P for Politics D for Dialogue: Reflections on Participatory Design with Children and Animals

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P for Politics D for Dialogue: Reflections on Participatory Design with Children and Animals

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ABSTRACT

Participatory Design strives to open up the decision-making process and empower all those who may be affected by design. This is opposed to Design as a non-participatory process, in which the power to make decisions is vested in the hands of one group to the possible detriment of others. In this paper we interrogate the nature, possibilities and limitations of Participatory Design through the perspective of Child Computer Interaction (CCI) and Animal Computer Interaction (ACI). Due to the cognitive and communication characteristics, and to the social and legal status of their participants, researchers in these communities have to contend with and challenge existing notions of participation and design. Thus, their theories and practices provide a lens through which the nature and goals of Participatory Design can be examined with a view to facilitating the development of more inclusive participatory models and practices.

CCS CONCEPTS

• **Human-centered computing → Interaction design → Interaction design process and methods → Participatory design**

Author Keywords

Participatory design; Animal Computer Interaction; Child Computer Interaction; ACI; CCI; PD.

INTRODUCTION

As Bratteteig and Wagner [10, p.41] pointed out "design is decision making" and "*decision making is the exercising of power*". Participatory Design (PD) strives to open up the decision-making process and hence empower all those who will be affected by the design. The combination of the words *Participatory* and *Design* suggests that *Design* on its own is a non-participatory process, in which a designer or a group of designers control all of the decisions and hence exercise all of the power.

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The root of this suggestion lies in the 18th century with the rise of industrialization and mass production and with the inherent complexity of modern machinery and more recently of computer systems. In this regard, Design historian Victor Margolin [31] has made a distinction: design with a small 'd', i.e. the artefacts that people create to satisfy their needs and organize their environment, which characterized the design and use of artefacts up to the 18th century where production was the domain of artisans; and Design with a capital 'D', i.e. the practices and processes associated with industrialization and mass production, which characterize modern manufacturing and use from around the 18th century to the present day. Along the same lines, linguist James Paul Gee [25] distinguished: Discourse with a capital 'D', which would "*capture the ways in which people enact and recognize socially and historically significant identities or 'kinds of people' through well-integrated combinations of language, actions, interactions, objects, tools, technologies, beliefs, and values*"; and discourse with a small 'd', which would refer to the analysis of language in use.

Arguably, the socio-economic systems of the industrial age favoured those who control the means of production over those who operate them; at the same time, the principles of mass production favoured the ideal over the individual and the specialized expertise required from 'D'esigners. In turn, this fostered a design ethos that privileged the "kinds of people" who possessed the "right" expertise or exercised relevant powers over those who would merely use or operate the equipment and artefacts being designed. It is this very form of discourse, and the power imbalances implied by it, that PD emerged to challenge. PD provided a set of values, actions, methods and tools that would enable all those with a vested interest in the equipment and artefacts in question (i.e. not just the professional designers and those who commissioned the design but also the intended users and those who may be called upon to support such use) to join the 'D'iscourse and participate in the 'D'esign (decision making) process. In early '70s Scandinavia, this shift enabled the co-realization of participative solutions in the workplace providing a blue print for the development of equipment and artefacts; just as importantly, it opened a space for discussing the nature of empowerment and how the processes of 'D'esign could support individuals in exercising 'd'esign.

But, if inclusion and empowerment are the essential values of PD, what happens when participatory practices have to deal with fundamental differences and asymmetries between participants that go well beyond those that might exist between workers and employers? In particular, 'natural language' is the form of expression we use for daily interactions, legal representation and scientific discourse; its use is presumed to relate to the expression of common cognitive constructs and abilities; and indeed, natural language continues to be an essential vehicle of participation. Thus, how can participatory practices be inclusive when participants are unable to use natural language? Furthermore, how can participatory practices be empowering when they take place in socio-economic systems that do not represent participants' interests and do not recognise non-linguistic forms of self-representation?

In this paper we interrogate the nature, possibilities and limitations of PD from the perspective of two groups of participants with particular communication capabilities and representation statuses: children and nonhuman animals. We examine the work conducted within the Child Computer Interaction (CCI) and Animal Computer Interaction (ACI) communities, which contends with and challenges existing notions of participation and design. Both communities attempt to address the needs of participants who, for biological or legal reasons, depend on mediators for representation or caregivers to fulfil basic needs such as food or shelter, with the assumptions, biases, expectations, and vulnerabilities that such unequal dependencies implies. In particular, CCI researchers have been facing the challenge of working with children who, given their cognitive and linguistic developmental stage, might experience difficulties in expressing their thoughts and ideas, affecting their ability to engage in verbal conversation and articulate abstract concepts and actions. On the other hand, ACI researchers have been dealing with the seemingly impossible task of working with nonhuman animals who, given their species and circumstances, might have very diverse physical, sensory and cognitive capabilities, and correspondingly different psychological constructs and communication modalities. This work questions the nature and exposes the mechanisms of participatory design, offering insights into its possible forms and validity in a diverse world in which computing technology is changing the lives of all.

