (Bucchi, 2008; Trench, 2008; Cortassa, 2016; Simis et al., 2016).

2.3.1. AI in science communication initiatives

The ways in which AI developments are communicated to and perceived by the public can, thus, have significant influence on its further development, public acceptance and use (Cave et al., 2019). The field of AI is quickly expanding and its applications in daily life are becoming increasingly apparent, heightening the need for the general public to familiarize themselves with the technology. For this, various forms of science communication exist. Formal science communication about AI mostly takes place in educational institutes, as AI-related subjects are increasingly addressed in schools as part of Science, Technology, Engineering and Mathematics (STEM) courses (Sakulkueakulsuk et al., 2018; Alonso, 2020). Informal science communication about AI, on the other hand, can be found in a myriad of different formats.

For instance, museums and art exhibitions increasingly make use of interactive AI technologies, thereby giving visitors the chance to personally engage with them (Giannini & Bowen, 2019; Singh & Atta, 2021). Furthermore, Barbacci (2002) describes how scientific theatre can aid visitors in their reflections on fundamental considerations, such as human-technology relationships and the meaning of life, caused by technologies such as AI. Similarly, Reinsborough (2017) explains how (science) fiction can function as a means for engagement between science and publics through "the imagination of scientific futures" (p. 2). That is, science fiction can bring attention to the topic of AI, flesh out potential future scenarios - which enables the public to reflect and form attitudes about them - and serves as a means to provide social critique about the technology and its implementations (Reinsborough, 2017). Additionally, AI has been the topic of various citizen science projects over the past twenty years, in which citizens, for instance, contributed to building databases or providing data for machine learning training sets (Ceccaroni et al., 2019).

2.3.2. AI in the popular media and public discourse

While the aforementioned initiatives may be helpful in educating and engaging the public about AI, most citizens tend to engage with science communication about AI through the mainstream media by consuming informational content (Maier et al., 2014; Vergeer, 2020; Zhai et al., 2020). As argued by Brennen (2018), "mainstream news outlets remain a key space for, and influence on, public discussion" (p. 2). That is, media coverage can heavily affect the public opinion and shape or start a public debate (Ouchchy et al., 2020). Quite some research, thus, has been dedicated to the ways in which the media report about AI and how this influences public perceptions of the technology.

From this, one important trend can be identified: the sensationalized and extreme narratives deployed by the media. Cave et al. (2019), for instance, researched public responses to AI in the UK and found that in the media, as well as in the citizens' responses, the extremized utopia-dystopia dichotomy prevailed. That is, both the positive and negative narratives about the future of AI were quite far from current reality, with extremes ranging from AI granting humanity immortality in the future to AI exerting total dominion over humanity (Johnson & Verdicchio, 2017; Zhai et al., 2020). Similarly, Johnson and Verdicchio (2017) noted that within the media and the public discourse, there is a tendency to a) ascribe AI a higher sense of autonomy than is reality and b) neglect or downplay the role of humans in the development and implementation of AI technologies. Such media framing may, ultimately, lead the public to view AI in a much darker light and result in public misunderstanding (Johnson & Verdicchio, 2017).

Brennen (2018) identifies another important trend: the future-oriented narratives that are often used to describe AI applications. That is, within the UK media coverage and public debate on AI, a lot of focus is directed to the potential implications and future functions of AI, rather than on the current functionalities and applications (Brennen, 2018). However, the future-oriented and sensational nature of much of the contemporary AI coverage and debate has also led to some backlash. Crawford (2016), for instance, argues that although these popular narratives hold some valid concerns, the disproportionate amount of attention that is being paid to them distracts from the fundamental issues about AI that exist and have an impact today, such as discriminatory algorithms and how they exacerbate inequality and contemporary power structures.

Vergeer (2020), in their research on the Dutch news reporting about AI, found a few salient topics that were most frequently discussed. These include, among others, autonomous driving, health care, AI in warfare, deep learning games, robots, singularity, smart assistants, tech giants, fake news and AI in Asia (Vergeer, 2020). Brennen (2018) identified three distinct themes within the UK media coverage and discourse about AI, of which the first theme is generally common, the second mostly within right-leaning outlets and the third mostly within left-leaning outlets. These include 'new industry products, announcements and research', 'economics and geopolitics' and 'ethics, discrimination and killer robots' respectively (Brennen, 2018). Notably, these themes represent the inherent politicisation of AI as it is addressed in the media and public discourse (Brennen, 2018). Zhai et al. (2020) identified robots, speech recognition, autonomy, driverless cars, big data and machine learning as the main topics of conversation in the media and public discourse in the US. Lastly, Ouchchy et al. (2020) focused specifically on topics within the AI ethics debate. They found that the most frequently discussed topics concerned issues such as prejudice, privacy, data protection and the militarization of AI.

In both the media and the adjacent public discourse, various stakeholders are present to voice and defend their interests. Zhai et al. (2020) identified the most apparent individual actors and institutions present in the US news media about AI. This concerns three main types of institutions, including universities, companies and government agencies, as well as scientists, artists, politicians, businesspeople, writers, chess players and, to a lesser extent, celebrities who have expressed an interest in AI (Zhai et al., 2020). Mao and Shi-Kupfer (2021) performed a similar study for the Chinese online discourse on AI and found AI scholars, journalists, tech corporations, cultural elites and members of the general public – especially individuals who work in the tech industry -, to be the most vocal stakeholders in the debate.

Vesnic-Alujevic et al. (2020), who focused specifically on the public debate about AI in the EU context, argue that although a variety of different stakeholders is present in the debate, the conversations are still quite fragmented. In order to improve AI governance and policies, they propose a more collaborative and integrated discourse between AI researchers, civil society and international organisations (Vesnic-Alujevic et al., 2020). Consequently, they emphasize the importance of public

engagement with a wide range of stakeholders, in order to create a more fair, open and transparent political process (Vesnic-Alujevic et al., 2020).

2.4. Public engagement

The concept of public engagement emerged as a response to the knowledge deficit-thinking that has characterized much of science communication efforts in history (Nisbet & Scheufele, 2009). Rowe and Frewer (2005) generally define public engagement- or participation as "the practice of involving members of the public in the agenda-setting, decision-making, and policy-forming activities of organizations/institutions responsible for policy development" (p. 253), which may include citizen communication, consultation and, ultimately, participation. As described by Hetland (2016), the concept of public engagement is highly integrated with science communication, and can be perceived as a specific model or trend within the field, although the importance of dialogue and participation has inspired science communication on a more holistic level as well. Indicative of public engagement specifically, however, is the wider political context to which it relates (Stilgoe et al., 2014).

Public engagement is often referred to as 'democratizing' science and technology development in the sense that it provides citizens the opportunity to participate in debates on ownership, development, benefits and risks, as well as the shaping of regulations and applications (Nisbet & Scheufele, 2009). Especially the latter emphasizes the political power of public engagement, in contrast to, for instance, dialogue-centered approaches of science communication that focus merely on consulting citizens to generate conversations – albeit without the possibilities to truly integrate citizens' input in policies. That is, previously, political power mostly resided in the public acceptance - or lack thereof - essential for political decisions and scientific or technological movements to translate effectively into long lasting, meaningful change (Woodly, 2015). On the contrary, public engagement is perceived to have an important agenda-setting function in the sense that the concerns, values, realities and possibilities expressed in the public debate can be addressed by citizens on a political level from the offset, an important shift in power dynamics (Gudowsky, 2021).

Especially in the context of large-scale, societal challenges and impactful developments in technology, the political significance of public engagement becomes apparent. Such topics may elicit divergent responses among experts, the public and the variety of stakeholders that is involved, thereby causing increased polarization. Consequently, as described by Jasanoff (2005), there is a need for spaces in which scientists, politicians, citizens and other stakeholders can together negotiate visions of the future that are acceptable for all. However, although the variety of perspectives and people participating in public engagement initiatives can provide a base for fruitful discussion, it also gives rise to an inherent issue of knowledge asymmetry which may impede the construction of effective communication and mutual understanding (Askehave & Korning-Zethsen, 2003). Meaningful participation and engagement, thus, requires informed participants (Stiglitz, 1999). Science communication can play an important role in informing citizens about the issues at hand and general scientific principles, thereby setting a base for informed discussion (Scheufele & Krause, 2019).

2.5. Inclusivity and diversity in science communication and public engagement

The terms 'diversity' and 'inclusivity' (or: inclusion) increasingly appear in the body of literature on science communication and public engagement. Diversity, generally, is referred to as the acknowledgement and celebration of differences between people, their experiences and perspectives (Swartz et al., 2019). It may relate to a wide array of different aspects, including age, gender, race, nationality, religion, culture, socio-economic status, sexual orientation, disability, education and skills (Pless & Maak, 2004; Swartz et al., 2019). Pursuing diversity is important for accurate representation, specifically for groups that tend to be underrepresented (Bernstein et al., 2019).

According to Winters (2013), diversity can, thus, be seen as describing a state, while inclusivity refers to the processes and actions of creating an environment that is accepting of different people, perspectives and experiences in a way that values everyone's unique contributions and allows everyone to reach their potential. In other words, inclusivity reaches beyond representation by demanding for everyone to be granted the same opportunities as well as to be valued in their uniqueness. According to Nishii (2013), an inclusive environment is characterized by the fact that "individuals of all backgrounds – not just members of historically powerful identity groups – are fairly treated, valued for who they are, and included in core decision-making" (p. 1754). Pursuing inclusivity, therefore, is a key activity in any attempt to confront inequality (Nishii, 2013).

Consequently, the political value of both science communication and public engagement raises questions about inclusivity and diversity and emphasizes the necessity to include all audiences (Massarani & Merzagora, 2014). As explained by Scheufele and Krause (2019), where certain groups in society will highly benefit from scientific knowledge and the resulting implementation of innovations and technologies – such as AI -, minority groups tend to be disproportionally affected by these developments, often in a negative way. It is, therefore, highly important to include specifically these groups of people in public engagement initiatives surrounding such developments, as well as science communication in a more general sense (Scheufele & Krause, 2019). That is, those who are the most negatively affected, should be visibly included and heard in public engagement initiatives and science communication in order for them to feel engaged and be able to voice their opinions or concerns.

2.5.1. Social exclusion

However, this is often neglected in practice. Both access to information and opportunities to take part in citizen engagement initiatives are inequitably distributed, with certain groups being severely underrepresented in science communication and public discussions (Canfield et al., 2020). Dawson (2014, 2018) argues that science communication efforts in the western world are inherently shaped by social exclusion and inequality, thereby withholding minorities from being able to access representative science communication and gather dominant forms of cultural capital. This social exclusion from science communication is twofold.

Firstly, most science communication efforts in the western world are built on a history of cultural imperialism; that is, "socially dominant perspectives and practices suppress or invalidate the views of marginalised groups" (Dawson, 2018, p. 776). They highlight the example of having one's cultural artefacts and practices featured in ethnographic exhibits without permission and co-operation, treating those cultural practices and artefacts as 'other' (Dawson, 2018).

Secondly, due to the social reproduction of existing injustice, people may experience feelings of powerlessness; for instance, in terms of them feeling disrespected and lacking the autonomy and power to either participate in activities or change the terms of their participation (Dawson, 2018). That is, citizens may feel as if their opinions and participation efforts are not respected or even desired. Furthermore, navigating oneself in a space that fails to accommodate perspectives and experiences outside the socially dominant structures requires the emotional labour and discomfort of trying to fit in, which may lead citizens to conclude that science "is not for me" (Humm et al., 2020, p. 166).

Furthermore, people may experience financial and/or logistic barriers to participate in science communication activities (Dawson, 2014). Humm et al. (2020), therefore, distinguish between material- and emotional or social exclusion factors. The former may refer to, for instance, the lack of financial resources to afford entrance fees and transportation or wheelchair inaccessibility, while the latter may refer to feelings of alienation, shame or being left out (Humm et al., 2020).

Moreover, Reincke et al., (2020) note that contemporary science communication is still heavily influenced by the knowledge deficit model, which disregards any other knowledge than scientific knowledge as subordinate. This renders any perspectives from those not included in the scientific

discourse obsolete, thereby providing a very limited account of valuable perspectives and experiences (Reincke et al., 2020). Notably, true inclusivity and diversity of science communication, thus, stretches far beyond mere financial or logistic barriers (Haddon, 2000). It requires active reformation of established, mainstream science communication and the development of alternative forms of science communication that respect and value a broader range of knowledge and practices (Dawson et al., 2022).

2.5.2. (Non)participation

Although many citizen engagement initiatives in scientific and technological fields are deployed, only few manage to successfully establish meaningful engagement and dialogue (Powell & Colin, 2008). Wynne (2006) describes how science as an institution constantly tries to lay responsibility for distrust and public alienation with citizens, unable to acknowledge its own role in the "institutionalized idolatry of science" and the imposing of scientific objectives on the public without considering the "salient dimensions of legitimate public risk concern" (p. 214). Consequently, when citizen engagement projects are initiated and carried out by institutions that fail to reflect on their own activities, perspectives and role, no meaningful dialogues about science can be established (Wynne, 2006).

Humm et al. (2020) conceptualize this issue as a deficit perspective on participation. This perspective describes emotional barriers for citizens to engage in science communication as deficits of these citizens, rather than acknowledging that usually, nonparticipation is a consequence of systematic and long-term negative encounters that are often passed down generations (Humm et al., 2020). The assumption that certain audiences are simply not interested in science and do not acknowledge the potential value of citizen engagement is a consequence of this deeply engrained, Western belief in scientific superiority that neglects unconventional experiences and practices of science (Canfield et al., 2020).

Fostering participation therefore is, above all, a matter of rebuilding trustful citizen-science relationships (Hansen & Hilbrich, 2021; Humm et al., 2020) and reshaping the systems that underlie science communication and citizen engagement and perpetuate inequality by default (Canfield et al., 2020). The deeply entrenched legacy of the knowledge deficit model and the exclusionary history of Western science communication and discourse encourages people to obscure perspectives on science that undermine the status quo. Hayes et al. (2006) refer to this type of nonparticipation as a form of self-censorship, used to avoid conflict and/or social degradation in a context in which one is likely to encounter criticism or opposition. Amplifying underrepresented voices and exploring unconventional perspectives on science, therefore, may be a first step in diminishing this self-censorship.

Furthermore, Powell and Colin (2008) note that, in order to realize effective citizen engagement, true institutional support is required and clear goals and desired outcomes should be discussed and potentially negotiated beforehand. That is, in order to truly break down the traditional top-down approach to citizen engagement, transparency, openness and willingness to reflect are key prerequisites. If these are not respected, the engagement activities will most likely end up being mere forms of superficial symbolism (Powell & Colin, 2008).

2.5.3. Inequalities in AI science communication and engagement

Regardless of what exact future scenario will play out, the impact of AI is expected to be great and likely to affect many aspects of human life (Makridakis, 2017). It is, thus, highly important to pay attention to the ways in which AI can potentially enforce or perpetuate contemporary inequalities and power structures. That is, those who are privileged by the contemporary status quo and currently in charge of the development of AI are expected to highly benefit from the technology, while, as established by Scheufele and Krause (2019), minoritized groups are most likely to be negatively affected by its implementation.

For instance, people from a socio-economic minority working manual jobs may be one of the first to lose their job due to AI revolutionizing the work floor (Rajnai & Kocsis, 2017). Furthermore, people of colour, women and gender-fluid people may fall victim to sexism and/or racial discrimination (Zuiderveen Borgesius, 2020) and the introduction of AI may very well be just another way to enforce the technoableist rhetoric that technologies can and should be used to fix disabilities (Shew, 2020). Thus, in the words of Roche et al. (2021), "both the AI technology itself and the ethical frameworks and standards emerging around it can reproduce and reinforce a variety of biases if not designed, developed and deployed on the basis of inclusive participation" (p. 643).

Although it is crucial to incorporate the perspectives, opinions and experiences of those most likely to be negatively affected by AI in public engagement initiatives and science communication, this need is often neglected. Cave et al. (2019) studied the publics' perceived influence on AI development in the UK. They found that 61.8% of respondents felt that they, in no way, could influence how AI develops and is implemented in the future (Cave et al., 2019). The reasons for this can be divided into three categories.

The first category referred to age, meaning that the older generation did not feel as if they would be taken seriously in discussions about AI considering their age (Cave et al., 2019). The second category referred to technological determinist views, which argue that AI will develop in the future regardless of attempts to change or inhibit it (Cave et al., 2019). The third and last category refers to the fact that the public is barely consulted; respondents stated that their views are neither solicited or desired (Cave et al., 2019). Important to note is that this research focused on the general public as a whole, thereby not accounting for differences in experience as resulting from one's different identities and backgrounds. That is, it can be expected that individuals who are part of a minoritized group may feel even less involved and heard in the contemporary debate surrounding AI.

Roche et al. (2021) affirm that this is indeed the case. In their study, they found a great absence of important stakeholders in the global discourse on ethical AI; those who are most likely to be marginalised by the technology, including women and the Global South (Roche et al., 2021). This unequal participation in the debate is indicative of the inherent power imbalance. Considering that the debate currently is dominated by higher-income countries and a male-dominated industry, it can be expected that important topics such as gender equality, global fairness and cultural pluralism are unlikely to be featured in further policy- and AI development (Roche et al., 2021). Frankly, it can be argued that the ways in which the Global North imposes power by implementing and controlling new digital ecosystems in the Global South without respecting the values, perspectives and interests of local communities, is a form of technological colonialism itself (Kwet, 2019; Birhane, 2020).

Similarly, in the study of Niklas and Dencik (2021) on the European discourse about social rights in AI policy, it was found that little attention is given to specific challenges and particular rights as compared to the general discussion on fundamental rights. If specific problems are addressed, however, these are mostly submitted by migrants groups, organisations representing people with disabilities, women, ethnic minorities and the elderly (Niklas & Dencik, 2021). This emphasizes the importance of the inclusion of minoritized voices in the discourse, science communication and engagement surrounding AI, as their experiences can highlight issues usually unforeseen or neglected. Especially when the stakes are high and the technology will heavily impact lives, as is the case with AI, inclusivity and diversity should be core values during the development and implementation processes, which currently does not seem to be the case.

