Applying Children's Rights to Digital Products: Exploring Competing Priorities in Design

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Despite efforts to promote children's rights in digital environments, a gap remains between principles and practice. To understand this gap and identify possible solutions, we examine whether and how designers embed children's rights when developing digital products and services. Using the child-rights-informed 'Playful by Design' (PbD) principles and associated card pack as discussion probes in workshops with 30 designers from diverse companies, we identify designers' understanding of children's rights, their workplace requirements for implementing these, and competing professional and commercial priorities faced in designing for children's play. Findings reveal the challenges of embedding rights-based principles in product design, given also the importance of child development. Designers may believe that children's rights are sufficiently realised by protecting children from risk, without ensuring their rights to provision and participation. Further, given the competing demands of commercial design settings, designers require a compelling rationale for and a practical means of implementing children's rights.

CCS Concepts: • **Human-centered computing → Interaction design theory, concepts and paradigms**.

Additional Key Words and Phrases: Child Rights, Children, Technology Design, Digital Play, Design Tool

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1 INTRODUCTION

There is increasing recognition of the value of rights-based principles in guiding the design of digital products and services likely to be used by children, along with growing efforts to create policy frameworks for realising children's rights that can mitigate risks to children's safety [17, 58], security [15], privacy [10, 27], healthy development and wellbeing [1, 18, 36] and other rights [3, 50]. However, a gap between principles and practice remains. Even when the design of digital products seeks to prioritise free play or 'playfulness', for example, it can unintentionally fuel the biases, risks or other rights violations that fill media headlines and undermine public trust in technology [32]. Business values centred on profit can result in technology that is, in effect, 'risky by design' [19, 20], even though certain problematic

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design practices are already prohibited under international (and some national) law [49]. These include practices that infringe on children's rights through the use of exploitative design features or business practices that can put children at risk, such as 'dark patterns' or tricky user interfaces [25, 47], loot boxes [11, 66] or algorithms that promote extreme content [19, 60]. Three kinds of adverse consequences can be anticipated: (1) harm to the safety, development and wellbeing of children as individuals and collectively [35, 52]; 2) unfair or exploitative practices that infringe privacy, safety and data protection regulations [61]; and 3) inefficient business models that risk brand reputation and undermine consumer trust [34].

To counter such risk consequences, Child–Computer Interaction (CCI) has emerged from an interest in technologies developed for use in education [5, 6, 53, 62] and is a well-established area of research within Human-Computer Interaction (HCI). It draws on theories of child development [22, 26, 56, 63], especially the constructionist approach, which positions computers and computing systems as tools to facilitate children's learning [51]. It also draws on Bronfenbrenner's ecological approach [7, 8], which contextualises children's unfolding interactions with objects (including products), people and places [57] by recognising the specific proximal and distal factors (including social and commercial actors, institutions and political/cultural influences) that operate systemically and dynamically to shape or constrain children's development over time. Such constructionist and ecological approaches, themselves complementary, are now being developed to investigate user engagement with digital devices or contents as well as the ways in which the broader digital environment influences children's specific contexts and possibilities for action [46, 55]. Together, these build a bridge between knowledge of technological design and use and theories of child development [22, 26, 56, 63], especially when enhanced by critical reflection on how industry norms and design practices may undermine this effort.

This article investigates the challenges that designers face and the resources they need in order to navigate the multiple and at times competing influences and pressures upon them so as to respect and realise children's rights in a digital world [49]. Specifically, we examine how designers from different types of companies interpret and apply children's rights in relation to the development of digital products and services. Focusing on the child's right to play, and building on the 'Playful by Design' (PbD) principles [42], we prototyped a card-based tool as a probe to help designers explore and reflect on their current practices in ways that could better align with children's rights. The aim was to explore the challenges of embedding children's rights in digital products and services that children use, thereby gaining insights to inform and motivate the development of rights-based yet practical design practices for the benefit of children, businesses and the public [38]. We conclude that such efforts are vital in order to respect, protect and fulfil children's rights, and thereby ensure their healthy development in a digital world.