ORIGIN AND TENETS OF PARTICIPATORY DESIGN

Participatory design originated in Scandinavia in the early 1970s as a response to technological changes in the workplace. The emergence of electronic and computer-based machines and office equipment that required users to operate them via electronic interfaces (as opposed to valves, keys and switches), a tradition of consultation with trade unions, and the enactment of new laws aimed at addressing power asymmetries between workers and employer [20] required a new design approach. Such a new approach would need to address the design and organizational challenges posed by the introduction of these new laws and technologies. Thus, the impetus leading to the emergence of participatory design was both political and technical.

Given its political motivation (empowering workers to shape working practices and means of production within the workplace) and its technical motivation (harnessing workers' expert knowledge of established practices and existing tools), the practice of participatory design was founded on the following principles:

- Users of technological artefacts should have a say, that is, take an active part, in the design of technology intended for them. The users should not merely be consulted for their domain knowledge but should participate in the derivation of the design solution and empowered by the process.
- The design process should strive to balance the weight (importance) ascribed to the requirements and ideas of three participating groups: workers (users), employers (clients of the design agency) and designers (expert service providers), since all have a legitimate stake in the design process.
- Since design does not spring from a vacuum but is situated in complex socio-technical and socio-cultural contexts, it cannot be resolved in a single step. In order to achieve the right balance in a specific context, successive iterations are required to engage the participants in actions and reflections that enable them to learn from each other in order to achieve shared solutions to design problems.

In the earliest examples of participatory design work involving metal and print workers [20,75] there was a direct relationship between the user and the end design as the participants in the design activities were the actual workers (or a subset of the actual workers). They were the ones who were going to use the systems being designed and thus the process was in the most literal sense inclusive and empowering. As advances in computer technology have led to its expansion beyond the workplace and into virtually every aspect of daily life, the practice of participatory design has also expanded. Thus, practitioners have been gradually adapting its principles to the demands of domestic environments and public spaces, to the requirements of specific domains - such as education and entertainment - and to the needs of specific user groups - such as human children and older humans, and even non-human animals.

More fundamentally, advances in computing technology have effectively changed the nature of participation. Rather than engaging the very population for whom the technology is intended (i.e. the workers who will be using the technology to do their work in their workplace), participatory practices now engage potential end users from a target population who may or may not have a recognised need for the technology that is being developed (e.g. potential customers). As Sanders and Stappers [69, p.8] note how "*the design process, as it is practiced today, is focused more on the exploration and identification of presumably positive future opportunities than it is on the identification and amelioration of adverse consequences*". From this perspective, the tendency is to think of users in more stereotypical and abstract terms, typically around personas of adult humans with typical capacities. But what if users are not adults and not humans? Surely, where user characteristics diverge from stereotypical representations, there is a greater need to engage more directly. Thus, fundamental questions arise about the possibility of PD with such users:

• How do we enable participation where the possibility for (verbal) communication is limited or impossible?

• How do we actively engage and empower participants with disparate cognitive, sensory and physical capabilities?

• How do we identify and balance inclusion and power asymmetries that derive from capability differences and communication barriers?

These questions are key for both CCI and ACI, and have been the subject of inquiry and debate in these fields for some time, with parallels between the two fields being drawn more recently [35,13]. In the sections below we unpack related challenges faced by CCI and ACI researchers and approaches they take to address these.

PARTICIPATORY DESIGN WITH CHILDREN: CCI

Child–Computer Interaction (CCI) [63,61,16,37], like Participatory design, grew out of the introduction of computers into children "workplaces", i.e. schools, in the form of applications, such as the Mindstorm programming environment [57], and has evolved alongside the incorporation of computer technology into every aspect of daily life.

Children pose a difficult challenge with regards to participatory design: on the one hand, they are individual human beings with their own thoughts and desires, and thus ought to be empowered with a voice in the design of technology intended for them; on the other hand, they are not mature individuals and depend on adults for their well-being and care. Also, depending on their individual rate of cognitive and social development, they will have difficulties in conceiving, articulating and communicating their desires and design ideas. As a result, there is an inherently unequal power relationship between adults and children, making it challenging to find a balance between the influence of adult designers and child partners. Practitioners of participatory design with children need to account for, not only the culture, norms, complexities and preference characterising any particular group of participants, but also their cognitive, attention and communication abilities, and their tendency to treat adults as authority figures.

With a few exceptions [7,32,6,73], the majority of the work in CCI has been conducted with children between the ages of 4-12. By the age of 4 typically children have developed the ability to speak in detailed sentences and can distinguish reality from fantasy; from the age of 12 onwards they possess the ability to reason abstractly and think in hypothetical terms, and thus are akin to adults in cognitive terms [58,70].

To work with children, the CCI community has adapted the activities used when engaging adults in the design process to the needs, attention span and cognitive abilities of children in different age groups by:

• controlling, often through reduction, the amount of time, writing and reflection involved in an activity,

• increasing the amount of exploratory activities and the level of structure, guidance and facilitation employed during the activity,

• conducting the activities in a setting that would be familiar to the child (e.g. living room, playroom), while using a 'simplified' vocabulary and a form of interaction (e.g. sitting on the floor) that strives to place all participants at the same level.