2.6. Conclusions from the literature

In this theoretical framework, the most important and prevalent themes with regards to AI, science communication, public engagement as well as inclusivity and diversity have been discussed. The existing body of literature shows an extensive history of research on both AI and its associated ethical

concerns, as well as how these relate to issues of exclusion and injustice. It has become clear that people from minoritized groups are at the highest risk of being confronted with negative consequences of AI, such as privacy harm and algorithmic discrimination (Scheufele & Krause, 2019). Yet, they often have limited access to science communication and public engagement due to the exclusionary beliefs that underlie these initiatives, thereby withholding them from important information and decision-making processes (Dawson, 2014, 2018).

Considering this, it is important to reflect on science communication and public engagement efforts surrounding AI, with specific focus on how inclusive and diverse they are. Existing research on science communication and public engagement about AI focuses mostly on the portrayal of AI in the popular media and public discourse, which explains citizens' perceptions of AI but lacks insight into their experiences with educational- and citizen participation initiatives about the topic. Existing research on inclusivity, diversity and exclusion in science communication and public engagement focusses mostly on science as a general concept. This study is, thus, unique in combining literature on science communication and public engagement with inclusivity and diversity, in the specific context of AI.

3. Method

In this section, the methods for this research are discussed. Firstly, the reasoning behind the research design is elaborated on. Secondly, the sampling procedure and the pool of participants is described. Thirdly, the data collection procedure is presented and lastly, the data analysis process is explained.

3.1. Research design

This study aims to research the inclusivity and diversity of science communication and public engagement surrounding AI in the Netherlands. Key to the goal of this study is to build an understanding of the specific experiences of citizens in low SES neighbourhoods. This may include, for instance, one's perceptions about AI and the accessibility of science communication and public engagement initiatives, motivations to engage with or withdraw from information and activities about AI, as well as other considerations and potential encounters or situations that have shaped their experiences.

Due to both the explorative nature of the study and its focus on the personal experiences of citizens, a qualitative research design is ought to be most appropriate. That is, a qualitative research approach allows for nuanced and detailed elaborations, providing the opportunity to gain deep insight into individual perceptions, emotions, motivations and thought processes (Boeije, 2014). Furthermore, an inductive approach is expected to help identify the relevant concepts, themes and stakes (Thomas, 2003) that shape and characterize the different experiences citizens may have had.

In terms of the data collection, semi-structured interviews were conducted. Semi-structured interviews, as described by McIntosh and Morse (2015), are "designed to ascertain subjective responses from persons regarding a particular situation or phenomenon they have experienced" (p. 1), which in this case refers to individuals' experiences with science communication and public engagement surrounding AI. Semi-structured interviews usually are based on a pre-defined framework of open-ended questions, however, leave room for follow-up questions and further elaborations on the participants' input (McIntosh & Morse, 2015). This flexible interviewing approach allows for participants to freely answer questions and provide detailed accounts of their personal experiences. The chosen research design was approved by the University of Twente Ethics Committee of the faculty of Behavioural, Management and Social Sciences (BMS), under the request number 230108.

3.2. Sampling and participants

To answer the research question, it is essential to understand the experiences of citizens with the aim to identify potential forms of exclusion. Hence, participants were recruited on the basis of being most likely to be underrepresented in science communication and public engagement initiatives, which, according to Dawson (2018), mostly affects people from socio-economically disadvantaged backgrounds and minority ethnic backgrounds. Doing so, however, should not be taken lightly.

The categorisation of participants as being part of an underprivileged or minority group creates labels, and as described by Young (2000), "none are innocent or neutral" (p. 143). That is, when studying issues of exclusion, there is tension between the risk of contributing to or even constructing harmful notions of 'others', while simultaneously acknowledging the varying experiences and perceptions of people (Dawson, 2018). Bhopal (2008) corroborates that research on exclusion may cause damaging effects, however, also emphasizes the need for researchers to prevent bypassing minority populations in their studies. Essential is, thus, to approach this type of research with careful consideration of the balance between describing and analysing people's experiences in relation to exclusion and the harmful identification of groups of people as 'other' or 'marginalized' (Dawson, 2018).

The participants of this research were recruited in the neighbourhoods Wesselerbrink Noord-Oost and Twekkelerveld in the city of Enschede, the Netherlands. According to Centraal Bureau voor de Statistiek (2023), these neighbourhoods have a higher average of people from a lower socio-economic status (SES) as compared to other neighbourhoods in Enschede. Their SES-WOA score, which is based on the combined factors of welfare, educational background and employment history (welvaart, opleidingsniveau and arbeidsverleden), were respectively -0,781 and -0,633 in 2019. The neighbourhood Drienerveld-UT had a lower SES-WOA score (-0,980), however, was not taken into account due to its proximity to the local university. The neighbourhood has a high population of students who tend to have a low income and do not have an extensive employment history, however, do enjoy higher education. This neighbourhood, therefore, was not considered suitable for this research.

In addition to its SES-WOA score, the neighbourhood Wesselerbrink Noord-Oost also has relatively more residents with a migration background as compared to other neighbourhoods in Enschede – except for Wesselerbrink Zuid-Oost and Stroinkslanden-Zuid. In 2019, Wesselerbrink Noord-Oost had a total of 3.905 residents, of which 495 were citizens with a western migration background – which Centraal Bureau voor de Statistiek (CBS) defines as including migrants from Europe (excl. Turkey), North America, Oceania, Indonesia and Japan - and 1450 were citizens with a non-western migration background (Centraal Bureau voor de Statistiek, 2023). Considering that citizens from a lower SES-WOA background and with a migration background are expected to be less represented in science communication and public engagement initiatives (Dawson, 2018), the recruitment of participants mostly took place in, but was not limited to, Wesselerbrink Noord-Oost.

For this research, a convenience sampling method was used which means that participants were recruited on the basis of their availability (Emerson, 2015). This approach to sampling usually is criticised for basing a pool of participants on overlapping social networks or geographical locations, which tends to result in a relatively homogenous pool of participants that is not representative for the general population (Emerson, 2015). However, the aim of this research is not to provide a representative account of the experiences of the Dutch population or even certain communities; the problem of exclusion is complex and individual experiences usually are characterized by a variety of intersecting identities and factors (Judd & McKinnon, 2021), which do not necessarily apply to other individuals' experiences. Rather, this study aims to provide an in-depth understanding of the participants personal experiences. Hence, this sampling approach was ought to be most appropriate.

In order to recruit participants, the researcher approached citizens at the local shopping mall and library. Especially the library functions as a physical space for local residents to meet, which is why it provided a suitable point of entry to establish contact with the residents – as well as a suitable location for the interviews to be conducted. Based on their willingness and availability to participate, participants were recruited. Every participant was recruited by means of this sampling method, with the exception of one participant who was contacted on the basis of the researcher's own personal network.

A total of 19 participants took part in this research. The participants were all between the ages of 22-63 years old, with an average age of 42,7 years. The majority of the participants was born in the Netherlands, but the sample also featured participants born in Lebanon, Azerbaijan, Angola, Indonesia and Hungary. The participants had various occupations, ranging from working in healthcare, transport, customer service, construction and administration. The sample also included participants who were still studying, doing volunteering work, and running a household. With regards to educational background, ten participants – the majority – had a MBO education. Three participants had a HBO educational background and five participants enjoyed secondary education. Furthermore, one participant held a non-Dutch educational degree obtained abroad. Since gender was not taken into account as a potent factor in this research, in the result section, all participants are referred to as 'they.'

3.3. Procedure

The interviews took place both online and physically. While most participants were available to conduct the interview at the library immediately after being approached by the researcher, some indicated to rather do it online at another moment. Eventually, two of the nineteen interviews were conducted online; the others took place at the library in the city and in one instance, at a participant's house.

Before the interviews took place, participants were briefed about the topic of the study and the goal of the interview. Subsequently, they were handed an informed consent form, which can be found in Appendix A. By means of this form, participants were informed about the anonymity of the study, their right to withdraw as well as how the data of the study would be handled. Furthermore, the form asked for participants' consent to record the interview audio. After signing the informed consent form, the actual interviews started. In the case of the online interviews, the informed consent form was read out loud by the researcher and the participants gave their verbal consent. One participant did not consent to having the interview recorded. Consequently, no transcript was made of that specific interview; however, the participant did give consent for the researcher to take handwritten notes for the analysis. The interviews had an approximate duration of 25-55 minutes.

During the interviews, a pre-defined topic list with questions based on the existing literature was used as a guideline for the conversation. The pre-defined topics included a small set of socio-demographic questions, general questions about the participants' feelings towards AI, questions about their experiences with both information and activities about AI and, finally, questions about the extent to which they felt included and how science communication and public engagement activities can be designed to be more inclusive in the future. Before answering the general questions about their perceptions of AI, participants were shown a two-minute explanatory video to ensure a basic understanding of the technology. The complete topic list with questions and a description of the timeline can be found in Appendix B.

3.4. Data processing and analysis

After 19 interviews, the conversations showed similar themes and patterns without introducing new ones. At this stage of theoretical saturation, it was decided to continue with the data preparation for the analysis. Firstly, all audio recordings of the interviews were transcribed manually. Subsequently, all the data was anonymized, meaning that all names and other identifying factors were removed from the transcripts. After the data processing, the transcripts were uploaded to the software programme ATLAS.ti, which was used for the coding process and qualitative analysis.

By using a combination of both deductive and inductive coding, the codebook was based on both the foundations of the conducted literature review and the findings in the new data. The most important themes and concepts found in the existing literature formed the basis of the coding scheme. Then, after the initial, first reading of the transcripts, a draft codebook was established covering the most apparent themes within the data as well. Based on this coding scheme, the first rounds of open coding were conducted, throughout which the coding scheme developed into a more substantial framework with more clearly defined categories and subcodes.

In order to test the coding scheme and the reliability of the coding, an intercoder-reliability test was performed. An independent coder coded 10% of the complete corpus of data, after which a Cohen's Kappa was calculated for each of the code categories, except for the category Demographics. The first round of coding with an independent coder showed insufficient agreement. Consequently, the codebook was revised. After further defining the codes and providing more detailed descriptions, a second round of coding with an independent coder was performed. After the revisions, the codebook did yield Cohen's Kappa's higher than 0.6, thereby ensuring sufficient agreement. The values are presented in the table below.

Table 1

Cohen's Kappa's of the main categories

	Category	**Cohen's Kappa**
2.	Perception of AI	0.736
3.	Engagement with AI information	0.621
4.	(Non)participation and inclusion/exclusion in AI activities	0.628
5.	Wishes and needs for inclusive science communication	0.633

The final coding scheme can be found in Appendix C. This coding scheme was used to code all data, after which the most important concepts and relationships could be identified. The results of the analysis are presented in the following chapter.

4. Results

In this section, the results of this research are presented. This is done on the basis of four main categories, including 1) perception of AI, 2) information engagement and behaviour, 3) (non)participation in science communication and public engagement activities about AI and 4) wishes and needs for inclusive science communication and public engagement about AI. These main categories are, in turn, divided in subcategories, which reflect the main themes found in the data.

4.1. Perception of AI

To understand the context in which the participants (do not) engage with and experience science communication and public engagement about AI, it is important to first elaborate on their general perceptions of AI.

4.1.1. Perceived knowledgeability

To get insight into the perceived knowledgeability of the participants with regards to the topic of AI, they were asked about their familiarity with the technology. The majority of participants indicated their knowledge of AI to be quite limited, and in a few cases, participants expressed to not be familiar with the technology at all. For them, the interview appeared to be their first introduction to the concept of AI. However, after watching the explanatory video and talking about AI for a while, most participants in this group expressed to, in fact, be familiar with certain specific applications of AI, which they had encountered or heard about in their daily lives. The most frequently mentioned examples were Tesla's self-driving car, chatbots, personalized advertisements and social robots. Participant 12 (LN: 251) said: *"We use it, but we actually don't even know what it is. It is unconscious."* Thus, almost all participants turned out to be, at least to some extent, familiar with the concept of AI or some of it specific applications – with the majority of participants reporting their perceived knowledge of the topic as either low or moderate. To illustrate the latter, participant 17 (LN: 42) stated: *"Yes, I have heard about it. But I am not very familiar with it."*

On the contrary, a few participants also expressed their perceived knowledge of AI to be relatively high. In these cases, participants generally had a background in IT, showed an innate interest in computer technology or had personal contacts who were knowledgeable about the topic. Consequently, they were able to give quite elaborate descriptions of not only potential applications of the technology, but also of how AI technology generally works.

During the interviews, participants mentioned a multitude of potential applications of AI technology. In addition to the most frequently mentioned and well-known applications – self-driving cars, chatbots, personalized advertisements and social robots –, participants also often mentioned the potential of AI in healthcare. That is, participants indicated that they expect AI to play a substantial role in both the treatment and diagnosis of diseases in the future. Furthermore, participants mentioned (potential) applications of AI in security, art and the government. When describing applications, some participants also referred to countries as China and Japan, where AI is perceived to be more visible in daily life. Some participants also described conditions for the implementation of AI, for example in terms of supervision, responsibility, testing and transparency.

4.1.2. Attitude

When asked about their feelings and thoughts about AI, an overwhelming majority of participants was found to have either a negative or somewhat neutral attitude towards AI. Only a few participants expressed an evidently positive attitude towards AI, in some cases founded in their general appreciation for technology. To illustrate, participant 18 (LN: 26) stated: "*I find it beautiful, amazing, technological progress*" and participant 16 (LN: 75) mentioned: "*I love computers and everything that has to do with the computer.*" Others referred to the potential solutions AI can offer in terms of security

and healthcare, or emphasized the higher levels of efficiency that can be reached through the use of AI. Participant 6 (LN: 112-113) said: "*I think it can really help us forward, in terms of efficiency and speed.*" Overall, efficiency and healthcare solutions were perceived to be the most important advantages of AI, also among those who expressed a neutral attitude towards AI. For instance, participant 10 (LN: 219-220) explained: "*In a medical context it can really be your friend. Given that it is, of course, properly developed and tested. Yes, then I definitely see the advantages in that.*" One participant also mentioned the social advantage AI may provide - for instance for battling loneliness – and another perceived the possibility to create personalized advertisements as an advantage as well.

The general sentiment towards AI, however, was a bit more nuanced. Many participants held a more neutral attitude and sometimes had difficulties describing their feelings towards AI. When asked why, many participants referred to the perceived ambiguity and opacity of the technology. As participant 4 (LN: 180) explained: "*It isn't right or wrong, it is more like.. what is the goal behind it?*". Participant 5 (LN: 88) also expressed that they perceived AI to be a difficult topic: "*One can see the advantages.. but the disadvantages might be really severe.*"

During the interviews, many potential disadvantages of AI were mentioned, often as part of the reasoning as to why participants had a negative attitude towards AI. The most frequently mentioned disadvantage of AI concerns technological dependency, or the idea that the use of AI will leave humans incapable to live without it. Participant 5 (LN: 443-445) stated: "*I'm really afraid of that. That everything will come crashing down. Just one minor thing has to happen, and the whole of the Netherlands is down. You can't do anything anymore.*" An important worrying factor for some participants is the future of their children, due to their increasing dependency on technology. Participant 9 (LN: 99-100) explained: "*That is what AI is doing to the whole system, it neglects the children, makes them lazy.*"

Furthermore, privacy loss and the risk of power misuse – i.e., the use of AI by a powerful entity or person as a means to execute their maleficent agenda – were frequently mentioned as disadvantages as well. To illustrate, participant 10 (LN: 223-226) said: "*Society just has to be protected against people like (..) If you are mentally incapable to think straight and you have power over so much personal data… Then it is really good that measures are being taken.*" Other disadvantages described by the participants concerned a lack of human authenticity, loss of control over the technology, plagiarism, financial expenses, job loss, manipulation through fake news, discrimination, weaponization, unsolicited use and the notion that humans should not 'play God'.

Two participants had a particularly negative attitude towards AI. They indicated that their attitude is rooted in the belief that AI is currently being deployed by the World Economic Forum (WEF), governments, companies and the weapon industry to gain and exert power over citizens, for instance, in the form of a social credit system. As participant 4 (LN: 80-84) stated: "*What's making me itch is how far they are implementing it in China. That if you cross a red light, you are scanned and you can't withdraw money from the bank anymore, or you are being cut on your insurance. I believe the world is heading towards that. And that the big plans of the World Economic Forum are contributing to it.*"

The participants shared the fear that the implementation of AI will reduce citizens to mere links in a system and will strip them of their humanity. To illustrate, participant 19 (LN: 15-16) said: "*People really have no clue that they want us to become robots… I just want to remain human.*" According to these participants, the government is pushing a clear transhumanist agenda of which most citizens are still oblivious. Consequently, they deeply mistrust the government and associated institutions, such as science and the media, which are believed to be bribed by the WEF to support and spread their agenda. Participant 19 viewed AI as an inherently problematic tool for manipulation and exerting control and power. Participant 4 took a more moderate perspective by stating that to them, AI is not inherently problematic, but their negative attitude is more so rooted in the way that it is currently deployed and the people and institutions that are in charge.

4.1.3. Importance and interest

In terms of the importance of AI, there was more consensus among the participants. Almost all participants indicated AI to be an important topic, mostly because it is expected to become a vital part of future, modern life – regardless of whether that is to the participant's liking or not. Participant 1 (LN: 67-68) explained: "*You know, the entire world is built around it, it is all about it (..) It determines the future.*" Both opportunities – specifically potential healthcare innovations – and risks were mentioned as part of the reasoning as to why AI is such an important topic to the participants.