2 BRIDGING CHILDREN'S RIGHTS AND DESIGN

2.1 Children's rights in the design of digital products and services

Defining a child as a person below the age of 18, the United Nations (UN) Convention on the Rights of the Child (UNCRC) [48], which applies to all children wherever they live, recognises 'the right of the child to rest and leisure, to engage in play and recreational activities appropriate to the age of the child and to participate freely in cultural life and the arts' (Article 31), among other 'provision' rights (such as those to education and cultural heritage, Articles 28-30). Further rights relevant to play include those regarding non-discrimination (Article 2) and best interests (Article 3(1)), rights to health (Article 24), and to life, survival and development (Article 6), the right to be heard (Article 12), to participation (civil rights and freedoms, Articles 13-15), and protection rights (notably the right to privacy, Article 16, and to safety from harm and exploitation, Articles 19, 34, 39). Importantly, this also includes treatment in accordance

with one's age and maturity (or 'evolving capacity', Article 5). While most of these rights are already included in international human rights law, those specific to children – the right to play, fullest development, information, best interests, and to parenting and support in accordance with their maturity – can be seen as distinctively important for child development.

This close relation between rights and development for children, and the benefit to individuals and society of supporting both, is particularly strong when development is conceptualised in ecological terms. As with a rights-based approach, such a holistic approach to child development goes beyond the mere absence of barriers or problems to encompass opportunities to achieve a good quality of life in both present and future [57, 59]. This approach can offer designers, especially those engaging in value- sensitive design, a holistic range of factors to consider when answering the question of what matters to children in their lives [21], including positive opportunities for children to flourish, and do so with recognition of their interdependency.

As explained in 2021 by the UN Committee on the Rights of the Child in its authoritative General comment No. 25 [49], these rights apply equally in the digital environment [32, 35]. How can this be achieved in practice? The process of designing digital products is often fluid, iterative and messy, involving considerable negotiation among competing influences and expectations. Designing digital products for, or likely to be used by, children can be even more complex because children have diverse needs relating to their development and lived circumstances, and because there is insufficient consensus on what 'good' looks like, for instance regarding children's play in the digital environment [8, 13]. Since the realisation of children's rights can be complex, context-dependent and contested, it is to be expected that embedding children's rights in the design of commercial digital products and services will prove challenging. Indeed, meeting such a design challenge in ways that encompass children's protection, provision and participation rights, rather than trading one of these off against another, can be considered a 'wicked problem' [9]. Yet there are increasing calls to succeed in meeting this challenge from policymakers, rights advocates, parents and children as well as from within the design community [44].

2.2 Playful by Design principles and children's rights

To realise children's right to play, among their other rights, we built on the 'Playful by Design' (PbD) principles [42]. Grounded in empirical research and consultation with children on how the design of physical and digital environments enable or impede the qualities of free (or, child led) play [13, 14], these principles accord with the classic works on child development theory[26, 56, 63] that have shaped good practice in CCI [5, 6, 22, 24, 31, 62] and child-centred design [4, 23, 28, 29, 33, 64]. The seven PbD principles, each of which references distinct children's rights [48], including those noted above as particular to children, are as follows:

(1) **Be welcoming**: Prioritise digital features that are inclusive, sociable and welcoming to all, reducing hateful communication and forms of exclusion, and reflecting multiple identities [48, Articles 2, 24, 30].
(2) **Enhance imagination**: Prioritise creative resources and imaginative, open-ended play over pre-determined pathways built on popularity metrics or driven by advertising or other commercial pressures [48, Articles 13-15, 17, 28-30, 31, 32].
(3) **Enable open-ended play**: Provide and enhance features that offer easy-to-use pathways, flexibility and variety, as these support children's agency and encourage imaginative, stimulating and open-ended play [48, Articles 12, 13-15, 31].

(4) **Adopt ethical commercial models**: Reduce compulsive features designed to prolong user engagement or cultivate dependency on games, apps or platforms so that children's immersive play is intrinsically motivated and freely chosen [48, Articles 3(1), 16, 24, 32, 36].
(5) **Ensure safety**: Ensure children's play in online spaces is safe, including giving them control over who can contact them and supplying help when needed [48, Articles 16, 17, 19, 24, 34-35, 37-40].
(6) **Allow for experimentation**: Recognise that exploration, invention and a degree of risk taking are important in children's play, and that the burden should not fall on them always to be cautious or anxious, or to follow the rules set by others [48, Articles 3(1), 28, 29, 31].
(7) **Be age appropriate**: Respect the needs of children of different ages by providing age-appropriate opportunities for play while also allowing for safe intergenerational play [48, Articles 5, 18, 29, 30, 31].