As a general rule, the younger the children the more structured and facilitated the activity, and the more focused on experience and imagination (as opposed to logic and abstract thought) to fit with the cognitive and communication abilities of the children involved. However, as Malinverni *et al*. [49] note, this is a delicate balancing act that "*cannot be simplified to reducing the contributions of children to some very limited and discrete aspects*", as this would, not only reduce their willingness to participate, but would also limit the scope of their contribution, and thus their voice within the design process. Designing solutions with the participation of children who experience communication and cognitive development challenges involves additional challenges, as discussed by Benton and Johnson [8], Ibrahim, *et al.* [38], and Spiel, *et al.* [74].

Druin [18] has suggested four ways in which children can contribute to the design process: *indirect* (being observed while using technology or a prototype); *feedback* (providing feedback on the use of a particular technology or prototype); *dialogue* (engaging in a discussion about an idea or a prototype); *elaboration* (elaborating on an idea or a prototype). These contributions can be made via design activities in which the child plays one or both of the following broadly defined roles[1]:

User/Tester. The ways in which a child uses and interacts with a particular bit of technology is observed and potentially also discussed with the child or a care giver. The distinction between a user and a tester is usually based on the state of the technological artefact in question with user inquiries usually centered around technologies that already exist or are about to be released to the market and tester inquiries centered around low or high-fidelity prototypes in various stages of development. As users or testers, children do not have the ability to engage in a creative practice as part of the design process and are thus restricted to being observed using or providing feedback on artefacts and ideas created by others. However, their creativity or frustration in interacting

[1]For a more fine-grained classification and further references see Table 1 in Iversen, *et al* [39].

with the artefacts and the dialogues that may ensue from these interactions can be highly informative and thus can play a crucial part in propelling the design process forward.

Informant/Design Partner. A child, either individually or as part of a group, is engaged in design activities which can take many forms but often include a variation or a combination of the following techniques:

- semi-structured playful explorations, with a variety of art and craft materials, to create a storyboard of a design idea or a low fidelity prototype that reflects the ideas of individual children [17,28], individually or by mixing the ideas of a group of children [27]
- role play activities in which the children act out a role set within a fictional narrative, such as talking to a Martian [14], or use a box of magic objects sent by the king of Atlantis [15] to express their ideas and experiences from their daily lives; the role play, not only provides a fun activity that will engage the children, but also provides the means through which they can subvert established conventions and expectations and explore novel thoughts and radical ideas
- using story telling techniques to provide a mechanism through which children can relate their ideas or experiences, as in KidReporter [2], where children participated in making a newspaper about a zoo as a form of requirements gathering for an educational game; or comicboarding [55], where a partially filled comic strip is used to provide the children with a known structure and a narrative direction through which they can present their own ideas
- in cases where a long-term relationship with the children exists [43,82] and where the children are mature enough, they may be trained to engage in various techniques such as journal writing, photo journalism and even contextual interviews with other children, as a part of the design process [41,76].

The nature of these roles has been a matter of considerable debate, particularly due to the interpretive nature of working with children [21,62]. As Frauenberger, *et al.* [22] report, regardless of their prescribed role, a child may advance the design and be a design partner when they "*directly or indirectly provided the researchers [with] a window into their life-worlds*".

How the participation of children in these roles actually contributes to the realization of a solution at the end of the design process has also been a matter of considerable debate, not only given translate and often filter the contributions of children, but also due to the inherent power and role disparities between the child participants and the adult designers.

Read *et al.* [60] classified child participation into the following categories: *informant design* (in which design decisions are made by adults but children are provided with an opportunity to inform the design); *balanced design* (in which the decision making is shared between the children and the adults); and *facilitated design* (in which the children make the decisions and the adults act as facilitators in realizing the designs).

In their respective reviews of the current CCI literature, Landoni, *et al.* [44] and Barendregt, *et al.* [3] note that in many projects the participation of children was restricted to a particular phase of the design process, most commonly the ideation and testing phases, and only rarely were they actively engaged in the entire process. Furthermore, Barendregt, *et al.* [3] note that in some projects different groups of children were engaged at different stages of the project and that their participation was restricted to the "*crowdsourcing of ideas*", as Read, *et al*. [62] put it.

Notwithstanding these variations, Iversen, *et al.* [39] note that "*PD is now considered mainstream—and, arguably, has almost become a trademark of* [Interaction Design and Children (IDC)] *research*", and that along the many different interpretations there is a genuine effort to broaden the perspective of the designers and increase the involvement of children. These same efforts are characterising much work within the ACI community, in the face of obvious additional challenges.

PARTICIPATORY DESIGN WITH ANIMALS: ACI

For decades, animals have interacted with technology in open fields [68], laboratories [72], farms [66], zoos [79] and homes [52], often regarded as resources and instruments supporting the functioning of socio-economic systems rather than legitimate stakeholders. However, in recent years researchers have been endeavouring to investigate these interactions from an animal-centred perspective [51]. Indeed, Animal-Computer Interaction (ACI) aims to re-frame the interaction between animals and technology, through the design of user-centered interactive systems for animals, which can improve their welfare, support their activities and foster inter-species relations; and, crucially, through the development of animal-centered methods, which can enable animals to participate in the design process as legitimate stakeholders and contributors [54]. In this regard, the challenges faced by CCI researchers and practitioners are amplified manifolds in ACI research and practice, due to the staggering diversity of potential nonhuman animal users and design participants.