A handful of participants, however, had a more neutral perspective in terms of the importance of AI. Generally, they indicated that AI could be important under certain circumstances, for instance when it could positively contribute to their personal life. Only participant 9 (LN: 128) indicated that AI was not really important to them. They stated: "*No, it is a side-issue for me at this moment. Because I don't live with it*", implying that the topic at this moment is not very important to them personally, however, this might change in the future if AI becomes a more visible part of their daily life.

Where the level of importance of AI was generally considered high, the participants' levels of interest in the topic were more equally distributed. Half of the participants indicated that they found AI to be an interesting topic. The other half of the participants reported to not find AI interesting, or only to a small extent. In most cases, participants expressed not to have a specific reason for this; they simply did not find the topic intriguing and they had different interests. However, some participants also indicated that their lack of interest could be due to the fact that AI is still an abstract concept to them, and they expected their interest to grow over time. To illustrate, participant 11 (LN: 112) explained: "*I think it is because it is not yet as visible in the world.*" Similarly, other participants expressed that hearing and talking about AI had sparked their interest a little bit, although they would not be likely to follow-up: "*Now that we're talking about it like this, I find it kind of interesting, but I would not go and get a book about it.*" (Participant 10, LN: 86-87).

The group of participants who indicated to find AI interesting, however, reported to be very open to receiving information about the topic. Some were already relatively knowledgeable because of their general interest in computer technology. These participants also expressed to be interested in the more detailed workings of AI. For others, especially applications of AI were perceived to be interesting, such as security cameras, self-driving cars and robotics, which participants wondered could be useful in, for example, their own work. For instance, participant 18 (LN: 172-175) said: "*I find it fascinating, such gadgets. It makes it pretty interesting. The whole idea of self-driving cars is actually also purely IT.. That's fascinating. But maybe also because it relates to my job.*" Furthermore, the novelty of the topic sparked the interest of the participants.

4.1.4. Worldviews towards technology

During the interviews, participants were asked to talk about their feelings and thoughts towards AI. Interestingly, this spurred conversations not only about AI, but also about some participant's more general worldviews towards technology. Notably, the worldviews described by the participants all had a negative sentiment, and can be categorised under three main themes: world of control, dependency and complexity.

The first worldview which was described by participants relates to control, power and manipulation and is based on the belief that AI – or any technology - is destined to be abused by powerful figures, in one way or another. As described by participant 5 (LN: 110 & 72-73): "*Mankind is not in its right mind. There's too much greediness in this world. (..) Humans are bound to abuse everything.*" The fear for power misuse, thus, goes far beyond just AI. Rather, for these participants, the implementation of AI is exemplary for much of the manipulation, greed and power hungriness they perceive in the world – for instance, in the case of the social credit system. Participant 4 (LN: 354-357) stated: "*Ultimately, everything is about money, money and power. And the more money and power, the*

crazier people start behaving. And it's the same with this. It doesn't benefit humanity anymore. But even if it harms humankind, but it creates money and power.. then that's what is going to happen." Especially for the two participants who viewed the implementation of AI as part of the agenda of the WEF, this worldview characterizes the way in which they look at both AI and other developments in the world.

The second worldview relates to technological dependency. The participants who described this worldview, shared great fears of humankind becoming fully dependent on technology – including AI. Talking about AI, for them, spurred worries about the general increase of technology use and, in many cases, how this will affect their children in the future. To illustrate, participant 3 (LN: 73-74 & 80-82) stated: "*30-40 years ago it was better, because there was more stimulation. That is a new problem. (..) If we read a book, ask someone, or conduct some research ourselves, our brains grow. But the computer makes people dumb.*" Participants foresee – and to some extent already experienced - a world in which people are not only becoming lazy and/or dumb, but also lack the needed social skills and are highly dependent on technologies to function in their daily lives. To them, AI is just another of many technologies that hinders people to develop themselves and function independently, a trend that they have been observing for a while.

The third worldview relates to the complexity of today's world. For some participants, AI is exemplary for the many difficult challenges society is facing today, including climate change, war, housing problems and recently – COVID-19. As explained by participant 5 (LN: 134 & 150-152): "*Everything has become way too complex, and goes way too fast right now. (..) It weighs heavily on me, I'm scared. Back in the day you'd never have to think about it. There was good and evil.*" For this participant, AI is a reminder of all the wicked problems society is facing, while it simultaneously leads them to reminisce about a better time in which they did not have as many problems.

4.2. Information engagement and behaviour

Citizens may engage with science communication and information about AI in various ways, for various reasons. Therefore, in this research, a distinction is made between consuming informational content about AI and joining science communication and public engagement activities about AI, as citizens may experience and/or perceive the two very differently.

4.2.1. Level of engagement

In order to gain insight into the extent to which the participants engage with information about AI, they were asked about their experiences and, subsequently, their reasons for (not) consuming information. The responses were relatively equally distributed among three levels of engagement: high, moderate and low.

The first level includes participants who displayed a positive attitude towards consuming information or content about AI, and also indicated to do so on a regular basis. To illustrate, participant 6 (LN: 91-93) said: "*I don't really delve into it that deep, but you do hear a lot about it. And I find it interesting enough to remember stuff and learn a bit more about it.*" Most of these participants stated that they generally try to stay up-to-date with new developments surrounding AI, and also expressed that it is important for them to be and feel informed. For some, this is a matter of innate interest, while others even perceive it to be an obligation or duty: "*You have to move with the times, you have to know what is happening in society.*" (Participant 9, LN: 215-216). Furthermore, participants reported to be more inclined to look for and consume information about AI when they hear about it in their daily lives, for instance, at school. Moreover, they expressed to be more interested in consuming information whenever they sense an opportunity for AI to be implemented in their own life or work. Innate curiosity, the desire to improve one's general knowledge and relevancy for one's personal life, thus, can be perceived as important stimulators for the participants to engage with information about AI.

The second level of engagement relates to the participants who indicated to enjoy occasionally consuming information about AI – at least to a certain extent, but who do not tend to take initiative to find informational content themselves. That is, their information consumption in relation to AI is situational, dependent on what content they naturally come across. To illustrate, participant 17 (LN: 104-105) stated: "*I am open to it, so if I were to come across some articles that grab my attention, I would read them. But I would not start looking into it myself.*" When asked about what would in fact spark their interest, they explained: "*Something in the medical sphere, how it is being implemented in hospitals. Something that has an impact on society, what really affects people and is less about social media and phones.*" (LN: 110-112). Apparently, practical, real-life examples provide an important reason for participants to engage with information about AI.

However, importantly, these participants also indicated that, although they might appreciate some basic knowledge about AI, they generally do not feel the need to further strengthen their knowledge. To illustrate, participant 11 (LN: 284-285) explained: "*Now that you are telling me all of this, I'm like: oh, okay! But it is not as if I am going to act upon it, I don't feel the need for that.*" Similarly, some participants described that, even though they might make the effort to engage with content about AI, the information salience is usually low. That is, the information is usually quickly forgotten and participants tend not to consciously think about the topic for much longer after consuming the information.

The third level refers to the participants who indicated not to, or barely, engage with informational content about AI and/or tend not be consciously aware of the topic. That is, while some participants reported that they consciously choose not to engage with informational content about AI – for instance, because they distance themselves from the news -, others had never given it a conscious thought, thereby withholding themselves from accessing information. To illustrate, when asked about whether they sometimes came across information about AI, participant 17 (LN: 84-85) answered: "*Barely. And maybe I also may not always notice it is about AI, because I am not conscious about it.*" Low levels of engagement with information about AI, thus, do not necessarily have to stem from a lack of interest or effort to engage with informational content; rather, it may be caused by unawareness. The majority of participants who reported to have a low level of engagement indicated this to be the case for them.

However, a few participants also reported to distance themselves from informational content about AI purposely, for a variety of reasons. Firstly, some participants indicated to simply have no interest in the topic and, therefore, see no use in being informed about the topic – even though they might still perceive AI as an important issue for society as a whole. To illustrate, participant 10 (LN: 198-201) stressed: "*Well, I don't find the topic to be very interesting, at least not for me personally. But I do really understand that you are doing a study about this, and that you have to warn people about the risks, especially young people. So it is good that you are occupied with it, but it's just not for me.*" These participants indicated that they have other priorities that they would rather dedicate their time and attention to.

Secondly, some participants indicated not to engage with information about AI because of their age. They do not expect AI to become very apparent in daily life during their lifetime, and therefore perceived AI to be a topic that is more relevant for young people. Furthermore, they felt like it would take them a lot of effort to familiarize themselves with the concept, considering they lack the general experience with and knowledge of technology that the younger generation is more likely to possess.

Thirdly, some participants reported not to engage with information about AI due to the perceived lack of influence they are able to exert. That is, they feel like the development and implementation of AI is immune to the public opinion and, therefore, cannot be influenced by citizens. Participant 1 (LN: 89-93) explained: "*I do not think big companies such as Google and Microsoft care. If we say 'we'll call it quits', I think they will still continue under the radar. So it's good that it's getting*

more attention, but will it matter in the end? I don't think so. Those companies will do whatever they want anyway." Their perceived lack of power to influence the impact of AI on society, therefore, leads them to question what the benefit of being informed even is.

Fourthly, participant 5 said to actively distance themselves from information about AI to protect their mental health when necessary. In line with the complexity worldview, thinking about AI strengthens their concerns about the state of society and its future, and the news coverage about the topic tends to feed into these worries. They explained: "*It's a very difficult topic, so it is taking a toll on me mentally. (..) It's scary. You don't want to have all the information, of course.*" (LN: 126-127 & 324). However, they also emphasized that this is not always possible and that they sometimes have to sacrifice their mental health in order to remain informed: "*If I wouldn't watch TV or I didn't have the newspaper, I'd know nothing about it. That certainly would be easier.*" (LN: 155-156). According to the participant, this is a trend they have been noticing among their peers and in their environment lately, as concerns about AI grow bigger.

Lastly, some participants indicated that they avoid information about AI due to a lack of trust. These participants, who reportedly follow the belief that the development and implementation of AI has a direct relation to the WEF, actively distance themselves from all mainstream news media and the government in an attempt to avoid what is perceived to be propaganda. Participant 4 (LN: 366-369) explained: "*The government is really making me itchy, because I just don't have any trust in them. So anything the government would do, I'd be really sceptical about, especially when it comes to this topic. Because I think it is not in favour of the citizens.*" For them, being confronted with information about AI communicated by the mainstream media or the government raises frustration, which is why any informational content about AI provided by these parties is consciously avoided.

4.2.2. Information consumption

During the interviews, participants described a variety of different sources they use to gain information about AI, - or would expect to use in case they gained an interest in the topic. The majority of the participants indicated that they find their information about AI in the mainstream media - including TV, radio and the newspaper -, followed by the internet, or more specifically, Google. Important to note is that, in most cases, participants indicated to only consult the internet after an encounter with AI somewhere else, for instance in the mainstream media. That is, participants reported to often have a specific incentive to start a Google search about AI, while in the case of mainstream media, a less active role is required; they take the role of passive receivers. Furthermore, participants also indicated to learn about AI through entertainment media, such as movies. Especially science-fiction movies have played a big role in shaping some participants' understanding of AI; some of the applications they mentioned were derived from or inspired by movies.

Some participants also indicated to have family, friends or other people in their social circle who are knowledgeable about AI. These people are perceived as valuable sources of information, who tend to keep the participants up-to-date on a regular basis. Notably, the participants who indicated to have close personal contact with someone who is informed about AI, also were relatively knowledgeable themselves – in comparison to those who did not have such contact. Participant 16 (LN: 132-135) explained how such contact among peers has inspired them to move beyond consuming information to trying out AI tools – such as ChatGPT - themselves: "*So what we sometimes do among friends.. we try out different things and look at the results. Which one is the best and fastest? And what are the answers? Same thing with colleagues. Because we have a shared interest in computers.*" Thus, engagement with information about AI may, according to participants, not only create more awareness and basic knowledge about the technology, but also motivate citizens to think more about and actually work with applications.

Furthermore, a few participants mentioned social media as sources of information, as well as international news media. In terms of the latter, the participants who reported to make use of international sources did so in a very conscious manner, for specific reasons. To illustrate, participant 7 (LN: 200-203) explained: "*The international news sources sometimes have a bit more in-depth information. An example is that they, for example, interview a group of scientists about the blackbox in AI who say that they don't know what is going on. So they tend to go a bit deeper, while here in the Netherlands it is a bit more general*", and participant 9 (LN: 220-222) argued: "*The developments here are very different than in the UK, America, France, Asia. Very different than Ethiopia. So you have to compare that. Because in wealthy countries they are starting to use it more.*" Notably, these two participants are very conscious about the way in which they consult and interpret news about AI, both in terms of its depth and the context in which it is communicated. This illustrates that, according to participants, one's engagement with information about AI is not solely based on the amount of content that is consumed, but can also be defined by the ways in which participants engage with information; for instance, taking into careful consideration the sources that they are using and their strengths and limitations.

Another illustration of the consciousness with which some participants select their sources relates to the participants who reported to make use of alternative news sources. These are defined by participants as news channels that do not stem from the government or mainstream media and often present narratives that challenge the status quo. Their preference for alternative sources is grounded in a deep distrust in the government and media, who are believed to spread unilateral – or even incorrect – information with regards to AI. Furthermore, they are believed to withhold important information with the aim to maintain and exert power over citizens. As participant 19 (LN: 22) stated: "*We cannot know too much about it, so that the government can maintain more power.*" Furthermore, participant 4 (LN: 126-128) explained: "*I think it is one-sided information. (..) And it is not the information that I believe to be true.*"

Consequently, these participants said they resort to alternative sources of information, usually through social media platforms as YouTube, Twitter and Facebook, but also through online forums and the newspaper 'de Andere Krant' (the Other Newspaper, translated). One participant said to follow a few influencers that spread an alternative message on social media as well. When asked about the appeal of these alternative sources as compared to the more mainstream sources, participant 4 (LN: 149-152) answered that it shows them a more nuanced and realistic perspective on AI: "*Well, the negative side. You know, the way in which China implements its policies, that there are cameras everywhere. Robots that take over everything, that kind of stuff. Yes, they discuss it.. often the negative consequences, or what people can do with it.*" According to the same participant, they use a variety of different (alternative) news sources to find the broadest range of perspectives possible to, subsequently, draw conclusions from; again exemplary for a highly conscious approach to consuming informational content.

In addition to the sources that they generally consult, participants were also asked about the perceived visibility of informational content about AI. Here, two types of responses can be identified. A slight majority of the participants indicated the visibility of information about AI to be high. Importantly, this mostly concerned participants who reported to regularly consume mainstream media. They indicated that they had been hearing a lot about AI in the news lately, both on TV and on the radio. In the words of participant 1 (LN: 129-130): "*It's been on the news a lot lately, so I think people are being quite well informed about it. They are not keeping it quiet, at least.*"

Although the visibility of informational content about AI was perceived to be high among these participants, some did place a critical note by emphasizing that this is, in part, a personal choice. According to them, it takes a certain amount of effort and/or dedication of time and attention to become informed. To illustrate, participant 6 (LN: 121-124) mentioned: "*I think it is also a personal*

choice if you want to. At least, I think that if you Google a bit or watch some TV programmes, you'll definitely find something. But if you always zap away because it doesn't interest you, or you never look up anything, you won't."

The other group of participants indicated the visibility of informational content about AI to be low. Many of these participants indicated that this could be due to the fact that they only became knowledgeable of AI as recent as the interview itself. Consequently, they had never consciously registered any informational content about AI. However, some participants were quite convinced of the fact that actually, not that much information is available for citizens. For instance, participant 11 and 12 (LN: 148-149 & 250) said: "*No, I think a lot of it is just unconsciously creeping in on us, and that people do not even notice that. The advantages and disadvantages. (..) In that respect, we don't hear a lot about it.*" While for some participants, who expressed not to feel the need to become more informed than they currently are, this might not be such a problem, others did think this is problematic. They expressed the belief that the government and media do not bother enough to keep citizens updated with new developments, resulting in many people not being aware of what the concept of AI means in the first place.

4.3. (Non)participation in science communication and public engagement activities about AI

In addition to informational content about AI, various science communication and public engagement activities are being deployed to try to inform and engage citizens with AI. This section is dedicated to understanding the participants' attitudes towards such activities, their intent to join and the reasoning behind this, as well as the extent to which this relates to any exclusionary structures.

4.3.1. Attitude and intent to join

In order to gain insight into the ways in which the participants relate to science communication and public engagement activities about AI, they were asked about both their attitude and intent to join with regards to various types of activities. Although attitude and intent to join, naturally, are two different concepts, they sometimes appeared to be heavily related. For instance, when participants expressed to have a negative attitude towards an activity, their intent to join was generally low as well. Consequently, one might expect to find a similar observation for positive attitude and a high intent to join; however, this was not always the case.

Overall, the sentiment surrounding science communication and public engagement activities about AI was relatively positive. The majority of the participants expressed a moderately positive attitude towards activities, describing something to the extent of: "*Well, I think that's good. I don't have anything against that. If people want information or want to give others information about that, I support that.*" (Participant 1, LN: 139-140). That is, most participants indicated to support the general idea of offering science communication and public engagement activities about AI. A small group of participants responded enthusiastically to the thought of specific activities as well, describing them as cool, good initiatives or even fun.

However, a significant portion of the participants also described to have a negative attitude towards such activities about AI. Participant 14 (LN: 96), for instance, said: "*No, it really doesn't appeal to me.*" Interestingly, those who expressed to have a negative attitude towards activities about AI generally did so from a personal point of view – that is, based on their own expectations and feelings. On the contrary, those who expressed to have a positive attitude often did so from a more general perspective, attributing their attitude to the basic idea of organising activities rather than focusing on the appeal an activity may or may not have to them as an individual.