Each principle encompasses specific components derived from the underpinning research showing which qualities of play correlate with which design features [41]. For example, 'Be welcoming' includes reducing hateful communication as well as overcoming forms of exclusion (mapping onto rights of non-discrimination, mental health and cultural inclusion). Crucially, these principles should be implemented together rather than separately or piecemeal, since human rights cannot be ranked or traded off against each other [38, 43, 49]. Taken together, they offer a holistic approach that prioritises both 'hygiene' factors such as safety, security, privacy and freedom from commercial exploitation and also children's positive opportunities for agency, creativity, expression, sociality and learning through play, all of which are vital for healthy child development. In short, developing a pathway for designers to promote 'playful by design' and minimise 'risky by design' practices [20] ccould help bridge the gap between child rights and design. With this objective in mind, our research questions were:

- Q1. How do designers interpret and apply children's rights when developing digital products and services that children use?
- Q2. What challenges do designers face in embedding child rights principles in the development of digital products and services that children use?

3 METHODOLOGY

3.1 Phases of the research

We used the PbD principles to engage 30 designers in discussions of their practice when designing digital products and services. Subsequently, we developed an associated card-based tool to probe how they interpret and embed these principles and their underpinning in children's rights and to identify whether such tools can be helpful in their work. This research comprised three phases:

Phase I, exploratory workshops. We conducted four workshops online to explore digital designers' workflow, organisational requirements, and interpretation of the PbD principles. Participants attended the workshops with their teammates, choosing a product they had worked on together as a use case.

Phase II, prototyping a card-based design tool. We analysed findings from the exploratory workshops and used this information to prototype the type, prompts and mechanics of the card pack. The resulting prototype design tool comprised two types of cards: 'principle' (Fig. 1) and 'prompt' (Fig. 2) cards as well as prototype activities which became 'playboards' (Fig. 3). The cards and activities were then used in Phase III to examine how designers negotiate the competing priorities that can arise at different design stages.

Fig. 1. The seven 'principle' cards for Playful by Design

Each 'prompt' card asks a question to support reflective (Why?), exploratory (What if...?) and practical (How?) responses to design challenges (Fig. 2). The aim was to support designers in unpacking the issues and addressing the interplay across the social, material and spatial factors that shape playful possibilities in a digital world [13], consistent with children's rights and their underpinning in ecological approaches to child development [8]. Each type of prompt included 35 prompt questions, five for each of the seven principles, in order to provide sufficient options for diverse products and circumstances.

Phase III, final workshops. We conducted five workshops online in order to deepen our understanding of designers' practices, now using the prototype design tool (PbD cards and playboard activities) to probe further. In these workshops, some designers worked with their teammates and some with designers from different companies. For these workshops, we deployed two types of activities. The first used the PbD 'principle cards' to identify design priorities and challenges. The second activity used the prompt cards to support critical reflections and discussions.

In the first activity, we began by asking designers to compare their product with the PbD principles to identify the principles which they wished to interrogate as a team, using our prototype 'principle cards'. We observed participants arranging and using these cards in various ways, which we later converted into 'playboards' (Fig. 3). For example, they began to list the features of their products and their priorities against each of the seven PbD principles in order to explore alignment ('Check It' playboard). They also raised issues or challenges that they were currently experiencing