To begin with, the huge variety of animal species potentially involved implies an equally significant diversity of sensory, physical and cognitive capabilities, as well as a diversity of activities in which different species are engaged, and of environments in which these activities take place; not to mention individual differences that exist among members of many species, particularly more complex ones, depending on factors such as genetic heritage, environmental conditions and developmental stage, all of which influence individuals' health and personality. For instance, bees and great apes possess very different sensory, physical and cognitive characteristics, form very different societies, live in very different environments and conduct very different activities; between the species of the more complex great apes, there are also very significant differences in social organization and behaviour [12], as well as significant differences between individuals [78].

On top of such evolutionary variations, animals' characteristics, activities and environments are largely influenced by human activity, the roles that animals play within humans' socio-economic systems and the associated conditions in which animals live and operate. For instance, there are significant differences between the environment in which many free living and captive wild animals (e.g. felids [42]) live and the extent to which they can express their capabilities. Similarly, the living conditions and opportunities for expressing species-specific and individual capabilities afforded to domesticated farmed or working animals (e.g. pigs, horses, dogs) tend to differ significantly from those afforded to their companion counterparts. Furthermore, society's cultural ambivalence towards nonhuman animals results in significant differences in the way in which humans regard and relate to other animals, beyond existing legal frameworks. For example, regardless of the fact that, in the legal systems of many countries, dogs (and other animals) are considered property [45], many dogs' legal guardians regard them as family members [53], consistent with the affective value their animals have for them and in stark contrast with the limited legal protections the animals benefit from compared to human family members.

Such diversity poses major challenges for ACI researchers. For one thing, as with very young children, the inability of human and nonhuman interlocutors to use symbolic languages makes it very difficult (if not impossible) to exchange complex abstract concepts and gain insight into one another's psychological constructs. For another thing, ACI researchers cannot assume to share commonalities with their participants, which they might be able to assume when designing with young children, on the grounds that they belong to the same species and that they have been through the same developmental stages. Thus, most ACI researchers are acutely aware of the distance that exists between them and the participants they aspire to work with, but at the same time they know they need to seek ways of bridging a seemingly irreducible gap.

To address these challenges, ACI teams tend to include researchers and practitioners who have expert species-specific knowledge, as well as individual-specific knowledge, of nonhuman animal stakeholders [26,65,77,79]. But, while species and context-specific knowledge can help researchers identify fundamental requirements related to an animal's known capabilities (e.g. that the visual elements of a canine interface should take into account dogs' dichromatic vision), less obvious usability and user experience requirements may be far more difficult to identify without direct input from the animals in question [24,71]. In this regard, aside from, or in addition to, involving animals by proxy through their care-takers [53], researchers have taken different approaches to enable animals to partake in the design process, including through free exploration [33], play [59, 80] or training [11]. These approaches to participatory research with animals vary in terms of activity structure and engagement modality, from research set-ups entailing unstructured activities with which animals can engage entirely freely and fluidly with no interference from human participants or researchers (i.e. free exploration) [33], to set-ups in which animals are invited to engage in structured activities according to specific modalities with the guidance of human participants or researchers [11]. From a pragmatic point of view, different set-ups seem to facilitate the emergence of different kinds of contribution, arguably corresponding to Druin's categories described above (*indirect, feedback, dialogue, elaboration*), in spite of the fact that nonhuman stakeholders are involved.

On the one hand of the spectrum, for example, Hirskyi-Douglas and colleagues conducted studies that explored dogs' interest in and ability to trigger audio-visual media. Having received no training for the purposes of the study, the dogs were allowed to move freely around a familiar room, in which bedding, water and toys had been arranged. In one study [34], at any time and with no prompt, the dogs could choose to pay attention to different media playing on screens located on one side of the room; while in another study [33], the dogs could trigger the media by moving closely in front of a screen. By letting the dogs entirely free to engage on their own terms, this research set-up allowed the authors to measure the dogs' spontaneous behaviour towards and preference for the audio-visual stimulus, and to conclude that the dogs were not particularly interested in media, but overall had a marginal preference for content featuring other dogs [34]. In this set-up the dogs made contributions seemingly akin to those described by Druin [18] as *indirect*. However, the effectiveness of the dogs' *feedback* was arguably limited by the fact that, when it came to understanding whether and how dogs might want to interact with media content, the openness of the research set-up made it hard for the authors to establish whether the dogs were aware that their movements controlled the media and whether the triggering of the media was deliberate [33].