In terms of the participants' intent to join science communication and public engagement activities about AI, there was generally more consensus: almost all participants indicated their intent

to join to be low, and only two participants had ever been to a science communication activity about AI before. Interestingly, not only the participants who expressed to have a negative attitude towards such activities about AI reported a low intent to join; those with a positive attitude did so as well. Where in the former case the participants simply may not give activities a chance because they feel like joining would not be fun or would not benefit them in any way, in the latter case, the reasoning is more nuanced.

Most of the participants in this group expressed that, although they might appreciate the idea of science communication and public engagement activities about AI, it in most cases still felt as if they were not for them. To illustrate, participant 15 (LN: 145-146) said: "*I wouldn't be interested. But I do think it could be fun. You can get some information, strike up some conversations maybe.. But it does not appeal to me.*" This emphasizes that for many participants, there is a substantial difference between their general opinion and their personal feelings or behavioural intent towards an activity. Although one's attitude towards an activity about AI may be positive based on its perceived benefit of increasing general knowledge within society, one may still experience individual boundaries that withhold them from actually participating. These boundaries will be further elaborated on in the sections about exclusion.

Although the majority of the participants indicated their intent to join to be low - regardless of their attitude -, a small group of participants did actually express a high intent to join. These participants generally expressed a positive or moderately positive attitude towards science communication and public engagement activities about AI and, based on their general interest in the topic, indicated that they would give such activities a try. To this group also belong the two participants who had been to a science communication activity about AI before: an AI-powered light and music show at the Gogbot festival in Enschede.

However, most of the other participants in this group, had never heard of such activities before. This was reported to be one of the main reasons as to why they had never gone to an activity. For instance, participant 15 (LN: 91-93) said: "*I usually am quite curious about certain things. But I have never seen any lecture about this, or heard that there was some information about it. That is why I also have never been there*", and participant 2 (LN: 165-166) mentioned: "*That's a pity, because I would have liked to have some information about it. I didn't even know that existed, so...*". Clearly, promotion of science communication and public engagement activities about AI is lacking for this specific group, especially considering their openness to give it a try. Moreover, the visibility of activities about AI was perceived to be very low among all participants, except for the couple who went to Gogbot. To illustrate, participant 10 (LN: 139-140) wondered: "*To be honest, I don't come across any of that. Maybe I belong to a different part of society, because I never run into it.*" Although more visibility may not directly increase these participants' intent to join, some participants did mention that it may be part of the reason why they are not really interested in or engaged with activities about AI; it reinforces a lack of conscious awareness of the technology.

Important to note is that, according to the participants, one's attitude and intent to join are subject to many different factors, which result in an activity being perceived as attractive or unattractive and might trigger an individual to join or reject an activity. Consequently, participants indicated that their attitudes and intent to join may change in the future, depending on the activity and the circumstances. Therefore, one's attitude and intent to join can hardly be defined as definite values that describe one's behaviour and feelings over a longer period of time. However, they do give an indication of the general position of the participants in relation to science communication and public engagement activities about AI.

4.3.2. Expectations

Although the majority of the participants had never been to a science communication or public engagement activity about AI before – or even heard of one -, most of them had certain expectations of what they would look like. Most expectations were related to the attendees and the actual content of the activities. In terms of the attendees, the participants expected mostly people working in the tech industry, students and people with a high level of education to join activities about AI. As participant 13 (LN: 304-305) said: "*Usually people with a normal or high intelligence join, who already know a thing or two about this.*" It becomes clear that many of the participants do not perceive themselves to fit into this profile. To illustrate, participant 12 (LN: 229-231) described his perception of a Science Café by saying: "*I think you'd be in a café with people… with a very different target group than we belong to. Look, after a few drinks I might be able to talk along, but I think they will be there with a very different goal than we are.*" Another participant added that they perceive an activity organised by a university, such as a Science Café, to be for highly intellectual people only; they think the organisers would not expect 'someone like them' to even show interest in the event.

A similar trend became apparent when participants elaborated on their expectations with regards to the content of such an activity: "*What I expect… Well, that I won't be able to understand a lot of things.*" (Participant 14, LN: 119). Some participants also expected science communication and public engagement initiatives to be boring, especially in the case of an activity where a scientist will give a presentation: "*Because often when a scientist starts talking.. zzzz. Because it's so boring and dry.*" (Participant 13, LN: 334-335). Moreover, some participants reported specific descriptions of the types of information they would expect to find at activities, including practical examples, informational videos, brochures and actual demonstrations of AI tools and applications.

Furthermore, two participants also had very specific expectations about the trustworthiness of science communication activities about AI. In line with their general distrust in the government, media, and - to a certain extent – scientists, they believe such science communication activities to be part of the WEF propaganda programme which aims to keep citizens oblivious to the dark side of AI. That is, they expect science communication activities to have a hidden agenda, which does not align with their personal beliefs about AI. Participant 4 (LN: 212-217) described: "*If I look at it sceptically, based on what I have been noticing around me in terms of media attention, I expect it to be a very positively charged event. Where they show all whatever AI is able to do, and hallelujah. That is my expectation. And I don't think that is the entire truth. So if that's the idea, I'm like: please skip these activities. Because people are being tempted with something that is not realistic.*" Similar to what they experience with informational content about AI, these participants get frustrated by the approach they believe is taken by those organising activities about AI, and therefore, try to avoid them.

Interestingly, talking about their expectations of science communication and public engagement activities about AI sparked many participants to think about other people's level of engagement with information and activities, and the extent to which others might enjoy such efforts, as well. The majority of participants expressed to think that most people do not know what AI is. As participant 17 (LN: 131-133) explained: "*I think a lot of people don't realise how widely it is implemented. Just like me, because I think that there's a big group of people who isn't really conscious of it.*"

Most of the participants with this expectation also appeared to think that other citizens would not be interested in engaging with science communication and public engagement activities or information about AI: "*It's difficult to get people to join, of course. Most people are not aware of it, you know. They think: oh, nice, it's in my app and it works perfectly, let's leave it at that.*" (Participant 1, LN: 226-228). When asked why the participants think this would be the case, they explained that they think many people feel like AI is too difficult of a subject to engage with, and that they will not be able to

understand. Furthermore, they feel like people have other, more important problems that are prioritized over being informed about AI.

A small group of participants, however, also indicated to think that other people would in fact be interested in being informed about AI. Participant 2 (LN: 320-322) described: "*If you were to approach them, like: we want to come and give a presentation about this, I think they'll welcome you with open arms. Like: 'come here!' People are curious about this, I think. At least if they hear about it.*" Another participant added that they think many people would be interested to know if AI could be of value to them in their personal life, for instance, at work. Notably, the participants who expressed to think that others would be interested in information and activities about AI, also indicated to have a positive attitude and high intent to join activities themselves.

4.3.3. Material exclusion

During the interviews, participants were asked about the reasoning behind their attitudes and intent to join activities. Consequently, they described a plethora of reasons not to engage with science communication and public engagement activities about AI, among which a few reoccurring themes can be identified that structurally exclude citizens from participating. In most cases, these were related to emotional- or social forms of exclusion – which will be discussed in the next section -, but participants also reported material barriers that withhold them from participating in science communication and public engagement activities about AI.

The most frequently mentioned material barrier for participation concerns time. Half of the participants, among which both participants with a negative and positive attitude towards activities, indicated that they generally do not have time to participate, even if they would want to. While for some, participating in science communication and public engagement activities about AI is not perceived to be a priority anyway, others indicated that their lack of free time really mitigates their possibilities to participate. For instance, participant 5 (LN: 249-250), who showed a clear interest in joining an activity about AI, mentioned: "*I think I'll be more engaged when I am retired.*"

Most of the participants indicated to have a busy lifestyle, with almost all participants having a fulltime job and being responsible for their finances, household, and in quite some cases, their children. Some expressed to already have difficulties juggling all their responsibilities now, leaving barely any free time in which participants could potentially participate in activities about AI. To illustrate, participant 15 (LN: 72-73) explained: "*I think it is mostly because I am in a phase of life with two small children. And I am raising them on my own, so I am very busy with that"*, and participant 3 (LN: 200-201) added: "*I don't like going there, because I am occupied with a lot of other things: my kids, the house, volunteering work..*". The latter participant emphasized that not only would it be logistically impossible to schedule a visit to a science communication or public engagement activity due to their lack of time, the idea of having to do so also raises their level of stress, as it adds another item to their ever growing to-do list.

In addition to time constraints, participants also described other material barriers to participate, albeit with a lesser frequency. A few participants described the transport to the activities to be a barrier for them to participate: they expect the events to often be far away from home and the transport to be expensive. To illustrate, participant 6 (LN: 220 & 376-377) mentioned: "*But most of the time I don't go, because it's far away. (..) I would not go to Amsterdam or something, that is way too expensive. So that's a really big thing for me.*"

The same participant also indicated to experience another important barrier for them to participate in activities, as locations are often not wheelchair accessible: "*Barely anything is wheelchair accessible. Also in newer buildings. A lot of people just don't care.*" (Participant 6, LN: 310-311). They added that this inaccessibility makes participating in activities a more tedious occupation from the

offset, as they always have to make a conscious effort to ensure that they can actually enter the location.

Furthermore, a few participants mentioned the potential entrance fees to be a barrier for them to participate in science communication and public engagement activities about AI, or more generally, the overall expenses associated with joining an event. This includes, for instance, the costs made for transport to the location or any food/beverages consumed at the event itself.

4.3.4. Emotional- and social exclusion

Interestingly, when asked about the barriers participants experience with regards to participating in science communication and public engagement activities about AI, most of them appeared to be related to emotional- or social exclusion rather than material exclusion. That is, although participants may not experience any physical, financial or time restraints to participate in activities, there may still be plenty of factors associated with these activities that leave participants feeling unwelcome or out of place on a structural basis.

The most frequently mentioned barrier to participate in science communication and public engagement activities about AI concerns the participants' perceived level of knowledge. As became clear from the expectations participants described to have, science communication and public engagement activities are generally perceived to be 'difficult' and suitable for those with a high level of education or intelligence only. Consequently, many participants did not perceive themselves to be fit for participating in such activities and expressed a low intent to join. Overall, the activities are expressed to be too difficult both in terms of the complexity of the topic, as well as the jargon and difficult language that is used: "*Talking about this topic.. It's way too difficult, you know, for people to come and find it interesting. It is way too difficult.*" (Participant 8, LN: 249-250). For the majority of participants, this barrier led them to have a negative attitude towards and low intent to join science communication and public engagement activities about AI.

However, for the significant portion of participants that did express to have a positive attitude towards science communication and public engagement activities, this perceived difficulty is an important dealbreaker, leading them to ultimately refrain from participating. To illustrate, participant 13 (LN: 279-283) explained: "*It can be really interesting, but not for me. Not for the target group I belong to, not for people with a mild intellectual disability. Because, to be frank, often times people just use so much difficult words that I have to leave after two minutes, because I am receiving too much information that I don't understand. So they may say, 'we want to make it accessible for everyone', but that is unfortunately just not the case.*" This difficulty, for them, severely diminishes their intent to join, although they may have a general interest in learning more about AI, something this participant regrets deeply.

On the same note, participant 3 (LN: 276-278) explained: "*Well, I like it, but it's about AI and that's new to me, you know. I'm not yet a 100% sure what it means. It's difficult and then people will start laughing at me, 'haha, he doesn't understand', something like that.*" This participant, thus, indicated an underlying fear of being rejected and laughed at. The same pattern of feeling alienated in a group of people can be identified more often in the conversations with the participants. When talking about themselves in relation to the people they expect to find at science communication and public engagement activities, some participants consistently referred to themselves in terms as 'normal people' and 'the average person'. One participant even referred to themselves and their peers as 'the less important people', thereby illustrating that they clearly do not identify with the people they think usually visit such activities and who are, apparently, perceived to be 'important'. Some participants described those people as 'yuppies' and 'intellectuals'. Apparently, these participants experience a divide between themselves and the expected audience in terms of knowledge and status. To illustrate, participant 5 (LN: 272-273) explained, when talking about his preference for the local library over

visiting the university: "*You feel more at home here. The university is colder, more performance-oriented. One would rather go to the Jumbo than a Super Class Jumbo.*"

Another relatively frequently mentioned barrier concerns concentration problems and a lack of mental space. Quite some participants, among which participants with both a positive and negative attitude towards science communication and public engagement activities about AI, reported to have concentration issues, especially during lectures or informational talks. That is, in more passive settings, they indicated to be easily distracted and have trouble remaining seated for longer periods of time. For instance, participant 11 (LN: 212-213) explained: "*I'm a busy bee, so I can't really be at such a lecture for a long time. At some point I just don't have the concentration anymore.*"

On the contrary, though, participant 1 (LN: 187-189 & 201-203) indicated that more interactive settings, such as a Science Café, trigger their concentration issues: "*If I'm sitting there with a drink, or some music, the message doesn't really get to me. (..) I'd rather have the information be directed immediately to me. I like that better, just straightforward. Just the information, directed immediately to me. Everything around it, all the fuss.. that's unnecessary. It just distracts you from what you have to know.*" For them, there is a clear distinction between activities done for leisure and educational purposes, and they do not see any value in attempting to merge the two together.

Similar to the lack of concentration that some participants described, a few participants reported a lack of mental space to be a barrier for them to participate. According to these participants, this barrier is twofold: a) they fear that they will become overwhelmed by all the information they are receiving during an activity, and b) they struggle with other problems, making it difficult for them to create mental space and be mentally present at an activity. To illustrate, participant 5 (LN: 332 & 346 & 486) explained: "*Yes, too much information. That it just becomes too much for the people present. (..) Normal people don't want that much trouble on their minds.*"

Another important barrier participants described relates to age, and more specifically, how the elderly are structurally excluded from science communication, public engagement and access to information about AI. As explained by the participants, the difficulty of the topic requires a certain extent of digital skills and background information on computer technology, which the older generations tend to lack. Consequently, it is nearly impossible for them to become informed – let alone engaged -, even if they want to. As described by participant 16 (LN: 330-332): "*A lot of people don't understand. But the earlier you start with that.. You turn on the computer and see all kinds of things. But the elderly, they have barely seen that before. They are not aware of it.*" Furthermore, according to the participants, the older generations are barely stimulated to think about or engage with AI; some of the participants even wonder why they should bother, considering it is 'too late anyway'. Participant 10 (LN: 146 & 170) described this by saying: "*I'm 58. (..) I operate in another part of society, you know.*" Most of these participants did in fact see the value of being informed about – and being engaged with – AI, but due to their age felt like their time for this has passed.

Furthermore, participants mentioned a few more barriers they, or people in their environment, experience. The first relates to language barriers: considering that the neighbourhood in which the interviews took place has a relatively high percentage of citizens with a migration background, participants noted that not everyone may be able to properly understand Dutch – the language that is expected to be spoken during activities. As explained by participant 2 (LN: 281-283): "*Especially the immigrants don't know the language, that's the first thing. That's difficult, when they go there, they don't understand a thing.*" Similarly, participant 3 (LN: 266-267) mentioned they are scared of joining activities because he is afraid he won't be able to keep up, especially with this specific topic and its difficult jargon: "*Maybe my Dutch isn't good enough to understand computer terminology*." When science communication and public engagement activities about AI are not offered in a language one is proficient in, one's possibilities to access information are, naturally, very low.

The second barrier relates to the social aspect of participating in science communication and public engagement activities. Quite some participants indicated to struggle with crowded places and events with large audiences. In some cases, participant found it to be simply too overwhelming, while others indicated that it relates to an underlying problem of social anxiety. As participant 16 (LN: 378-379) stated: "*You know, lately I have been speaking to so many young people who have difficulties talking to other people.*"

Furthermore, according to one participant, attending events with large audiences averts them from getting the personal attention and additional explanation they need in order to understand the subject matter. They describe that, due to their mild intellectual disability, they may not always be able to grasp the message immediately, and being able to personally consult the lecturer to ask questions often aids their process of understanding. They explained: "*And if you want to have a talk with that person afterwards, or ask some questions, that person is usually very busy with other things.. Saying hi to everyone, shaking their hands, whatever. Then I'm like: bye, I'm leaving. That's the disadvantage of the whole thing.*" (Participant 13, LN: 284-286). Consequently, activities that are expected to draw large audiences are consciously avoided by this participant.

4.4. Wishes and needs for inclusive science communication and public engagement about AI

During the interviews, participants described a variety of reasons as to why engaging with information or science communication and public engagement activities about AI seemed attractive or unattractive to them, and how this may influence their intent to participate. It became apparent that in current activities, exclusionary structures exist that withhold participants from accessing information about AI. Consequently, participants were asked to describe their needs, wishes and requirements for science communication and public engagement activities to become more inclusive in the future.

4.4.1. Future requirements

Generally, the participants gave quite elaborate and detailed descriptions of what requirements future activities should take into account. These can be divided into separate categories, which will be discussed below.

4.4.1.1. Accessibility and inclusion

As often emphasized by the participants, accessibility was perceived to be one of the most important, key factors for a successful science communication or public engagement activity about AI. Especially if one's goal is to promote citizens' general awareness and knowledge of the technology, pursuing accessibility is, according to the participants, the first step to accommodate citizens from all kinds of backgrounds. It is, thus, highly important to identify potential barriers for citizens to participate in time and address them accordingly. Participant 6 (LN: 347-352) emphasized this importance by saying: "*I think it's attractive when it is open to everyone, meaning that you don't need a lot of prior knowledge. What also makes it attractive is when it is at a location that can be easily reached. So yeah, accessibility, both in terms of knowledge and location. So that in case someone is interested, they will not be held back like: oh, I guess I won't be going because it's inaccessible, or we probably shouldn't be going because we need a lot of prior knowledge which we don't have.*" Being accessible, therefore, is not merely a means to attract more people, but rather a necessity that ensures that citizens will not lose their interest from the offset.