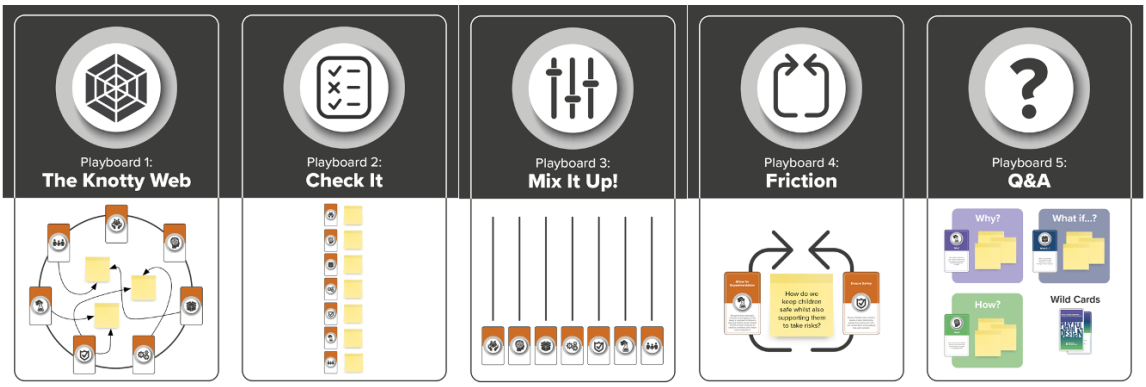

Fig. 2. Examples of playboard activities used to prompt and support discussions

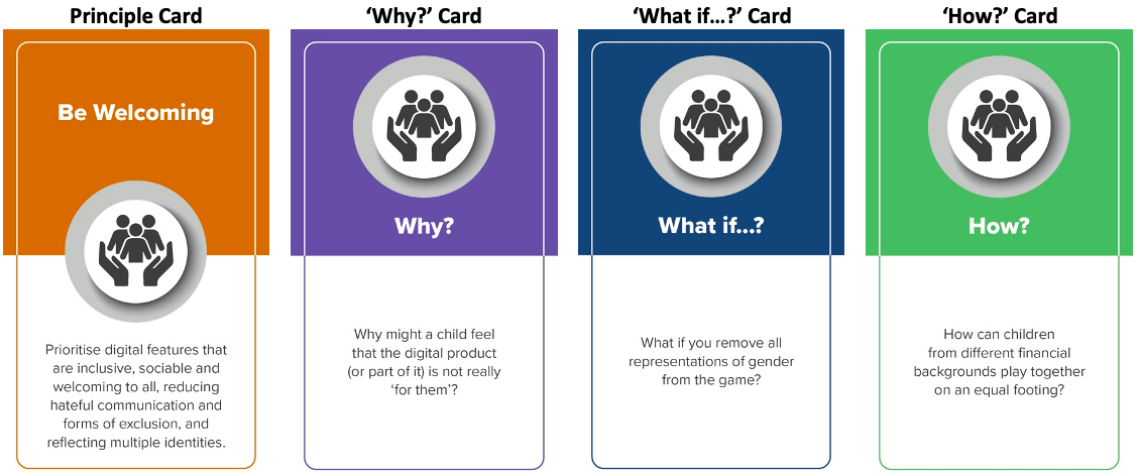

Fig. 3. Example of matched 'principle' and 'prompt' cards for the 'Be Welcoming' principle

and mapped these onto a range of principles in order to identify factors requiring attention ('Knotty Web' playboard). Two PbD principles which can cause tensions if addressed simultaneously in design were identified and discussed, contributing to a critical reflection on the product ('Friction' playboard). Lastly, participants applied the metaphor of a (music) 'mixer deck' in order to interrogate their priorities at different stages of the design process ('Mix it Up' playboard). This activity allowed participants to discover ways of reflecting on their design priorities, challenges and opportunities.

In the second activity, we used three types of questions – Why? What if? How? – as prompts to provoke designers to anticipate and consider the result of product features and design choices for children's experiences. These questions later became our 'prompt' cards. We asked the designers to select 'prompt' questions related to the PbD principles they chose (in the first exercise) in order to explore aspects of their product (using the icons on the 'principle' cards to find relevant 'prompt' cards). We conducted this activity as if running a Question and Answer session (Q and A playboard), with participants writing their responses on digital 'sticky notes'.

All workshops were held on Zoom. Each took three hours and was audio-recorded and transcribed, except for one exploratory workshop for which, following a participant's request, we took near-verbatim notes. This research has been approved by the ethics committee at the London School of Economics and Political Science.

We applied inductive thematic analysis to the transcripts, as research shows that this analytical approach is effective in answering research questions about practices and factors shaping an occurrence or behaviour, in this case, design practices [12]. As we analysed the transcripts, we identified themes which, according to Saldaña [54] describe designers' behaviours (what designers do) and values (what designers see as important to consider). In our first cycle of analysis of the workshop transcripts, we identified themes related to design activities, values, design processes and resources. In our second cycle of analysis, we categorised these descriptive themes according to the patterns of behaviours and thought processes we observed emerging across data sets and provided descriptive statements for these patterns [54].