A different understanding of participatory design with animals is exemplified by the work of Westerlaken and Gualeni [80]. Informed by Haraway's notion of becoming with [30], in the authors' work the interaction between human researchers and animal participants is central to defining multispecies participatory spaces and human influence is an element of a multispecies participatory game. In a recent study presented by the authors, human researchers and canine participants were allowed to interact freely and fluidly with and around objects designed for play. The interaction around the playful objects informed the evolution of the objects' design over successive iterations and, at the same time, the participants' interaction evolved along with the objects' design. While the study did not impose pre-defined goals on the participants, the influence of the humans was instrumental in stimulating the dogs' response and in influencing the design process, through a kind of open-ended physical conversation. Through the ongoing interaction with the human researchers, arguably this approach enabled the dogs to make *dialogue* contributions [18], although the interaction's openness might have limited their clarity; it also arguably facilitated *elaboration* contributions, for example, by allowing the dogs to engage with the evolving artefacts in unexpected and suggestive ways.

In a previous study, Robinson et al [65] had applied this kind of conversational approach to participatory design with animals within a more structured process, whose specific aim was eliciting design requirements for a canine alarm that would be used by medical alert dogs to call for help on behalf of their assisted humans. The dogs were invited to engage with different permutations of a modular low-fidelity prototype featuring interchangeable components. This allowed the researchers to offer the dogs different prototypes in rapid succession in order to probe the dogs' willingness to interact with each prototype and understand their interaction preferences. The study took place within the context of relatively fluid training sessions, in which medical alert dogs, their trainers and the researchers took part. Although the sessions were structured according to standard training protocols and the interaction with the prototypes was somewhat predefined, the dogs were able to express preferences that directly informed the design of a canine-friendly high-fidelity prototype [64]. Thus, they arguably made *feedback* and *dialogue* contributions, facilitated by the semi-structured interaction with a range of prototype solutions.

A more decidedly structured approach is to be found in work by Byrne et al. [11], who developed a training protocol for the evaluation of dogs' interactions with wearable haptic interfaces allowing handlers to communicate with the dogs at a distance. The protocol applied detailed measures of performance to assess the usability of the interfaces the dogs were being trained to respond to and determine individual requirements for the haptic stimulus. In particular, the dogs were required to complete a simple task (i.e. nudge or foot target an object in front of them) upon perceiving a haptic cue, which different dogs did at different frequencies. To determine the reliability of each dog's response to cues, the dogs were first trained to respond to a cue from the handler and their performance was assessed against specific measures (e.g., how many times the handler needed to cue the dog, how many times the dog did not respond to a cue, how many times the dogs targeted without being cued). This subsequently allowed the authors to precisely assess the dogs' sensitivity to the haptic stimulus and identify the most appropriate frequency for each individual. Here, a structured experimental protocol made the dogs' *feedback* contributions clear, although arguably the scope for *dialogue* was limited by the narrow focus on a specific design aspect.

In other words, with reference to Druin [18]'s categories, research set-ups that are very open and in which animals are left to their own devices might enable animal partakers to make *indirect* contributions; set-ups in which researchers and animals interact in a fluid or semi-structured way through evolving design solutions might enable the latter to make *dialogue* and possibly even *elaboration* contributions; and set-ups in which partakers' interactions are very structured and focussed on specific design aspects might better enable them to make *feedback* contributions. However, Druin [18]'s contribution categories seem to invariably imply the ability of all partakers to communicate (and understand one another) through the use of natural language. So, can animal partakers be regarded as capable of making the kinds of participative contribution defined by Druin?

ACI researchers have been debating the extent to which any of the engagement modalities described above actually constitute participatory design or would be better described as 'usability studies with animals'. Some have even questioned whether animals can be legitimately regarded as users, let alone design participants, or are indeed relegated to the role of usees [5]. In particular, Lawson et al. [46] have argued that animals' inability to speak makes it impossible for them to fully articulate their needs, propose ideas or raise concerns, thus preventing them from representing themselves during the design process. For the authors, without the power of speech, animals are unable to express their perspective, for example by denying anthropomorphic projections or resisting anthropocentric prejudices, and influence design decisions in a way that would qualify them as participants.

Hirskyi-Douglas et al [36] have taken a less radical position, admitting that animals might qualify as design participants, provided that they were allowed to interact with and make sense of technological artefacts entirely on their own terms. Informed by Hart's Ladder of Participation [29], the authors' Doggy Ladder of Participation placed hypothetical design practices, in which dogs would be able to understand the activities they participate in and initiate design decisions that directly influence design outcomes, at the top rang. On the other hand, practices such as training, in which dogs' understanding of the activities they were involved in would be merely based on the association between their actions and the rewards they receive, were placed at the bottom rang and deemed non-participatory.

In response to both the above positions, Mancini and Lehtonen [50] have argued how participatory models demanding that human designers and nonhuman animal participants share the same understandings of and goals for design activities are fundamentally anthropomorphic. For the authors, such models inevitably underpin discourses and practices that dismiss and ultimately exclude the participatory contributions of agents who do not possess the capabilities to enter what the authors describe as symbolic, deferred, abstract conversations. They point out how more-than-human participatory researchers [4] embrace a broader view of participation whereby both human and nonhuman agents are involved in the co-production of the shared worlds in which they live and operate. Thus, Mancini and Lehtonen [50] highlight the need for a broader and more inclusive participatory model that could adequately support ACI research by accounting for the diversity of multispecies participants and their diverse contributions to the design process. The question then arises as to what this broader and more inclusive participatory model might look like.