Participants described that, in order for them to show interest in an activity, at the very least, the obvious – i.e., often material – barriers to participate should be removed. For instance, as also emphasized by the participant quoted before, the location of the activity should be in the vicinity, easy to reach in terms of transport and wheelchair accessible. Ideally, activities should be hosted in locations with a social function that are well-known to the citizens, such as local libraries, schools or even nursing

homes. This has added value in the sense that such locations are usually familiar to citizens, which, according to participants, makes them a less hostile and more relaxed environment.

Furthermore, even when people do not show an immediate interest in participating in activities about AI, bringing it to their doorstep allows them to get a taste of the topic in an accessible, non-committal manner. Consequently, participants described to be more open to participating in activities that they may run into, albeit by accident: "*If I were to be somewhere on holiday, or on a small trip, and by chance there would be a museum with an exposition about AI, I would take a quick walk through.*" (Participant 18, LN: 91-92). Important is, thus, to focus on locations that have a natural influx of people and are easily accessible, in order to make it as easy as possible for citizens to participate.

Other important requirements concern the entry fees. Participants indicated that ideally, science communication activities about AI should be free, or require a small fee only, of at maximum 2 euros. Furthermore, as many participants indicated to struggle with time management, timing is an important factor too. As proposed by participants, activities should take place in the weekend or in the late afternoon or evening hours. One participant also emphasized that the activities themselves should not take too long, but rather should be simple and short to maintain the visitors attention spans and not consume too much of their scarce free time.

Although important, removing financial and logistic barriers will, according to the participants, not be enough to effectively increase intent to join. Considering the emotional- and social exclusion many participants described to experience, especially in terms of the required level of knowledge, more needs to be done to dismantle these structures. Most importantly, participants stressed that everyone should be able to participate in science communication and public engagement activities about AI, regardless of their knowledge and educational background. The organization of such activities, thus, should pay careful attention to the ways in which their language and knowledge is inclusive of all groups, including those who have no prior knowledge of the topic. As explained by participant 1 (LN: 257-259): "*Yes, keep it simple. You know, people who are doing that and are part of that world often talk with very difficult words, their own jargon. So keep it simple, because people don't know that.*"

Important is, though, to also be weary of any condescending language. Participant 13 (LN: 314-317) emphasized, when talking about their experience with individuals with a mild intellectual disability: "*So that it is being explained in a fun, childlike but also still mature way. But you really have to be careful that you don't explain it in too much of a childish way, because that can really insult them.*" As explained by this participant, this is a fine line and it is important to ensure that, at all times, citizens participating in activities are taken seriously.

The need for understandable and simple language is in line with the type of knowledge participants expressed they wish to receive: rather than being informed about the technical background behind AI and its specific workings, they reported to be more interested in learning about the basic idea of AI, its applications in daily life, advantages and disadvantages and the developments that are currently being worked on. As emphasized by participant 17 (LN: 221-223): "*So just give more information about what it entails, without people having to really dive into the topic. I think that would definitely make it more accessible, and interesting as well.*" Participants added that in some cases, it might be more desirable to discuss more in-depth matters, but that the general public would mostly be interested in basic knowledge and information on how the technology affects them.

When discussing accessibility and inclusion, participants also acknowledged and emphasized the importance of catering to different target groups. That is, when tyring to engage citizens from all kinds of different backgrounds, one inevitably has to categorize them in target groups to be able to fulfil their specific needs. Participant 18 (LN: 253-259) explained this by saying: "*If you, in a group of 25 people, have 3 or 4 know-it-alls who absorb so much energy from the lecturer, that's not pleasant for the big mass. But if there are a few who ask 'what does that mean?' after every single sentence.. So it*

would be good to organise something specifically for this lower group, middle group and the know-it-alls. The advice would be: make sure to have like-minded people, or at least people who understand just about the same. (..) for me, that would be a determining factor in deciding on whether or not to participate." Thus, according to the participants, it is important to ensure that all attendees are challenged in a way that fits their prior knowledge and understanding.

Another participant made specific note of the importance of identifying and engaging new target groups, especially when they are not considered to be conventional attendees. Due to their mild intellectual disability, this participant expressed never to have been stimulated to learn, although they would have liked to have been. Consequently, they think there are way more people interested in learning about AI than is assumed: "*I think there are a lot of people, maybe even people with more severe disabilities.. (..) who would like such things. If they can adapt it to that… or organise a specific evening for them! Like, then we have an event for normal people, and this evening is for people with a learning disability and we take into account your level of understanding.*" (Participant 13, LN: 309-314).

Although the participant reported to be sceptical that universities will actually be able to adapt their current activities to new target groups, they are calling on institutions to at least consider expanding and adapting their efforts to become more inclusive – whether it concerns target groups of people with mental or physical disabilities: "*If it is an option, to also engage other target groups at such an informal session.. people who are deaf, for example! Or people who are blind, that may be a bit more difficult, but they can hear. You know, that they look a bit more at how they can give deaf people, or people with an intellectual disability, a fun, informative lecture as well.*" (Participant 13, LN: 327-331).

Participants also addressed another solution for citizens to feel more included in science communication about AI and to reduce barriers to participate: the deployment of ambassadors. For instance, participant 2 (LN: 283-287) explained how ambassadors may play a role in activities becoming more inclusive to immigrants: "*You could approach these people through.. people like me. I work with foreign elderly mostly, because I speak the language and I know their culture, all those things. So it's convenient to have someone who can come with you, to give information. Who can communicate with them, inform them.*" Citizens who usually would not even get the chance to participate due to a linguistic barrier can, in this way, also become engaged.

Another participant also saw a chance to use ambassadors at science communication events to form a bridge between, for instance, the guest lecturer and the audience. They explained: "*Maybe it would be convenient to have some assistants who are also up-to-date. And when they see someone who they think might have questions, they can go up to them and ask: 'hi, can I maybe help you with some questions? I could try to answer them.' Then there are a bit more options. If you have a guest lecturer, and you want to ask something, you often can barely get a word in. And that's a disadvantage to me.*" (Participant 13, LN: 286-291). By employing ambassadors or assistants who can initiate contact with the attendees, more conversations and communication about AI can be established and participants can be given the personal attention that makes the activity worthwhile.

4.4.1.2. Relevance

When asked about what would make a science communication or public engagement activity about AI attractive, the most frequently mentioned factor was personal relevance. Most participants indicated activities that relate to one's personal life in one way or another to be significantly more interesting, and subsequently, their intent to join to be higher. Subsequently, personal relevance was perceived to be one of the most important requirements for an interesting activity. Participant 6 (LN: 407-409 & 412-415) explained: "*Demonstrate what it is used for, and why it is important to know something about it. Because often, you become interested in something when it relates to you. So give a few examples of how it affects people. (..) Because then, they might be like: oh, this does actually affect me, so I should*

go there. Otherwise you'll think: oh, this doesn't concern me, so I am not going. Except if you are already intrinsically interested, but the real challenge is to create interest." Especially career-related prompts were perceived to be effective. To illustrate, even some participants who indicated to have a negative attitude towards activities about AI reported that they would potentially give them a try if they expected them to have benefits for their career, or if they would be related to their job.

Furthermore, a few participants also indicated that personal relevance could operate by extension. That is, if an activity about AI would be relevant for a family member, friend or peer, participants might also be more willing to participate themselves. Participant 9 (LN: 352-354 & 366-367) explained: "*Say that my daughter wants to study robotics later. Then of course I'll join. If your mom or dad works in robotics, you're going to grow with them as well. (..) If my son were to.. then I'll go, for sure. Because it's his future, you know.*"

A few other participants mentioned how they might be more interested in activities about AI when linked to their hobbies or personal interests. For instance, participant 12 (LN: 265-266 & 268-271) offered an idea on how to create such relevance: "*I think you should maybe first combine it with something that you do prefer. (..) For example, for women… I'm just brainstorming, but artificial intelligence in combination with shopping, for example, how you can use it. I think that might attract target groups who, in the first place, did not want to have anything to do with it, but then think: oh, how can I use this?*" Furthermore, participants mentioned that it would be valuable to be informed about AI at the very moment it becomes relevant to them: say, when they come across personalized advertisements. One participant proposed a little pop-up accompanying personalized advertisements, mentioning that the advertisements one is seeing are based on their search history by means of AI.

In addition to the personal relevance that science communication or public engagement activities may have, some participants also mentioned that they would find an activity to be more attractive when the relevance of AI for society or societal problems would be addressed. When asked about what they would want to learn more about during an activity, participant 5 (LN: 441-442) mentioned: "*All the positive things you can do with it. For example, solving poverty by means of intelligence.*" Furthermore, they mentioned climate change and pollution as other issues they would want to know more about in relation to AI, and more specifically, how AI can play a role in solving them.

4.4.1.3. Format

In addition to providing content-related requirements for attractive and inclusive science communication and public engagement activities about AI, participants provided many suggestions with regards to the format as well. Interestingly, the most frequently mentioned format concerns personal conversations. Many participants indicated that simply talking about AI is an accessible way for them to learn more about AI, even if they reported not to have an innate interest in the topic. According to participants, it is a non-committal, simple but effective way to get the information they need without having to dedicate themselves to actually visiting events or activities.

Consequently, participants proposed, for instance, for scientists or students to set up a stall in the city centre and strike up conversations with citizens about AI there. To illustrate, when asked if they would be willing to participate in science communication activities about AI, participant 17 (LN: 144-146) mentioned: "*Maybe if someone in the city centre would approach me to talk about it, or during a gathering or small festival in the city, which happens quite often. If you have like a little stall there.. that would be interesting.*"

However, participants also stressed that more simple, casual conversations can also be very valuable in becoming more engaged with AI. For instance, some participants even perceived the interview itself to be a form of science communication: "*By means of these types of conversations… It helps you know, to show different perspectives on the topic. If you compare when I first came to sit here and now, I started looking at it from a broader point of view. And maybe I'll actually look it up later.*"

(Participant 10, LN: 278-280). As emphasized by this participant, such conversations may be the first step for citizens to gain interest and further investigate the topic.

The second most frequently mentioned format is an AI-related workshop. The majority of the participants indicated to be more practically oriented, and therefore would prefer to attend an activity in which they could work with the technology themselves rather than having to merely sit and listen. Participant 6 (LN: 285-287) explained: "*Yes, I think a workshop or something like that is more fun than just hearing: okay, it exists, but you can't do anything with it. Unless you already had a lot of interest in the topic itself.*" The same participant also proposed an idea for a workshop, in which participants get to feed data to an AI artist to see how different types of input influence the outcomes of – in this case – artworks. Furthermore, two participants even mentioned that they would take on a series of workshops, or a course, over a longer period of time if it were important for their job, for instance.

In terms of the preferred format of science communication about AI, participants also often emphasized the importance of integrating AI-related topics into school curricula. They argued that, as children are often impressionable and unaware of the impact of the technology, they should be made aware of the risks as soon as possible. As participant 2 (LN: 199-201) explained: "*Something like this should actually be taught in school already, if you ask me. High schools, primary schools. Especially with regards to the dangers, like: 'guys, this exists, be aware of it.' Many children of course don't know this, let alone their parents.*" They noted that such AI-related lessons in school are especially important because many parents are not aware of the technology, and therefore cannot adequately educate their children about it.

Furthermore, participant 10 (LN: 289-292) explained that it is important to start education about AI at a young age because it might plant a seed for them to become more engaged when they are older as well: "*You know.. You need to get the youth involved. And at the moment they are 16, 17, 18, you might already be too late. You need to try and make it interesting for the youth in school already. In the moment that it's part of the curriculum, they are obligated to deepen their knowledge.*"

One participant argued that schools or universities could also take it one step further and play a role in informing more citizens in addition to their own students; for instance, by organising 'open lessons' in which people can join a lecture or information session about AI. They explained: "*Just like open days, that you do something similar. Opening the school up and saying: 'okay, tonight – or then and then – we are organising an informational session about this thing, for the people who are interested' (..) And then you can just join such a lecture.*" (Participant 13, LN: 213-216). According to the participant, ideally, the students of the school would then be present as well to share their knowledge and function as ambassadors.

Other formats of science communication activities about AI that some participants indicated to be attractive – albeit to a lesser extent -, are museum expositions, local, informal information sessions, TedTalks and lectures. Especially in regard to the latter two, the opinions of participants were mixed. Generally, the participants indicated that museum expositions are specifically valuable in the sense that they make the concept of AI more tangible, due to the visual nature of expositions. Information sessions and lectures were mostly praised for the level of background one receives.

One participant indicated to be interested in Science Cafés, which they appreciated because of their non-committal nature and the ability for participants to share their opinions and contribute to the discussion. They explain: "*You're interested and you can actually contribute. And in the setting that you just described, a Science Café, with a small bite and a drink, friendly atmosphere.. You can always decide to leave, or to stay if you find it interesting. Based on what is being presented.*" (Participant 16, LN: 447-451). While in a lecture setting, it may be considered uncomfortable and awkward for participants to walk away, a Science Café, according to this participant, gives you the ability to do so without disturbing the rest of the audience.

In addition to these potential formats of activities, a few participants also stressed the importance of online information. Participant 2 (LN: 355-358) explained: "*I think the internet is just the best way to keep everyone up-to-date on what is there. Because everyone uses it. And it's the biggest information source for everyone. So I think that would be best, to inform people about it like that.*" Participant 3 (LN: 330-333 & 335) added to this that they would appreciate a specific website dedicated to AI that contains all kinds of information: "*Maybe you can open an internet website about AI. With more information. Because when you check Google, there really isn't that much. So you can make an internet site about AI with videos, information about what it is, robot technology, Tesla, something like that. (..) So that whenever I want to search something about AI, I'll get to your website immediately.*" According to this participant, the current online information available about AI is either unclear or difficult to find, which is why a dedicated, structured website with different information combined would aid in the process of independent information searching.

Lastly, one participant proposed the idea of citizen initiatives, meaning that citizens themselves will get the opportunity to organize informational science communication and public engagement events about AI. They provided an example of how Alifa, a foundation for improving well-being amongst the citizens of Enschede and connecting them with each other, had previously been invited at their children's school to give an information session about loverboys. This participant, consequently, wondered if the same could be initiated by citizens in the case of AI: "*It would be a solution if they could be invited. Say that I want to organise an information session at my job, that I can invite that person like: 'do you want to come and give an information session about this?' That would be nice.*" (Participant 2, LN: 271-273).

4.4.1.4. Content

When asked about the preferred content of an attractive science communication or public engagement activity about AI, participants raised many different points they perceived to be important. The two most frequently mentioned requirements concern interaction with AI and practical examples. Participants indicated that in order for an activity to be interesting, the concept of AI should be made as tangible and personally relevant as possible. Therefore, ideally, participants would be able to both interact with the technology themselves and be informed about its relevance through practical examples that relate to daily life. To illustrate, participant 1 (LN: 237-239) stated: "*It would be perfect if people in the audience could actually talk to the AI. So you have examples, that you can see what AI is, what is does and how it works. Maybe that sort of thing.*" Notably, participants often perceived interaction with AI and practical examples to be intertwined, and expressed a preference for activities that combine both.

As the majority of the participants described themselves as practically-oriented, they expressed to learn faster and be more engaged and interested if an activity takes on a hands-on and pragmatic approach. To illustrate, participant 15 (LN: 156-157) explained: "*Not just facts but practical things as well. That grabs my attention faster",* and participant 17 (LN: 245-246) mentioned: "*Not just sending, not just seeing and hearing, but also getting to work with it yourself. A bit of interaction.*" Furthermore, participants reported that visual support is an important requirement as well. That is, the use of videos, images and other visual stimuli is perceived to create more interest and keep the participants concentrated longer, as well as make the topic more tangible.

In terms of the information that participants hope to receive at science communication activities about AI, their opinions appeared to be a bit more distributed. However, overall, it appeared that quite some participants are interested in the process behind AI; that is, where it initiated from, how it is being developed, and what new developments are currently still worked on. As participant 8 (LN: 157) explained: "*For me, it's interesting to know how people can make this.*" Participant 6 (LN: 255-256 & 261-262) added that they would like to learn about the different steps that are needed for AI to

create output: "*Often you're not being told what the computer has been fed, and that's what I actually would like to see. (..) Yes, that sounds interesting to me, the steps. And not just the output.*"

Furthermore, many participants indicated that raising risk awareness is an important requirement as well. To illustrate, participant 10 (LN: 221-222) said: "*You need to be protected from its negative side.*" Consequently, participants felt like science communication activities provide an opportunity to warn citizens about the disadvantages of AI. Moreover, two participants indicated that they would like to receive more in-depth, technical information about the internal workings of AI and its applications – although the majority of participants indicated to rather receive more practical and basic knowledge. The division of citizens in target groups is, thus, essential according to these participants.

Another aspect that participants felt like would make an activity more attractive is discussion. That is, interaction was not only perceived to be important in terms of interacting with the technology, but also with the educator and among the audience itself. In the first place, participants find this valuable because it allows them to reflect on a variety of different opinions and perspectives. To illustrate, participant 8 (LN: 137) said: "*I like to hear the different opinions people may have.*" However, it also appeared to have a deeper layer of importance for some participants; being able to give and discuss their opinion with others shows that they are being taken seriously. As summarized by participant 6 (LN: 369): "*People need to feel involved.*" When asked about why this is so important to them, participant 16 (LN: 262-264) explained: "*That you can give your opinion, and you're actually being listened to. Because sometimes you're just not being listened to. It's important, that you're able to make your point and give your opinion and ideas. That is so important.*" In order to achieve this, participants proposed for science communication activities to have brainstorm sessions, or even follow up with work- or discussion groups.