3.2 Research participants

We recruited 19 designers from four companies for the Phase I workshops (see Table 1). Participants represented the toy industry and social media for children, children's educational games and children's media. Twenty designers joined the final workshops (Phase III), nine of whom had participated in Phase I, and 11 of whom were new to the research, to expand the range of products and companies included (see Table 2). These recruits included representation from safety tech developers, other educational games developers, independent toy and interaction designers, children's media content developers and digital education content providers.

Altogether, 30 designers participated, of whom 27 out of 30 worked in the UK and Europe, while three were based in North America or Southeast Asia. They were recruited through our networks of industry partners. Upon their registration of interest, we sent participants an email summarising the research objectives and detailing what their participation in our research would involve and asked them via email to consent to participating in the research, to the processing of their data and input and to the use of their input for publications. Where participants did not provide email consent, we audio-recorded their consent before proceeding with the research activities.

Table 1. Phase I workshop participants

Type of organisation	Type of products/services	Participant code
Company 1 – Start-up (UK)	Education game	P1 – P2
Company 2 – Large international company (100+ employees)	Children's social media	P3 – P6
Company 3 – Start-up (UK)	Education game	P7
Company 4 – Large publicly funded organisation (100+ employees) (UK)	Media and education content for children	P8 – P19

We ensured diversity and prevented bias by varying the size of companies, funding models, working contexts and product lines, as well as participants' seniority in the team and their roles, including interaction designers, graphic designers, toy and game designers, data scientists and product owners. The diversity of product lines allowed us to understand designers' requirements as they work across diverse product ranges, whether or not the products are intended for children.

3.3 Limitations

Participants were recruited through our existing networks of industry partners and therefore primarily worked in Europe, with some international expertise. Care should be taken in generalising the results more widely, whether to the USA (where many companies providing digital services for children are based) or to the global south, where distinct regulatory, economic and cultural factors may shape design contexts. In all contexts, regulations in particular are being introduced, including during the conduct of research, and designers are increasingly aware of ethical and rights considerations, so if this research was to be repeated in a few years the findings might be different.

This research did not directly include children or invite their views on product design, but the research that informed the Playful by Design principles had consulted children. In the first (exploratory) workshops, the participants variously referred to how they involved children and to the role children played in their own design processes, for example as

Table 2. Phase III workshop participants

Type of organisation	Type of products/services	Participant code
Company 1 – Start-up (UK)	Education game	P1
Company 2 – Large international company (100+ employees)	Children's social media	P3 – P5 and P30
Company 4 – Large publicly funded organisation (100+ employees) (UK)	Media and education content for children	P9 – P10, P17, P19, P23 – P24 and P29
Independent designer 1	Interaction designer	P20
Company 5 – Large company (100+ employees) (USA)	Children's media	P21 – P22
Independent designer 2	Digital designer	P25
Company 6 – SME (UK/EU)	Safety Tech	P26 – P27
Company 7 – Start-up (Malaysia)	Education game and content	P28

'testers' in product testing or 'design partners' throughout the design processes [16]. However, this was not documented for the final (evaluation) workshops because these included companies that might or might not create products for children. Future efforts to encourage child rights-respecting design could valuably encompass child participation.

Finally, it may be that the conduct of the workshops online limited the free flow of designers' ideas and expression, although we note that they had become used to online discussions during the pandemic and were adept at using online tools and resources in collaborative ways. Much was said during the workshops that we lack space to capture in this paper, and often designers spoke in detail about their specific product, in a way that is difficult to include here anonymously.

4 DESIGNERS' INTERPRETATION AND APPLICATION OF CHILDREN'S RIGHTS

4.1 Factors shaping designers' interpretation and application of children's rights

Many aspects of participants' practices aligned broadly with the PbD principles, although the language of rights was itself rarely used spontaneously. This is encouraging, since most of the products that participants were working on were intended for children. Despite this alignment, which highlighted principles of safety and imagination in particular, designers participating in our workshops interpreted the principles in various ways, in accordance with their products' functionality, organisational settings and commercial models. This variation in interpretation also suggests different approaches to children's rights. We illustrate this for two of the principles: 'Ensure safety' and 'Be age appropriate'.