PD AS EMBODIED DIALOGUE

Advocating the development of more inclusive participatory design models, Mancini and Lehtonen [50] questioned the legitimacy of the constraint that design participants must share or pursue shared understandings of and goals for the design process they are involved in. The authors argued that, regardless of their capacities, participants engage with the design process based on their own understandings of the design context and activities, and motivated by their own goals; and it is through the interaction with other stakeholders that understandings develops and goals are pursued. For the authors, what determines the possibility for participatory design with (human and nonhuman) animals is not whether partakers can express their own, or access one another's, psychological constructs through symbolic exchanges; rather, it is whether research set-ups are configured to support the embodied dialogues through which meanings can be exchanged and outcomes can be negotiated. In this regard, as the authors point out, even structured and relatively constrained activities such as formal training, often practiced in ACI research to show animal participants how to interact with artefacts and to elicit their design preferences, can be regarded as participatory. Similarly, we argue, role play methods and scaffolding approaches, such as comic-boarding [55], employed in CCI research to help children relate to the problem domain and express their ideas, can be regarded as forms of training that are themselves inherently participatory. These methods structure and direct children's engagement with a problem domain, at the same time inviting them to respond and enabling them to engage through their very scaffolding and somewhat constraining function.

Combining classical and operant conditioning [72], training is based on participants' capacity to establish associations between co-occurring events. These associative mechanisms enable participants to make and exchange meaning with one another. At the same time, participants' engagement is underpinned by fundamental drives (such as self-preservation) and contextual motivations (such as internal and external stimuli) resulting both from evolution and previous learning [1]. Mancini and Lehtonen [50] point out how participants actively interpret and respond to one another through the filter of their own drives and motivations, and conditioning is only possible if contextual stimuli are sufficiently relevant to their drives and motivations, and if the rewards are sufficient to justify the effort required to respond. Of course, affording participants the ability to make choices as to whether and how to engage, and what to do under what conditions, is essential. In this regard, the authors argue that the characteristics of research set-ups are key in facilitating participatory engagement through embodied dialogue, in an open-ended process of progressive orientation through iterative cycles. Such orientation process can happen where research set-ups afford participants sufficient space to respond, but does not take place in a void of infinite possibilities [50].

This notion has been discussed by various researchers in different domains, particularly by Eckert [19], in the context of architecture and industrial design, and by Makhaeva et al. [48] in the context of CCI. The authors use the German term *handlungsspielraum* (*handlung* = action; *spiel* = play/game; *raum* = space/range [19]) in which spiel refers both to the 'playing of a game' or to the 'little space that allows a mechanism to move (e.g. a bolt has a little play)' [19]. For Makhaeva et al. [48] the concept encapsulates a design approach that allows them to: 1) plan and configure structures and freedoms that are tailored to individual participants or groups; 2) explore individual pathways during the design activity by continuously managing the balance between structure and freedom, thus allowing participants to stay in the flow; 3) reflect upon and analyse both the structures and freedoms that were tailored into a session and the ways in which the participant(s) navigated through and employed these structures and freedoms in order to inform the planning process for subsequent sessions.

Mancini and Lehtonen [50] define participatory spaces along four dimensions: 1) *biological salience*, whereby settings and procedures should offer participants something each of them want (this would not need to be the same for all but it would need to be salient for each); 2) *signal reliability*, whereby the timing and consistency of associations between the events occurring during an exchange should enable participants to make (their own) sense of the context in which they operate; 3) *engagement options*, which would be essential in enabling participants to express choices and thus influence the design process (albeit necessarily limited, should be sufficient to orientate the design process through successive iterations); 4) *contingency variation*, whereby variations along the above dimensions (e.g. increasing or decreasing engagement options or the biological salience of a reward) could help explore different thresholds (e.g. levels of difficulty, possibilities for interaction).

Along these dimensions, research set-ups might vary depending on what particular aspect of a design problem is being investigated. In this respect, the work by Hirskyi-Douglas at al [34], Westerlaken and Gualeni [80], Robinson et al [65] and Byrne et al [11] discussed above exemplifies different participatory modalities, each of which addresses a specific design question. For example, in Hirskyi-Douglas at al.'s set-up [34], what was under investigation was the very biological salience of the audio-visual stimuli that participating dogs were presented with. This required that no other biologically salient rewards be offered in order not to interfere with the dogs' spontaneous response; at the same time, it required that the dogs be allowed to engage or disengage at leisure with no direction on the part of the designers. In such a scenario the reliability of signals coming from the designers during the procedure was not an issue, since they abstained from interacting with the dogs; similarly, other than the audio-visual stimuli and their presentation, no other contingency needed to vary. On the other end of the spectrum, in Byrne et al.'s set-up [11], what was under investigation was the dogs' sensitivity threshold, so that the haptic interfaces under evaluation could be designed accordingly. This required a detailed engagement protocol, enabling the designers to communicate to the dogs the question they wanted to ask them and to enable the dogs to communicate the answer back to them. In this protocol, the delivery of biologically salient rewards was used as a communication tool; at the same time, the designers' signals to the dogs needed to be highly reliable and the engagement options needed to be focussed on a specific task. Finally, the contingency that needed to vary was precisely the haptic stimulus, but it was imperative that every other contingency remain constant.