Furthermore, participants indicated that it is important for science communication and public engagement activities to also be entertaining – at least to a certain extent. That is, according to the participants, activities should have variation, an enthusiastic educator or teacher and should, generally, be kept light hearted. Participant 7 (LN: 366-368) explained: "*Don't make it too lengthy and tedious, too monotone. Make sure to keep a nice balance, keep people engaged. Because otherwise, you'll at some point start wondering: what am I doing here? It's boring.*" Similarly, participant 13 (LN: 350-351) emphasized that, in addition to the fact that it sparks more interest and engagement, incorporating a bit of entertainment may also aid participants in their learning process: "*That's just the most fun. If you manage to get the message across in an entertaining way, it's often also more informative. You get the hang of it faster. And it's also just more interesting.*"

A similar perspective was shared by another participant, albeit in a bit more extreme fashion. They explained: "*You'll have to sugarcoat the message. Otherwise people won't come, when it becomes to dangerous. (..) They don't always want to hear the truth. (..) Yes, you should only promote the positive things. You shouldn't tell all the negative sides. It's of no use.*" (Participant 5, LN: 189-190 & 192 & 459-460). That is, the participant thought it is best to withhold visitors of science communication activities from certain information, in an attempt to protect their mental health and maintain their interest.

Interestingly, a different perspective was shared by some other participants: they felt like science communications should focus more on the dangerous aspects of AI and how these may impact citizens negatively. When asked what they would like to see changed, as compared to current science communications, participant 4 (LN: 217-221) explained: "*If it were to be an exposition about.. well, this is what you can do with it, but this is the dark side of the story: so really both sides of the story, the good and the bad... If it falls into the wrong hands, what can happen, on a large scale, whatever. At least then you're giving people the whole story. And in that case I would be in favour. Of organising such an exposition.*" These participants, thus, advocated for a nuanced perspective on AI which highlights

specifically what the technology means for citizens. In practice, this means that both the advantages and disadvantages should be addressed and risk awareness should be a key objective of activities.

4.4.1.5. Teacher

Lastly, a few participants also addressed the importance of an inspiring, experienced teacher or educator. They stressed that, regardless of the topic, teachers and their way of teaching play an important role in both informing and engaging people. According to the participants, a good teacher or educator is confident in their knowledge, has a sense of credibility and, most importantly, has the ability to adapt to the target group and their level of understanding. As participant 18 (LN: 195-196 & 211-213) explained: "*Look, the topic can be interesting, or not so interesting.. but the way in which the presenter brings across the message is really important. (..) if you get the idea that they are tyring their best and have the talent to adapt to my level of understanding – or the level that matches – so you can actually imagine it... That's what makes it interesting.*" A skilled and inspiring teacher, thus, is perceived to be an important requirement for a successful activity, according to these participants.

4.4.2. Incentives

In addition to the future requirements and recommendations for science communication and public engagement activities about AI, participants also shared a few insights about potential incentives citizens may have to join such activities. The first incentive concerns the social function science communication and public engagement activities appeared to have to some participants, although they may not necessarily be promoted as such. They indicated that, in addition to being informed, these activities provide an opportunity for them to have social contact with other citizens as well. As participant 5 (LN: 202-203) explained: "*A lot of people who go there, also go there because of the conviviality.*" Furthermore, participant 2 (LN: 233-234) added that it may also be a form of quality time if one decides to go with friends or family: "*Well, if I were to get that information, I would definitely go with my friends, you know. If you go as a group that's fun.*" According to these participants, the social dimension of attending an activity is an important incentive to them, and they expect this to be the case for other citizens as well.

Furthermore, a few participants indicated that offering some free goodies or food and drinks could be an incentive for citizens to join an activity about AI. Participant 11 (LN: 346-349) illustrated this by saying: "*I do like it better that way. Because I'm giving you something, but you're also giving something back to me. I think that's it. Because, you know, sometimes you're in the city centre and you get approached by someone, and you have this whole conversation.. and in the end you're like: what did I even do this for?*" The participants stressed that although this is not a necessity, it may lead citizens to perceive the activity as more attractive: "*They also have that at, what is it called again… at the cinema. They organise Mother's Day parties, and all of that stuff. And then you get a goodie bag, and they make it all very attractive. And everyone goes. You can really spark interest like that.*" (Participant 2, LN: 307-310). Notably, participants mentioned that these free goodies do not have to be very costly or extravagant; they can be as small as a free can of soft drink or free coffee, tea and cookies at the location itself.

4.4.3. Promotion

As the overall visibility of science communication and public engagement activities about AI was perceived to be low amongst all participants, they provided a multitude of recommendations for the promotion of these activities. These can be divided into both mass- and targeted promotions.

The majority of the recommendations made by participants concerned the mass promotion of science communication activities about AI. When asked about what would be needed in order to spark their interest in activities about AI, participant 11 (LN: 248-250) explained: "*I think more general awareness. So it also becomes more attractive to people. Because I think a lot of people here in*

Enschede really don't know what it means." Mass promotion, thus, was perceived to be an essential part of organising successful science communication activities.

The most frequently mentioned medium through which promotion should take place according to participants is the internet, and more specifically, social media – among which Facebook and Instagram were mentioned most often. When asked what would be the best way to reach them, participant 17 (LN: 231-233) explained: "*Social media I think. I sometimes watch Facebook videos myself when I am in the bus to work. So an easy, short and catchy video on social media. Or an article. That would be the way to reach me. Maybe a podcast about it.*" More participants proposed the idea of promotional videos: "*Maybe there should be way more videos with examples. Just like the one you just showed. Maybe more of those can be made, to show people. And maybe they'll find it more interesting then.*" (Participant 8, LN: 260-262). Furthermore, in addition to informational videos about the topic, participants also proposed to share promotional videos or trailers of the event itself.

Moreover, participants also frequently proposed to promote science communication events about AI in the mainstream entertainment media, such as TV and radio. Interestingly, participants also indicated that AI could be promoted more in movies, as citizens will then be confronted with the topic in a non-committal, entertaining setting: "*Maybe it should be integrated in movies or something like that. So that when people watch a movie, they unconsciously learn things about the topic.*" (Participant 12, LN: 374-375).

Furthermore, a few participants emphasized not to forget about printed advertisements as well: "*Also publish it in the newspaper as often as possible, like: there's an informational evening about this topic at this time.. People who are interested are welcome, 2 euros entry fee and there will be free coffee and cookies. Something like that.*" (Participant 13, LN: 255-257). One participant also indicated that posters should be hung up throughout the city and in the neighbourhoods, and a few other participants mentioned that the organization of science communication and public engagement events could go around the city handing out flyers. Or, as previously described, the handing out of flyers could be seen as a science communication activity itself, specifically when it is done with the aim to initiate conversations about AI with citizens.

One participant proposed another interesting idea for promoting science communication activities, being that information about activities or AI itself should be spread by – or under the name of – authorities. They described an example of how doctors and hospitals can potentially play a role in informing citizens about the role of AI in health care. As explained by the participant: "*Yes, through hospitals, you know. Or private clinics, that's also an option. That you can feature your information on their website. That's how you get in. People look it up, so that's important.*" (Participant 2, LN: 360-362). They reported that, in their own search for medical therapies and solutions, they have come across many different types of technologies and innovations that may be valuable, and therefore the same may be true for AI. According to the participant, people will be more inclined to read and learn about AI when it is a) relevant to them personally – which is often the case in a healthcare setting – and b) the information is spread by a trustworthy party with a sense of authority on the topic – in this case doctors and hospitals or clinics.

In addition to these recommendations for mass promotion, a few participants also proposed more targeted strategies that focus on citizens individually. According to participants, this is valuable because a) one can target their promotions to specific target groups and b) one can implement promotions at specific moments when it is relevant to citizens – for instance, when they are confronted with personalized advertisements.

The most frequently mentioned form of targeted promotion concerns word-of-mouth advertising. According to participants, this is one of the most effective ways of advertising, especially when recommendations are coming from their peers. As participant 15 (LN: 209-211) explained: "*Yes, I first need to hear about it from others. I usually am not the first person to go somewhere. That's just*

not who I am. But I think that if I hear multiple people about it, I would go." Another participant also emphasized the importance of conversations about AI in order for citizens to gain interest in science communication and public engagement activities: "*You can talk about it, yes. That's possible. And based on that, people might go to an activity.*" (Participant 16, LN: 437-438). Some participants even already started thinking about people in their own personal network who they potentially would recommend science communication activities about AI to.

Furthermore, two participants proposed the idea of a newsletter dedicated to AI, which could be send to citizens via email. One participant also proposed a similar newsletter, but send as a written letter delivered to citizens' houses. According to these participants, the advantage of this is that it enables them to read the information on their own terms, whenever they want, and not be confronted with all kinds of unsolicited advertisements for activities.

5. Discussion

This section is dedicated to interpreting the main findings of this research. Firstly, the research questions are answered. Secondly, the most important theoretical and practical implications of the findings are presented. Thirdly, the limitations of this research are discussed and fourthly, recommendations for future research in this domain are given. Lastly, the main conclusions from the research are summarised.

5.1. Main findings

The aim of this research is to investigate the inclusivity and diversity of science communication and public engagement efforts surrounding AI in the Netherlands, by understanding the experiences of citizens in low SES neighbourhoods. In order to answer the research questions a) *How do Dutch citizens in low SES neighbourhoods experience science communication(s) and public engagement surrounding AI in terms of inclusivity and diversity?* and b) *What are the needs and wishes of Dutch citizens in low SES neighbourhoods in terms of science communication and public engagement regarding AI?,* the main findings will be discussed. This will be done by reflecting on two main themes that can be drawn from the results: a) knowledge and perceptions of AI and b) tendency to inquire, engage and participate.

5.1.1. Knowledge and perceptions of AI

In terms of knowledge and perceptions of AI, the findings highlight the topic's salience and importance to citizens. Firstly, it was discovered that, although the majority of participants initially indicated their knowledge of AI to be either low or non-existent, ultimately almost all participants appeared to be familiar with daily life applications of AI. To illustrate, Yigitcanlar et al. (2022) argue that AI, indeed, is often invisible to the public; for instance, few citizens are aware of algorithms continuously tracking their behaviour. This was found to be true in this research as well; however, after being told about them, participants generally did indicate to be familiar with personalized advertisements.

Thus, participants who indicated not to be familiar with AI did in fact recognize certain applications from previous experiences. These findings are somewhat in line with those of Kelley et al. (2021), who in their sample also featured participants with partial knowledge of AI, describing AI based on the technologies and applications that were known to them. Thus, although the term 'artificial intelligence' was rather unknown among participants, its applications were not. This emphasizes that citizens may not be as oblivious to AI as is sometimes expected, even by themselves; a conclusion that was drawn in the study of Selwyn and Cordoba (2022) as well.

Secondly, it became apparent that the participants generally held strong, often negative attitudes towards AI, which is in line with recent studies from Kelley et al. (2021), Sartori and Bocca (2022) and, to some extent, Hick and Ziefle (2022). Interestingly, participants also almost unanimously expressed AI to be an important topic, even if they had no personal interest in the topic or held a negative attitude. This could be explained by citizens' technological determinist views, as described by Cave et al. (2019). This refers to the belief that AI will inevitably be developed and implemented - without citizens being able to exert influence -, heightening its importance regardless of one's personal interest in or attitudes towards the topic (Cave et al., 2019).

However, this perceived high importance of AI may also be due to the generally extremized views citizens tend to hold with regards to the topic. They tend to view the development and implementation of AI either through a lens of utopia or dystopia, with barely any room for nuance (Johnson & Verdicchio, 2017; Cave et al., 2019; Hick & Ziefle, 2022). Consequently, citizens may view the consequences of implementing AI as far more extreme than they are likely to be, thereby attributing it higher levels of importance.

Thirdly, as some participants spontaneously started describing their more general worldviews, it became apparent that the concept of AI relates heavily to the way in which some citizens perceive the world and their reality. As explained by Carbonell et al. (2016), "We can consider technologies, at least when they are emerging technologies, as a new reality" (p. 147), meaning that new technologies inevitably affect the way in which we make sense of our lifeworld; it puts new light on one's previous perceptions of reality and puts them into perspective.

Why specifically AI triggers this response for these participants is unclear. However, it could possibly be explained by its revolutionary nature. As argued by Boik (2020), "The new era of science is qualitatively and quantitatively different from what came before, (..) The new worldview emphasizes the cognitive and information processing characteristics of complex adaptive systems, including nested human societies and entwined ecologies, as well as the role of flexible self-identity in human and group cognition" (p. 4). The implementation of AI fundamentally changes the ways in which humans relate to themselves and their identity, each other and technology, thereby leading people to contemplate their own existence and humanity in terms of this new technology.

5.1.2. Tendency to inquire, engage and participate

One's knowledge of and attitudes towards AI were expected to translate into their tendency to inquire about the topic. To a certain extent, this was the case: some participants who expressed a high level of interest and importance did in fact regularly or occasionally consume information about AI, mostly through the mainstream media, internet, entertainment media and peers. This is in line with findings from Kelley et al. (2021), although in their research, social media was perceived to be the most frequently consulted source. However, more interesting is the low-level engagement group, for which this expectation was not accurate.

Although all participants in this group indicated to find AI an important topic, they did not engage with any information about the topic. A similar effect as the privacy paradox seemed to occur, in which one's attitudes and concerns do not line up with their actual behaviour (Kokolakis, 2017); an engagement paradox, in this context. To explain this gap, participants referred to their lack of innate interest, mental health, age and perceived lack of influence as reasons not to inquire information about AI. While the latter two are in line with research from Cave et al. (2019), there seem to be no other studies that explore these factors. However, Lyles and Swearingen (2019) offer a potential explanation for this paradox; they argue that people generally enter participatory processes motivated by both emotions and thoughts. Although the rational aspect may be present – that is, the participants think that AI is an important issue -, they lack the emotional urgency to actually engage with information about the topic.

Additionally, this group of participants perceived the visibility of information and news about AI to be low, whereas – interestingly - the higher engaged group indicated the visibility to be high. It, thus, appears that one's interest in and engagement with AI has an effect on the perceived visibility of news coverage about the topic. An interesting and unexpected conclusion, as most existing research focuses on content-related factors that influence news visibility, rather than recipient-related factors.

Another unexpected finding concerns the fact that some participants actively choose to refrain from mainstream information about AI due to a lack of trust in the government, media and science. Their belief that AI is being deployed by the WEF to push a transhumanist agenda and implement a world-wide surveillance state has skyrocketed recently. This seems to, in part, result from the COVID-19 pandemic. Arıkan (2020) reflects on the way in which information and communication infrastructures, in which AI plays a significant role, were used to establish data centred epidemic control systems. This development served as a catalysator for these participants to start researching alternative theories surrounding AI and to further develop their beliefs.

Baum (2017) already emphasized the potential of AI to be perceived as conspiratorial; the findings from this research support that, especially after the pandemic, these beliefs have indeed grown stronger. Interesting, though, is the high level of consciousness with which these people research the topic, consult their own sources and draw their conclusions – albeit contrary to the status quo. In that sense, their engagement with the topic can be perceived as higher than that of other participants, who are not consciously aware of AI or do not express an interest to learn more.

In terms of (non)participation in science communication and public engagement activities about AI, the engagement paradox could also be perceived. Generally, two types of people could be identified. The first group includes those who indicated not to be interested in joining activities due to a lack of interest or other priorities, but who nonetheless supported the general idea of organising activities about AI. The second group includes those who responded enthusiastically – or at least open - to the idea of joining activities about AI, but either did not know of their existence or figured the activities 'would not be for them'.

Thus, almost all participants indicated to have a positive attitude towards activities about AI, while simultaneously, almost all reported a low intent to join them as well. There appears to be a difference between general attitude and one's behavioural intent. However, as in line with existing literature on exclusion in science communication, this gap can be explained by exclusionary structures that withhold citizens from participating (Powell & Colin, 2009; Dawson, 2014, 2018; Humm et al., 2020).

Drawing from existing literature, citizens may experience both material and emotional- or social forms of exclusion with regards to science communication (Humm et al., 2020), a distinction which is supported by the findings in this research. Although the participants reported to experience material barriers concerning transport, time, entrance fees and wheelchair accessibility – which have been previously identified by Dawson (2014) and Humm et al. (2020) as well, the most troubling barriers for participants to join activities were social or emotional in nature.

The participants experience a large gap between themselves and the expected audiences at science communication and public engagement activities about AI, generally characterized by a perceived lack of knowledge. That is, the activities are perceived to be for 'highly intellectual' or tech-savvy people only, with whom the participants do not identify. Consequently, they often referred to these expected audiences as 'those people', 'different target group' and to themselves as 'normal people'. Romero-Rodriguez et al. (2021) explain that "binary views create borders between groups of people and place one group on a scale more substantial than the 'other'", which in this case refers to a certain level of perceived intellect and status. Consequently, participants expressed feelings of alienation and shame – for instance, the fear to be laughed at - associated with the emotional labour of trying to fit in with the audience at such activities, which is in line with the arguments made by Humm et al. (2020).

Apparently, this barrier to participate in activities goes far beyond the fear of not being able to understand; it touches upon people's wariness to enter a group they feel like they don't belong in, due to the perceived likelihood that they will not be accepted. Furthermore, based on the belief that their opinions and knowledge regarding AI are inferior to those of regular visitors of science communication and public engagement activities, some appear to feel as if their opinions and participation are not required or even desired, which is in line with previous findings from Dawson (2018), Cave et al. (2019) and Humm et al. (2020).

Other social- and emotional exclusionary structures identified in this research concern previously established factors, including language barriers (Humm et al., 2020) and age (Cave et al., 2019), which are, however, inextricably linked to lack of knowledge and otherness as well. However, some exclusionary factors, to the knowledge of the researcher, have not been identified before, including concentration issues – i.e., the lack of support offered to overcome them -, a lack of mental

space and crowded spaces. The latter appears to be linked to social anxiety in a general sense; the overall idea of having to participate in an activity where social interaction is required and many attendees are present forms a barrier for some participants. Overall, it can be concluded that, for most participants, their low intent to join science communication and public engagement initiatives about AI stems from exclusionary structures rather than a lack of interest or care.