In relation to safety, while protecting children from harm was a generally assumed value, it poses several challenges in relation to play. One challenge concerns the importance of experimentation and even risk-taking for child development (for which reason, this is also a PbD principle). Companies 1 and 3, which build educational games for children, interpreted and implemented 'safety' similarly; both focused on providing a safe environment within which children could take a degree of risk, and even sought to enable children to push their personal limits when engaging with their products. They framed this experimentation in educational terms, considering it good for children to make mistakes provided that they learn from them:

> P1 (Company 1) *We try and create a safe space for kids to learn in that, if they go wrong, there's... a hint system that can just show this isn't an error. They can basically choose to have a bit more instruction or, if they're really stuck, then pay for a hint with [a coin], not an in-app purchase or anything, but just within the gameplay.'*

Similarly, P7 (Company 3) reported allowing players to explore and experiment within safe boundaries by 'limiting camera panning to particular areas [of the game]' and ensuring that 'failure isn't a scar but has irritating enough consequences' so that children learn from their mistakes. Further, companies' design choices and rationales suggested that they interpreted 'safety' to include the provision for children of a space safe from commercial pressure. However, this proved challenging for Company 2, where participants reflected on how tensions between commercial pressures (relating to income generation and retaining engagement) and children's wellbeing complicated their design choices:

> P3 (Company 2) *'Building a relationship is very different from, if you're in a game environment, where you're completely happy if kids have fun and then they want to have an in-app purchase, and it's like junk food. . . But how do you actually build an experience that is fun, building that long-lasting relationship that is full of nutrients?'*

> P4 (Company 2) *'In the last sprint, I did a big piece on responsible engagement. One of the conclusions I got is that we shouldn't be the ones defining the screen time, [and that we should] give that ownership to kids. So, make it super easy for kids to decide if they want to have a reminder of how much their screen time is.'*

It became evident that Company 2 differed in its interpretation of 'ensure safety' from Companies 1 and 3 due to its product's design features and aims as well as to internal research that the company had undertaken. In emphasising safety in terms of protection from hateful communication rather than of its potential for undermining experimentation (as for Companies 1 and 3), a participant from Company 2 reflected on the challenge of designing safe communication tools that meet the needs and expectations of children:

> P4 (Company 2) *'What our research shows a lot is that kids are quite divided. . . They are just okay with having pre-made messages to share with each other because they know that it's for them to be safe. . . But then we have the other 50 per cent of kids that actually resort to external software to be able to communicate with each other.'*

The principle of 'age appropriate' also generated divergent interpretations, reflecting the challenge of designing products for users of different ages and needs – especially if the goal was to make a single product suitable for different age groups. Company 1 defined suitability primarily in terms of appeal to users, based primarily on visual aesthetics. On the other hand, Company 4 focused on the age-specific developmental capacities of their intended users and the (company's) intended learning outcome (e.g., skills development). The latter especially reflects a constructionist approach to the design, implementation and evaluation of interactive computing systems in the field of CCI [51].

Thus, Company 1 interpreted 'age appropriate' in relation to their product as manifesting through the appeal of activities to particular age groups and through the aesthetic aspects of the product:

> P1 (Company 1) *'So in terms of how we begin. . . we kind of draw upon our memories of what we loved when we were kids. Because if we don't create something we think is cool and that we love and we're happy to be making, we know that that will never translate into kids liking it too.'*

> P2 (Company 1) *'Well, I've always kind of drawn what now is age-appropriate stuff. . . we really try to keep it. . . the same as [what] Pixar and Disney are doing.'*

By contrast, Company 4's interpretation of 'age appropriate' emphasised balancing educational benefits to the child, such as gaining new skills or knowledge, with engagement and entertainment:

> P14 (Company 4) *'The app [is] meant to encourage [children] to read, but at the same time, we want to make them engaging and fun. But not to make them too fun [so] that it detracts from the reading. We've recently changed the way of doing those pieces of content. Subsequently we've seen a dip in engagement, and there are calls for it to be made gamier again.'*

As also noted by P17 (Company 4), children's developing maturity (or evolving capacity) is a particular difficulty when designing a product or service intended for more than one age group: 'For example, when we test this game which is aimed at a certain age level. . . let's just say 11 to 13-year-olds. It's a targeted audience [. . . but that site] could be [for those aged] 9 till 15-year-olds. So, when it comes to testing, we had this issue where it was, whom do we cater for?'