In other words, Mancini and Lethonen [50]'s framework for defining participatory research set-ups provides a broader and more fundamental definition of participation as embodied 'D'ialogue, encompassing a range of participant contributions (including those described by Druin's [18] dimensions). For instance, Hirskyi-Douglas et al. [34] and Byrne et al. [11] research set-ups differed significantly. However, in both scenarios, regardless of the fact that the human researchers initiated the design process, formulated the research questions and assembled the required experimental apparatuses, the dogs' engagement with and response to the specific activities and context ultimately provided embodied answers to embodied questions. Ultimately, the dogs' answers, as understood by the researchers, directed the design process. Modulated along the dimensions of biological salience, signal reliability, engagement options and contingency variation, those embodied dialogues expressed the *indexical form* and the *emerging nature* of multispecies participatory design [50]. While not providing the reassurance afforded by symbolic communication, the participatory function of such embodied dialogues cannot simply be dismissed. The key question is whether we are prepared to give such dialogues legitimacy. This is arguably a political question, which is likely to remain a point of contention.

PD AS ENACTED POLITICAL DISCOURSE

As discussed above, PD is a 'D'ialogue between various stakeholders engaged in a design process. As a dialogue, PD is essentially political, since its aim is to build a common polis (Greek for city), a co-constructed discourse embodied in the designed environment, which governs the lives of those who are able to place their stake within its confines (its stakeholders) both literally and figuratively. The Oxford dictionary defines politics as "*the activities associated with the governance of a country or area, especially the debate between parties having power*" [47]. In other words, politics involves ongoing negotiation and the adoption of concrete interim solutions that inform the environment (physical and otherwise) in which communities live and operate. In this regard, arguably all design is inherently political, with PD advocating for extending the negotiation and broadening the discourse based on an egalitarian ideology. Indeed, PD's original thrust was political, as designers set out to address inequalities in the workplace.

Regardless of their objectives, as discussed above, dialogues do not occur in a vacuum but themselves are enacted within the confines in which participants operate and, in this sense, both inform and are informed by the physical and legal environment in which participants operate. While PD's original thrust was an egalitarian political ideology with a long-standing history, its appearance in the 1970s was not coincidental; as mentioned earlier, it co-occurred with the enactment of labour laws specifically aimed at addressing workplace imbalances between workers and employers. The point of origin was thus important as it provided initial impetus, not only to find design solutions for the problems at hand, but also to develop a new design philosophy. Indeed, PD in the workplace represented the culmination of a long history of labour struggles. These were themselves enacted on top of a political struggle that sought to grant a vote (a say) to all adult citizens, as opposed to just land owners or males, as was the custom since the days of the Greek Polis. Thus, although PD was faced with the challenge of addressing inequalities in the workplace, that dialogue was enacted within an environment that saw all stakeholders as equal in the eyes of the law. This is not true for either children or animals as, although they are granted certain protections under the law, in the eyes of the law they are legal dependents, in the case of children, or property, in the case of animals, with all the biases and inequalities that come with such dependency and subordination.

In this respect, giving children and non-human animals a 'voice' in the design dialogue is essentially a political challenge. Certainly, the child or animal participant's inability to communicate or articulate their desires, thoughts and ideas to other stake holders through natural language is a major obstacle. However, more fundamentally, extending participation to social groups such as children and nonhuman animals subverts age old social constructs and power structures (e.g. the parent or teacher knows best so why ask the child, as Druin [18] notes), including the enacted privilege of legal guardians to shape and determine the destiny of the children and/or non-human animals under their care. For non-human animals this is a particularly pertinent issue, as the stakes are high for the likes of those who are destined to become steaks. This forces us to confront the fundamental contradictions inherent in the idea of enabling someone to participate as an equal in the design of technologies that will form a part of their own demise. In this regard, extending participatory design to these social groups forces us to question the very political constructs and power structures that underpin our socio-economic systems.

At the same time, the way in which human socio-economic systems are changing how we live and operate, and the impact of our species on the planet, make the development of more participatory models both a social and an ecological necessity. For one thing, the pervasiveness of computing technology and the rise of companies like Uber, Amazon, Facebook and Google, with their novel ways of conducting business and their massive information repositories, is transforming the means of production and the nature of work, market, public and communication places. For another thing, the effects of large-scale industrialization and urbanization on the environment are becoming increasingly evident in the form of global warming and other phenomena. The virtual nature of these work, market, public and communication places, and the new expectations and imbalances they bring with them highlight the inherent dependencies that exist between parties such as worker and employer, consumer and producer, state and citizen and parent and child; they also put the spotlight on the distance from which we (fail to) relate to and treat the natural environment and the non-human living beings who inhabit the planet, whether in co-habitation with us or in the wild.