Consequently, participants made a variety of recommendations for future science communication and public engagement initiatives about AI, which emphasizes their willingness to engage with the topic and reflect on their own needs and wishes. While most recommendations aim to enhance inclusivity, some simply aim to make activities more enjoyable and attractive. As emphasized by Dawson (2014), more than just removing material barriers should be done in order for citizens – especially those usually underrepresented in science communication – to feel welcome to participate and contribute. The recommendations can be roughly divided into three main pillars: the need for a practical, personal and pro-active approach.

In the first place, science communication and public engagement initiatives about AI should be approached from a practical perspective. As most participants indicated themselves to be practically-oriented, it is important to aid their learning and draw their interest by providing practical examples of AI in daily life. Ideally, citizens would be encouraged and supported to engage with AI tools themselves, to be able to translate theory into practice more effectively. Dillon (2010) argues that, indeed, practical work in science can aid in developing better knowledge and understanding of scientific concepts and developments. Similarly, McKinnon and Vos (2015) emphasize that this may stimulate citizens to become more intensively and emotionally engaged with the topic, which is perceived to be an essential aspect of learning.

Important, furthermore, is to avoid any jargon and complex language and instead, make use of visual materials (Mercer-Mapstone & Kuchel, 2017). Interestingly, this finding contradicts the argument made by Rowan (1991), who argues that simple language, examples and visuals are ineffective in overcoming difficulties in understanding science. Potentially, this discrepancy can be explained by the fact that the recommendations drawn from this study are self-reported by the participants and, therefore, not scientifically proven to be effective. However, often the needs and wishes of citizens are neglected due to a sense of scientific superiority (Canfield et al., 2020). Consequently, it remains important to listen to citizens' own recommendations and take them to heart.

A personal approach to science communication and public engagement was also emphasized to be highly important. Firstly, participants indicated that personal relevance is one of the most important factors that triggers their interest in an activity. This is in line with the findings from McKinnon and Vos (2015), who argue that in order for citizens to become truly, cognitively engaged, they should be emotionally invested too: that is, "students who feel their teachers support their autonomy and highlight the personal relevance of the task are more likely to value the task and exhibit greater engagement in learning" (p. 303). Thus, it is crucial for citizens to feel emotional involvement with AI, which could be done by making connections to one's hobbies and interests, occupation or daily life. Nisbet and Scheufele (2009) support this finding and emphasize that, indeed, connecting a scientific topic to something citizens already value or prioritize will aid them in making sense of the topic at hand.

Secondly, science communication and public engagement should, according to participants, be characterized by open, personal conversations between citizens, scientists, experts on AI and potentially, people who function as ambassadors. As acknowledged by Davis et al. (2018): "the concept of public engagement in science has broadened to encompass science in society activities, including a wide range of non-institutionalized knowledge-making and- sharing activities and conversations about emerging scientific and technological developments and their impacts" (p. 4). Such conversations are valuable as they allow participants more room to shape their own learning processes – for instance, by

addressing their topics of interest and asking questions they personally have been wanting to ask. Participants describe these to be more accessible, pleasant and open interactions as compared to large-scale, less personal initiatives; it bridges the perceived gap between scientist or expert and the audience. This is in line with the findings from McKinnon and Vos (2015): "science communicators need to know how to engage their audience not only with facts, but also on a personal level, to build that trust" (p. 304).

Moreover, science communication and public engagement initiatives should be approached pro-actively and designed carefully based on the target group, their familiarity with the topic, level of understanding, cultural and societal background, as well as other characteristics. This is in line with the studies of Mercer-Mapstone and Kuchel (2017) and Bultitude (2011), who acknowledge this pro-active behaviour of identifying and adhering to specific target groups as a core skill for effective science communication. As access to science communication and opportunities for public engagement are unequally distributed (Canfield et al., 2020), best practices often recommend something to the extent of 'providing value to the widest possible audience'. However, in such cases, open-access is mistaken for actual accessibility; inclusion is not attained by trying to create a one-size-fits-all format for activities, but rather by ensuring that every target group is catered to and gets an equal chance to participate. Especially with regards to the latter, it is important for science communicators to not make assumptions about a target groups' interest in science or AI. As expressed by the participants and found by Dowell (2014) as well, citizens may be more interested to engage than anticipated by scientists.

A pro-active approach should also be taken in consulting and leveraging citizens' input and insights. Citizens want to feel seen and heard, and being able to freely express their concerns, opinions and ideas while actually being listened to is expressed to be of immense value. This is in line with the findings of Powell and Colin (2008), who argue that in order for public engagement initiatives to be effective and meaningful, "relationships and dialogues among organizers, scientists, and citizens should be as reflexive, two way and transparent as possible. Involved citizens should have a say in the projects' goals, their purposes, who will be involved, and what kinds of processes will be used." (p. 134). This requires science communicators to pro-actively design activities which reflect citizen input, as well as provide room for the discussion of various perspectives and opinions during the activities themselves.

Moreover, participants stressed the importance of being pro-active in the promotion of events and AI itself. That is, in order for citizens to become engaged, they should in the first place become aware of the existence and impact of AI; preferably at a young age, to promote engagement and interest in later stages of life. This supports the findings from Lin et al. (2012), who found that "students' emotional perceptions of learning science incubated in the stage of compulsory education are likely to last to the stage of becoming as adults" (p. 38), heightening the need for science communicators to inspire the younger generation and create positive associations with learning about AI.

In terms of promotion among older citizens, a mix of mass- and targeted promotions was recommended, with special focus on word-of-mouth promotion. Especially in more closed-off communities in which, for instance, many citizens do not speak Dutch, invitations to join an activity by a respected or enthusiastic ambassador in the community may be more effective than regular forms of promotion.

5.2. Theoretical implications

The results from this research contribute to the body of existing literature in several ways. Firstly, this research adds to the literature by providing interesting insights into the information consumption behaviour of citizens in low SES neighbourhoods in relation to AI. Quite an extensive body of literature is available on media coverage about AI and the specific topics that are frequently addressed, however, little research is available on how citizens actually perceive this media coverage and how, or to what extent, they actually engage with it. Although this was not the focus of this research, these findings in

relation to information engagement and behaviour make an interesting contribution to a field of study that is expected to exponentially grow in the upcoming years. Considering the specific target group, these findings may not be generalizable for the general population in the Netherlands, however, they all the more contribute to a better understanding of the behaviour of those usually underrepresented in science communication and public engagement.

Secondly, this research contributes to the literature by rejecting the deeply engrained, knowledge-deficit thinking approach to science communication that the general public is ignorant and uninterested in scientific topics and, therefore, science communicators should not bother to try and involve them. Rather, this research has proven that, even among citizens who usually tend to be underrepresented in science communication, there are plenty of citizens who show an interest in and would be willing to engage with AI more – where there not so many barriers that systematically exclude them from participating. Although many studies have already been dedicated to discrediting the knowledge deficit model and its related beliefs, it has been proven to still influence much of today's science communication, which is why these findings still provide an important theoretical implication.

Lastly, this research adds to the body of literature of both science communication and public engagement about AI, as well as exclusion in science communication. Both domains of research are still relatively young and – especially in the case of exclusion in science communication – quite small. To the knowledge of the researcher, this research is the first to combine the two and study non(participation) and exclusion in the specific context of science communication and public engagement about AI. Considering the fast growth and revolutionary nature of the technology and the growing attention towards topics such as inclusivity and diversity, this is an important step forward in further exploring the ways in which science communicators can create more equal opportunities for citizens to learn about and engage with AI.

5.3. Practical implications

Some practical implications can be derived from this research as well. Although plenty of literature on best practices in science communication and public engagement already exists, this research adds recommendations that focus specifically on creating more inclusive initiatives and fostering participation among citizens in low SES neighbourhoods. Based on these recommendations, a set of guidelines is formulated for science communicators who are interested in engaging and accommodating a wider range of citizens. The guidelines are presented in the table below.

Table 4

Guidelines for fostering participation and creating inclusive science communication initiatives about AI

Identification & consultation	1. Identify target group: be specific and consider cultural and societal background, interests, as well as previous knowledge and understanding of AI. 2. Consult the target group about their wishes and needs. 3. Identify the learning goals of the target group.
Activity design	4. Identify a suitable location: consider accessibility factors such as transport, wheelchair accessibility and travel time. 5. Consider the duration of the activity in relation to the time resources of the target group. 6. Avoid any jargon, complex- and condescending language. 7. Based on the target group, provide a mix of detailed, technical information, process- and development related information and basic knowledge of applications, advantages and disadvantages. 8. Create personal relevance by connecting information about AI to the target group's personal interests, values and/or daily lives. 9. Take a practically-oriented approach: provide practical examples to illustrate information about AI and offer participants the chance to engage with tools or tasks themselves. 10. Use visual materials to aid participants in creating a more tangible understanding. 11. Consider – based on the target group – incorporating entertaining elements (including, for instance, humour, music and animations). 12. Create room for discussion and input/feedback from citizens. 13. Create room for personal attention, conversations and questions - for instance with knowledgeable ambassadors. 14. Involve an enthusiastic and inspiring teacher or educator who is able to adapt to the needs of the target group. 15. Consider the social role of science communication activities: if possible, make use of citizens' personal networks and create a welcoming and convivial atmosphere.
Promotion	16. Start as early as possible: try to engage citizens from a young age to promote interest and engagement in later stages of life. 17. Based on the target group, choose a mix of both mass (flyers, social media, mainstream media)- and targeted promotions (conversations, newsletters). 18. Stimulate involved citizens to engage in word-of-mouth promotion to leverage their social capital. 19. Focus on creating general awareness: citizens should, in the first place, become aware of the existence and impact of AI on society.

Most of these recommendations are in line with existing guidelines on effective science communication and public engagement. For instance, Christensen (2007) describes a few key success factors for science communicators that have also been identified in this research, including the use of visual materials and comprehensive, clear and concise language. Interestingly, they also mention the use of 'helpers' or 'multipliers' as the most essential part of transferring information to the public (Christensen, 2007), which is a notion very similar to the ambassadors as described and proposed by the participants in this research. Furthermore, Christensen (2007), Bultitude (2011), Illingworth (2017) and Bowater and Yeoman (2012) all emphasize the importance of specifying and tailoring to narrow target groups as well. However, they add the important nuance that, due to limited resources, this is sometimes neglected in practice (Christensen, 2007).

In their paper, Bultitude (2011) also describes techniques and best practices that are similar to the recommendations derived from this research. Most importantly, they emphasize the emotional engagement aspect of science communication and the need for science communicators to stimulate this in order for the audience to feel truly involved (Bultitude, 2011). To achieve this, they recommend the use of engagement tactics such as humour, interaction and storytelling, as well as involving a passionate, enthusiastic educator and creating personal relevance to the audience (Bultitude, 2011), which are in line with the recommendations made by the participants in this study.

The guidelines developed by Illingworth (2017) also align with the recommendations derived from this study. They highlight the importance of establishing dialogue and conversations within science communication and public engagement, as did Powell and Colin (2008), and specifically recommend to actively gather feedback from the audience (Illingworth, 2017). Importantly, they also emphasize to consider the accessibility of events – especially location-wise, for which they provide plenty of practical safety, accessibility and housekeeping guidelines (Illingworth, 2017). Furthermore, their recommendations with regards to the promotion of science communication initiatives are also in line with the findings from this research: they stimulate science communicators to tap into local networks and capitalize on word-of-mouth promotion, combined with a mix of more traditional promotion tactics such as flyers, posters, mailing lists and social media (Illingworth, 2017).

Notably, the recommendations formulated by the participants in this study are generally well-aligned with the existing body of literature. However, the established guidelines did all highlight the importance of evaluation and improvement (Bultitude, 2011; Christensen, 2007; Illingworth, 2017), a concept that is lacking from the recommendations from this study. As argued by Christensen (2007), "Part of the communication strategy should be to identify clearly some qualitative and quantitative success metrics and evaluate products after completion" (p. 214). Where the recommendations from this study do honour some type of qualitative success metric – i.e., the personal feedback from participating citizens -, they do not make any mention of quantitative measures, a strong deviation from what is generally considered best practice.

Note that the guidelines have not been empirically tested (yet) and that they are based on self-reported recommendations from a small pool of citizens. The guidelines, thus, may not be applicable for the general population of the Netherlands or various target groups; however, they do provide a few important points that are interesting for science communicators to consider.

5.4. Limitations

There are a few limitations with regards to this research that should be addressed. The first limitation concerns the potential social-desirability bias participants may have had during the interviews. This type of bias refers to "the tendency of research subjects to choose responses they believe are more socially desirable or acceptable rather than choosing responses that are reflective of their true thoughts or feelings" (Grimm, 2010; p. 1), meaning that there is a possibility that participants formulated answers they felt the researcher would approve of rather than expressing their own thoughts and

opinions. Especially considering the fact that the data collection took place face-to-face and the interview topic was a subject the participants might have thought of as important to the researcher, it could be that participants, for instance, indicated higher levels of interest, intent to join, or more positive attitudes than is truly the case for them personally. Although measures were taken to minimize this type of bias as much as possible – for instance, by stressing that participants' responses are fully anonymous and there is no right or wrong answer – it cannot be ensured that no social-desirability bias is present in the data.

The second limitation concerns the translation of the data into the codebook. During the interviews, the participants touched upon many different, interesting matters in relation to the topic. Simultaneously, many participants also shared highly detailed and specific insights, leading to a very rich body of data collected from the interviews. However, due to the richness of the data both in terms of breadth and depth, it proved to be difficult to translate this into a coherent codebook. As a result, the final codebook is relatively long and contains multiple levels of subcodes, making it slightly inconvenient to use and more prone to losing the scope of the research.

The third limitation concerns the lack of longitudinal perspective in this research. From the findings, it appeared that citizens' attitudes towards and levels of engagement with science communication and public participation efforts are subject to many factors that may change over time – including, for instance, personal relevance. This research does not take into account this longitudinal perspective and therefore does little justice to the dynamic nature of citizen engagement with science communication about AI. For instance, it provides little direction as to how citizen engagement, attitudes and interest may develop over time when AI and its applications become more visible in citizens' daily life. Rather, it provides a more static description of what the participants have experienced up until a certain point, without acknowledging the ever-changing nature of these feelings, thoughts and behaviours.

5.5. Directions for future research

Based on the findings of this research, a few interesting directions for future research in this domain can be identified. Firstly, it would be interesting for future studies to focus more on the longitudinal perspective and to collect data on the attitudes, interest and levels of engagement of citizens over a longer period of time. This would garner interesting additional results in terms of the factors that are expected to continuously influence citizen engagement with science communication about AI and the extent to which this is subject to changes in the environment.

Secondly, it would be interesting to conduct similar studies outside of the Netherlands and preferably, outside of Europe. For instance, conducting a study in China or Japan may yield interesting additional results, as the visibility of AI applications in daily life is perceived to be higher there as compared to the Netherlands. Furthermore, it might be interesting to conduct similar studies in non-western countries, in order to determine whether – and how – cultural differences and perceptions of technology influence citizen engagement with science communication about AI.

Lastly, it would be fruitful for future research to focus on case studies and observations during actual activities. By doing this, even more specific guidelines can be formulated on how to improve science communication and public engagement activities about AI, as citizens can report their experiences, recommendations and struggles in a more specific and timely manner in relation to a certain activity. Furthermore, this would be a suitable approach for participants who struggle to voice their opinions and thoughts in an interview or survey, as they may not have appropriate examples of previous experiences on top of mind to illustrate their attitudes, opinions and behaviours. Participating in an activity and, simultaneously or subsequently, reporting on one's experience and thoughts may, in that case, lead to richer and more detailed responses.

5.6 Conclusion

This research aimed to investigate the diversity and inclusivity of science communication and public engagement in the Netherlands, by exploring the experiences, attitudes and motives of citizens in low SES neighbourhoods in Enschede. 19 semi-structured interviews were conducted, which gave insight into the participants' perceptions of AI, their engagement with information about AI, their reasons for (not) participating in science communication and public engagement activities and their wishes and needs for future initiatives.

It became clear that the concept of AI heavily appeals to the imagination of citizens. Generally, the participants held strong opinions about AI, even though many of them indicated not to be familiar with the topic at first glance. It appeared that, rather than these citizens being ignorant of the technology, merely the term artificial intelligence was unknown and specific applications of AI were in fact familiar. AI was considered to be a highly important topic, even to the extent that some participants related their general worldviews to the development and implementation of the technology. The common assumption among scientists that the general public is not interested in or ignorant about this technological innovation can, thus, be considered inaccurate.

Interestingly, the perceived salience of the topic did not translate to the participants' behaviour in terms of information engagement: only a few participants indicated to frequently consume information about AI. This engagement paradox was explained to, in some cases, be due to a lack of interest, but more often it was due to factors such as one's age, perceived low visibility of news coverage or a lack of time. For some citizens, a lack of trust in the government, media and science plays a significant role in their conscious withdrawal from science communication about AI.

The engagement paradox is also visible in the context of participation in science communication and public engagement activities. While most participants indicated to support the idea of public participation in science, almost all participants had a low intent to join as well. While for some participants a mere lack of interest in the topic and limited time resources led them to be uninterested, a substantial number of participants indicated to be open to or even enthusiastic about participating. They, however, experienced too many barriers to actually participate.

Aside from material barriers such as financial- and logistic difficulties, many participants expressed not to feel welcome, at home, and comfortable at activities, leading them to conclude that 'they could be fun, but not for me.' Feelings of shame and alienation due to a perceived lack of knowledge, the perceived gap between themselves and the standard audience at activities, their age, concentration issues, lack of mental space and social anxiety were all factors withholding them from participating. These citizens, thus, experience science communication and public engagement activities as far removed from their personal lives and reality, as spaces they do not belong in and are also not expected to be at – even though they might have been open to it under different circumstances.

Indicative of the participants' willingness to consciously engage with the topic and to contribute to more inclusive science communication and public engagement, were their recommendations for future initiatives. They put out a variety of suggestions which, ultimately, could be divided into three main pointers: a practical, personal and pro-active approach to organising activities. Notably, citizens are quite willing, and able to, think about and formulate requirements for what they perceive to be successful activities, as long as they are being asked. Thus, in order to shape more truly inclusive science communication and public engagement activities, rather than acting upon best practices and assumptions, one should return to the basis: those who the activities are being organized for.

Science communication and public engagement can be very valuable in attempting to create a bridge between the world of science and the reality of the average citizen. Especially in terms of AI, an impactful and quickly integrating technology, this is a necessity rather than a luxury. Unfortunately, current science communication and public engagement initiatives leave a lot of untapped potential:

citizens who have valuable contributions to offer, but simply are not offered the possibilities to engage in a way that many others can. Therefore, in order to fundamentally improve science communication and public engagement about AI, it should become a moral responsibility of science communicators to direct efforts towards creating a more equal playing field; that is, commit to a future in which the default mode of citizens will not be to think 'this is not for me', but to say 'that sounds like something for me!'.

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Appendices

Appendix A: Informed consent form

Toestemmingsformulier – Masterscriptie Pien Spanjaard

Dit onderzoek is mijn afstudeerproject van de opleiding Communicatiewetenschap aan de Universiteit Twente. Het doel van het onderzoek is om te begrijpen hoe burgers uit deze regio denken over informatie en activiteiten rondom kunstmatige intelligentie en hoe dit in de toekomst beter kan.

Voor dit onderzoek wil ik daarom graag met u praten over kunstmatige intelligentie (ook wel AI genoemd) en de activiteiten die daarover worden georganiseerd. Uw antwoorden op mijn vragen gebruik ik in mijn onderzoeksverslag.

Voor we kunnen beginnen, vraag ik u om toestemming voor het interview.

- Deelname aan dit onderzoek is vrijwillig. Dit betekent dat u op ieder moment tijdens het interview kunt stoppen. In dat geval zullen uw antwoorden niet gebruikt worden voor het onderzoek.

- Deelname aan dit onderzoek is anoniem. Dit betekent dat uw naam en eventuele contactgegevens niet worden verwerkt. De resultaten in het onderzoeksverslag kunnen niet met u (of andere deelnemers) in verband worden gebracht.

- Ik vraag uw toestemming om een geluidsopname te maken van het interview. Dit maakt het makkelijker om uw antwoorden te verwerken. Met behulp van de opname zal ik ons gesprek uitschrijven. De opname zelf wordt na het afronden van het onderzoek gewist.

- Zodra het onderzoek is afgerond, zullen de op papier uitgewerkte interviews worden bewaard door de Universiteit Twente. Deze zullen – zoals wettelijk verplicht - 10 jaar in een beveiligde omgeving worden opgeslagen.

Datum:

Door het tekenen van dit formulier gaat u akkoord met de inhoud van dit formulier en staat u toe dat het interview wordt opgenomen:

Handtekening deelnemer: **Handtekening Pien Spanjaard:**

Informed consent form – Master thesis Pien Spanjaard

This research is my graduation project for the study Communication Science at the University of Twente. The goal of this research is to understand what citizens from the Enschede region think of information and activities surrounding artificial intelligence and how this can be improved in the future.

In this interview, I would like to talk with you about artificial intelligence (AI) and the activities that are being organized about AI for citizens. I will process your answers to my questions for my research.

Before we can start, I ask your permission to participate in this research.

- Participation in this research is voluntary. This means that you can stop the interview at any point if desired. In that case, your answers will not be used for the research.

- Participation in this research is anonymous. This means that your name and potential contact details will not be processed. The results in the final research report, therefore, cannot be linked to you or any other participants.

- I ask your permission to record the audio of the interview. This will make it easier to process your answers for the research. I will use the recording to write down our conversation. The recording itself will be deleted when the research has been finished.

- As soon as the research has been finished, the paper transcripts of the interviews will be stored by the University of Twente. They will be stored in a protected environment for 10 years, as is legally required.

Date:

By signing this form, I confirm my participation in this study, agreement with the content of this form and give my consent for the interview to be audio recorded:

Signature participant: **Signature Pien Spanjaard:**

Appendix B: Topic list

Table 2

Interview topic list

+- 7 min

My name is Pien Spanjaard and I study Communication Science at the University of Twente. In order to graduate, I am doing a research into citizens' opinions about communication and activities surrounding artificial intelligence (also referred to as AI).

I would like to thank you for your time and helping me graduate. The interview will take an hour maximum. During the interview we will talk about your opinions about activities that are being organised to inform citizens or engage them with AI. But before we start with that, I first have some background questions.

Theme/topic	Main questions	Sub/probing questions
Demographics	• How old are you? • What is your occupation? • Where were you born? • Where were your parents born? • What is your highest, completed education?	n.a.

+- 13 min

Now we can move on to the topic of artificial intelligence, or AI.

Introduction topic of AI	• Do you know the topic of AI? • What are your first thoughts on AI?	n.a.

Before we continue with the interview, I have a short video which explains what AI is. Let us take a look at that before we continue with the questions.

Video: https://www.youtube.com/watch?v=QJE_ycgR8E8

Introduction topic of AI	• Do you have questions already?	n.a.

AI is quite present in daily life already. For example, when you look something up on Google, you might get all kinds of Facebook advertisements of that specific thing. Or the robot in the HEMA lunchroom, which is able to recognize tables and chairs as obstacles and that way, can bring a drink to your table without running into something.

I am curious about your opinion on AI. Shall we talk about that a bit more in depth?

	Perceptions of AI	• What do you think of AI? • To what extent are you up-to-date with AI? • How important is AI to you (and can you give an example)? • How interesting do you find AI to be (and why)?	• What positive and negative sides do you see with regards to AI?

+- 15 min

My next questions are about your experiences with information about AI.

Information about AI	• Do you ever read, see or hear any information about AI? • What do you think of this information? • How important is this information to you? • Do you think you are being informed about AI enough? • Where do you go for information about AI?	• Why/why not?

In addition to your experiences with information about AI, I am also curious to know more about your experiences and opinion on activities about AI. That is what the next set of questions is about.

Activities about AI	• Do you ever go to activities about AI? • What do you think of such activities? • How important are such activities to you? • Do you think there are enough activities about AI? • Can you think of a situation in which you would go to an activity about AI?	• Why/why not? • If yes: what was this experience like?

+- 15 min

Because AI has a big impact on our daily life – both positive and negative -, scientists think it is important to inform people and engage them with AI. They try to do this in various ways. I'll give you two examples:

- Every now and then, universities organise Science Cafés about AI (or other topics). These are evenings during which scientists give a lecture about AI in a local café, with room for the public and the lecturer to discuss the topic. Science Cafés often have no entry fee and are sometimes combined with live music and/or other entertainment.

	- Musea are organising more and more expositions about AI. In the past year, the exposition BrAInpower was hosted in Rijksmuseum Boerhaave. This was, among others, about the applications of AI and how these can improve our lives, but also about the darker side of AI.		
	(Non)participation & exclusion	• Do you (or your friends, family) ever go to such activities? Why (not)? • Imagine that you were to visit a Science Café or exposition about AI. What do you expect of these activities? • To what extent do these activities fit you and your wishes? • What makes an activity about AI attractive or unattractive to you (and why)?	n.a.
+- 10 min	We have now talked a little bit about existing activities and what you think of them. I am also curious about how you would like to see this in the future.		
	Wishes and needs	• What is needed to get you (or your family and friends) interested in an activity about AI? • What are requirements for a good activity about AI? • How can we make information about AI more accessible for you? • What would you advise a scientist who wants to engage people with AI?	• What does your ideal activity about AI look like?
	These were my questions. Is there anything that you would like to add or say about the topic? Thank you so much for participating!		

Appendix C: Codebook

Table 3

Finalized codebook

Category	Code	Subcode	Sub-subcode
1. Demographics	1.1. Age	-	-
	1.2. Occupation		
	1.3. Place of birth		
	1.4. Parents' place of birth		
	1.5. Education		
2. Perception of AI	2.1. Perceived knowledgeability	2.1.1. High	
		2.1.2. Low	
		2.1.3. Moderate	
	2.2. Attitude	2.2.1. Attitude towards AI	2.2.1.1. Positive
			2.2.1.2. Negative
		2.2.2. Worldview	2.2.1.3. Neutral
	2.3. Importance	2.3.1. High	
		2.3.2. Low	
		2.3.3. Neutral	
	2.4. Interest	2.4.1. High	
		2.4.2. Low	
		2.4.3. Neutral	
	2.5. Advantages	2.5.1. Efficiency	
		2.5.2. Social advantages	
		2.5.3. Health care	
		2.5.4. Personalization	
	2.6. Disadvantages	2.6.1. Loss of control	
		2.6.2. Technological dependency	
		2.6.3. Privacy loss	
		2.6.4. Power misuse	
		2.6.5. Lack of human authenticity	

			2.6.6. Job loss 2.6.7. Fake news 2.6.8. Discrimination 2.6.9. Weaponization 2.6.10. Plagiarism 2.6.11. Expenses 2.6.12. Unsolicited use 2.6.13. Playing God	
		2.7. Applicability	2.7.1. Applications 2.7.2. Conditions for application	2.7.1.1. Health 2.7.1.2. Security 2.7.1.3. Robotics 2.7.1.4. Transport 2.7.1.5. Societal challenges 2.7.1.6. Government 2.7.1.7. Advertising 2.7.1.8. Art 2.7.1.9. Chatbots
3.	Engagement with AI information	3.1. Level of engagement	3.1.1. High 3.1.2. Low 3.1.3. Moderate	3.1.1.1. Reasons to engage 3.1.2.1. Reasons to not engage
		3.2. Information consumption	3.2.1. Information quality	3.2.1.1.High 3.2.1.2.Low
			3.2.2. Information trustworthiness	3.2.2.1. High 3.2.2.2. Low
			3.2.3. Information salience	3.2.3.1. High 3.2.3.2. Low
			3.2.4. Information presence	3.2.4.1. High 3.2.4.2. Low 3.2.4.3. Moderate
			3.2.5. Information content	
		3.3. Sources	3.3.1. Mainstream media 3.3.2. Internet 3.3.3 Social media 3.3.4. Peers 3.3.5. Alternative news channels 3.3.6. International	

			news channels 3.3.7. Movies	
4.	(Non)partici-pation and inclusion/exclusion in AI activities	4.1. Activity engagement	4.1.1. Intent to join	4.1.1.1. High 4.1.1.2. Low 4.1.1.3. Moderate
			4.1.2. Attitude	4.1.2.1. Positive 4.1.2.2. Negative 4.1.2.3. Neutral
			4.1.3. Visibility	4.1.3.1. High 4.1.3.2. Low
			4.1.4. Expectations	4.1.4.1. Attendees 4.1.4.2. Agenda 4.1.4.3. Content 4.1.4.4. Engagement of other citizens
		4.2. Exclusionary factors	4.2.1.Material exclusion	4.2.1.1. Entrance fees 4.2.1.2. Transport 4.2.1.3. Wheelchair inaccessibility 4.2.1.4. Time
			4.2.2. Emotional -and social exclusion	4.2.2.1. Level of knowledge 4.2.2.2. Language barrier 4.2.2.3. Age 4.2.2.4. Lack of mental space 4.2.2.5. Concentration issues 4.2.2.6. Crowded spaces 4.2.2.7. Performance-orientedness
5.	Wishes and needs for inclusive science communication	5.1. Future requirements	5.1.1.Accessiblity	5.1.1.1. Location 5.1.1.2. Language 5.1.1.3. Entry fees 5.1.1.4. Timing 5.1.1.5. Ambassadors

		5.1.1.6. Basic knowledge 5.1.1.7. Scale 5.1.1.8. Target groups
	5.1.2. Personal relevance	5.1.2.1. Personal use 5.1.2.2. Solutions to societal issues
	5.1.3. Format	5.1.3.1. TedTalk/lecture 5.1.3.2. Information session 5.1.3.3. School lesson 5.1.3.4. Citizen initiative 5.1.3.5. Online information 5.1.3.6. Conversation 5.1.3.7. Workshop 5.1.3.8. Museum exposition 5.1.3.9. Science Café
	5.1.4. Content	5.1.4.1. Practical examples 5.1.4.2. Interaction with AI 5.1.4.3. Nuance 5.1.4.4. Visuals 5.1.4.5. Process 5.1.4.6. Risk awareness 5.1.4.7. Positive perspective 5.1.4.8. Entertainment 5.1.4.9. Discussion 5.1.4.10. In-depth insight
	5.1.5. Teacher	

	5.2. Incentives	5.2.1. Social function 5.2.2. Gifts 5.2.3. Food and drinks	
	5.3. Promotion	5.3.1. Mass promotion	5.3.1.1. Flyers 5.3.1.2. Posters 5.3.1.3. Newspaper advertisement 5.3.1.4. Online promotion 5.3.1.5. Authorities 5.3.1.6. Entertainment media 5.3.1.7. Promotional videos
		5.3.2. Targeted promotion	5.3.2.1. Word-of-mouth 5.3.2.2. Email newsletter 5.3.2.3. Written letter

Table 4

Code explanations

Code	Description	Example
2.1. Perceived knowledgeability	Whenever a participant says anything about their perceived knowledge about AI, or what they think AI is or means.	"It is the first time I am hearing about this." "Yes, I know it, I have studied IT so I am familiar with the topic." "And GPS… would you say that is AI too?"
2.2. Attitude	Whenever a participant describes their feelings towards AI. Attitude is often linked to certain advantages and disadvantages, but the latter are more about the reasoning as to why one holds a certain attitude towards AI. This code, thus, refers to the more general feeling one has towards AI.	"It can be good, it can be less good… it is ambiguous. It can be helpful but it should remain within limits." "I think it is a good development." "I am not a fan of it."

2.3. Importance	Whenever a participant describes the perceived importance of AI to them and why this is the case.	"I think it is important because the whole word is built on it." "It is the future, so it is an important topic."
2.4. Interest	Whenever a participant describes their perceived level of interest in AI in a general sense.	"Yes, it is an interesting topic. I am always interested in new things." "Yes, it is interesting, I would like to know more about it." "It is not necessarily interesting to me."
2.5. Advantages	Whenever a participant describes specific advantages of (using) AI – often answers the question as to why one has a positive attitude towards AI.	"It can take a lot of work out of people's hands." "It is great that AI can help diagnose illnesses."
2.6. Disadvantages	Whenever a participant describes specific disadvantages of (using) AI – often answers the question as to why one has a negative attitude towards AI.	"I think it is problematic that it can be used in war, to create autonomous weapons." "I think a big disadvantage would be when AI gets a mind of its own.. what is it going to do?"
2.7. Applicability	Whenever a participant describes specific applications of AI or any conditions for implementing AI.	"For example cars with AI, they can decide autonomously when to stop." "I think humans should always remain responsible, instead of an AI deciding fully on its own."
3.1. Level of engagement	Whenever a participant says anything about their engagement with information about AI, their willingness to gather information and their reasons to engage or not to engage. This refers specifically to independent information interaction – so not to one's willingness to join activities about AI.	"I do follow news about it, I am not thinking about it regularly but I do find it important to stay updated. I do think there should be more awareness for it." "I do think it is important that there's information available, but does it matter in the end? I don't think so. Those tech companies are going to do whatever they want anyway, we cannot influence that."
3.2. Information consumption	Whenever the participant talks about the quality, trustworthiness, salience, presence or the content of the information that they encounter about AI.	"It is pretty basic, what I am reading about AI." "It has been in the news a lot recently." "I read it, but I forget about it immediately after." "News media tend to hold things back."

3.3. Sources	Whenever the participant describes what kind of sources they use to get their information about AI, and why (or why not).	"I mostly read about it on the internet, not on TV. I am too young for that I think." "I've heard about it on the radio."
4.1. Activity engagement	Whenever a participant says anything about their intent to join an activity about AI and their reasons to do so, or not (although the latter often -but not always- can be explained by exclusionary factors); their general attitude towards activities about AI; the visibility of activities about AI and any expectations they might have about activities about AI or other citizens' engagement with AI.	"I would go to an exposition about AI, I am curious to learn more about it." "I would not go to such an activity, I have other hobbies I'd rather invest in." "It is good that these activities exist for those who are interested." "I did not know a Science Café existed, I have never heard of it before." "I think there would be a lot of electronics." "I don't think many people are interested in AI. As long as it works, they are like: sure."
4.2. Exclusionary factors	Whenever a participant mentions any material (financial, logistic, time) barriers to join an activity about AI or any social/emotional barriers to join an activity about AI (difficult language/information, not speaking the language, lack of mental space, concentration issues, crowded spaces)	"It is just too difficult, scientists use very fancy and difficult words." "I have my work, household.. I don't have time for such activities." "In a café, drinking a beer and discussion at the same time.. no, the information then doesn't get to me."
5.1. Future requirements	Whenever the participant describes any requirements for a good activity or an activity they would join, including any requirements about accessibility, the format, content, teacher or personal relevance.	"I'd like to have some practical examples." "Ideally you would be able to interact with the AI yourself, that is better than just sitting and listening." "You need to have someone who knows what they are talking about." "It would be good to address how you can use it in your daily life."
5.2. Incentives	Whenever the participant describes any incentives to go to a future activity about AI (gifts, food and drinks, social contact).	"If you can go with friends, that would be nice." "I would like there to be free coffee and cookies."

5.3. Promotion	Whenever the participant describes any means to better promote further activities or raise awareness, either in mass communication or targeted form.	“Maybe receiving an email newsletter would be good to stay updated.” “An informational video may get people more interested for such an event.”