PD was enacted at the cusp of the mechanical era on humanistic post-modern ideals that opposed the notion of the primacy of the designer as an agent of the "client" (the socio-economic entity that pays the fees); it saw the designer as an agent of mediation and change, entrusted with the promotion of individual agency, while balancing the objectives and ideas of all the stakeholders in the design process. In an era in which virtual agents and virtual environments challenge our notions of the individual and individual agency, and in which the natural environment is making itself heard in alarming tones, it is perhaps time to challenge the notion of the primacy of the linguistic 'd'ialogue in design and its exclusionary implications on those who do not (yet) possess the power of linguistic communication, and to seek more inclusive forms and definitions of 'D'ialogue. It is perhaps time to consider the designer not only as an agent of design, contributing design expertise, but also as an agent of agency, enabling those without a voice - in the literal as well as figurative sense - to take part in design's enacted dialogue.

P FOR POLITICS AND D FOR DIALOGUE

The thread that weaves through both CCI and ACI, and that grounds our choice to examine issues related to PD in these domains, is their expressed aim to empower those at the margins of political discourse and on the lower rungs of society's power structures. PD does this by giving these actors representation and the space to influence design processes and outcomes through embodied dialogues that are woven on a canvas of freedoms and constraints, of structures and fluidities. Within these dialogues, meaning is not (necessarily) exchanged, handed over, through abstract symbolism, but it is co-constructed, incrementally achieved, through embodied interaction. These dialogues need not be verbal and need not exclude those who do not rely on natural language to communicate. As the raison d'être of PD was and still is inclusivity, the yardstick by which we develop and judge our designs should be the extent of our commitment to ensuring that the intended users of a technology have a voice, a say and a direct influence on the design process and its outcome. The inability of human or non-human animals to express themselves symbolically should be seen as a challenge to be dealt with rather than an insurmountable barrier that precludes participation.

By defining participation as engagement in embodied dialogue we do not refer to the material interaction that a sculptor might have with the grain of a stone, or a tailor with the flow of a fabric. This is exactly the type of one-sided information flow PD advocates against; users are not material to be shaped or consumers to merely be catered for. Instead, participatory dialogues should enable participants to engage in and co-construct some form of discourse, be it through linguistic symbols or embodied interactions, or any other form of constructive exchange, which contributes to mutual learning and thus propels the design process forward towards the eventual co-realization of an interim solution.

We see this expanded view of PD as a response to the original call to arms of PD, whereby dialogue was not only between workers and employers, but also between practices. As Ehn [20, p.7] puts it, in his reflections on the early days of PD design, it is about "*The dialectics of tradition and transcendence*", i.e. it is about understanding and, where necessary, preserving tradition but also transcending the very limitations imposed by tradition, technology or environment.

We further see this projection of PD as distinct from a merely user-centered (empathic) approach, as the aim is not to simply be conscious of and design for the needs and desires of children or non-human animals, as though we could 'get into their head'. Rather, the aim is to enable these participants to engage in a dialogue that will allow them to contribute to the design process, through the possibilities and limitations of their capabilities, as well as the freedoms and constraints of the research set-ups within which they engage, and thus to propel the design process forward.

CONCLUDING REMARKS

In this paper we have explored some of the similarities between ACI and CCI both in the methods they use and the challenges they face. We believe this is important not only as a means for each community to reflect on its own practices and learn from the experience of others, but also as a starting point for further explorations and mapping of the landscape for possibilities (and presumed impossibilities) with regards to extending the role, range and forms of participation in PD.

Design (participatory or otherwise) is all about purpose as opposed to art or philosophy which arguably are mainly concerned with exploration and meaning. Thus, the objective of a design process is not to understand "*what is it like to be a bat*" [56] (or a child) but to design an element (be it an artefact or a process) that will support a specific aspect of a bat's life. In this regard, the objective of PD is to involve bats in the design process both as a political acknowledgment that bats should have a say in the design of technologies intended for their use and as a means of avoiding batty designs that are based on pure suppositions on the life and needs of bats.

We argue that PD is not about using a common language through which a shared understanding could be reached, as such an understanding is embedded in layers of context and experience which cannot be shared; indeed, as Wittgenstein [81, p. 225] has argued, "*if a lion could speak, we still could not understand him*". Instead, PD is about establishing a dialogue (by whatever means) between the designer and the lion, bat or child, through which an interim design solution can be reached that makes some sense (their own sense) for each participant. Although such dialogues are interpretive by nature, they are not a monologue through which the designer asserts their ideas.

Recently there has been a renewed call [9,23,40,67] for PD to regain its political zeal as a means to address the many environmental and societal challenges we face. These are brought about by our extensive reliance on physical technology and infrastructure, and on virtual social and economic networks, impacting on very significant issues such as climate change and environmental degradation, threatening privacy and freedom of choice, altering employer and consumer relationship, and affecting humans and all other beings we share the Earth with.

By engaging with very young humans and with nonhumans, the CCI and, even more so, the ACI community place themselves at the cutting edge of PD. Thus, they have the opportunity, and the responsibility, to be the dramaturges who open the stage to all manner of actors so that we can all become protagonists in the dialogic co-construction of a shared future. As the UTOPIA project [75] has shown, this need not be a utopian idea but one that is possible and important to implement.

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