Company 3, similarly, interpreted 'age appropriate' as compatibility between levels of difficulty and age group of intended users. P7 said they engaged in research to determine 'what the capabilities of the players are [in relation to their age]', adding that they applied 'a light touch on nudge and designed in a cut-off point'.

Designers' interpretation of 'age appropriate' tends to be narrower in focus than is intended by PbD. 'Age appropriate' as a PbD principle demands that designers consider the ability of children to use digital products and services in ways that enhance the intrinsic motivation to play, sociality, diversity, emotional resonance and safety in ways appropriate to their maturity and developmental needs. To undertake this would add layers of complexity to product design, even that built on child development theory [5, 6, 22, 24, 31] and possibly make it harder also to create products that appeal to a wide age range.

4.2 Implications for design of designers' approach to children's rights

All companies conveyed their intention to design their digital products and services responsibly by not exploiting users' engagement with the PbD principle of 'Adopt ethical commercial models' (see section 2.1). However, there is no one-size-fits-all solution, and companies' requirements for business viability differ. While these four companies were mindful of their responsibilities towards child users, other digital providers whose products and services do not cater directly to children may be less sensitive to the fine line between creating engaging products and promoting prolonged engagement at the expense of children's wellbeing.

A child rights approach encourages designers to reflect on all the PbD principles, ideally across the development process, in case relevant insights are missed. In terms of outcomes, all principles should be supported and not undermined in order for a product to be called 'playful by design'. Nonetheless, during workshops participants sought to manage the task by discussing which principles do or do not apply to their product or design challenge, and on occasion seeking to reinterpret principles to better fit their priorities and practices. For example, in making their products age-appropriate, designers across all four companies had little to say about the possibility of intergenerational play included in the 'Be age appropriate' principle, perhaps finding this too difficult to accommodate along with safety. This challenge implies that there is value in a design tool engaging designers in different modes of thinking to successfully balance competing priorities without constraining children's playful experiences (see 5.1).

We conclude that designers need support from their organisations, and possibly from child rights or child development consultants, in valuing the full range of principles, recognising their contribution to the quality of playful experiences, and in anticipating how different design features can enable or impede each principle. Company 3 (P7) explicitly

discussed the tension between implementing business objectives and the principle of 'experimentation', struggling to accommodate both (adult/business-framed) educational goals and children's agency. As P7 noted, the 'challenge' was to engage children who were not interested in achieving any of the set educational goals without encroaching on their 'autonomy'.

5 DESIGNERS' CHALLENGES IN EMBEDDING CHILDREN'S RIGHTS

We learned more about designers' challenges in balancing different objectives of children's rights with their design priorities by using the prototype of the PbD tool as a probe in the final workshops. Designers participating in these workshops also reflected on the value of a design tool for embedding children's rights.

5.1 Balancing competing priorities and applying children's rights in the design process

We found evidence that designers, even those from the safety tech industry (P26, P27), were prompted to think beyond their products and to engage more critically with the tensions that arise when embedding children's rights in design when using the PbD principles to discuss real-life challenges in their teams. For example, one participant (P27) reflected on the tensions and challenges that arise when trying to respect PbD principles while balancing commercial pressures that encourage the design of compulsive features:

> P27 (Company 6) *'I think they're all relevant to our product, but then sometimes there are trade-offs. . . so we prefer generally where kids are creating and participating, rather than just consuming. . . I think compulsion varies by age and child development. So, things that could be compulsive for a five-year-old would be very different even for an eight-year-old. . . I think game and educational app developers face a real massive challenge because. . . retention is very, very low. So, unless you include these elements in it, then kids aren't going to use it. But how do you do that [in an] ethical. . . way?'*

The way in which P27 engaged with the PbD principles during the workshop suggested that they prompted this designer to think more deeply about new ways to find a middle path rather than trading one PbD principle for the priorities of the designer's product. P27's consideration of other products (such as game and educational apps), to which the principle may be applied, suggested recognition of how an ecological approach could support new thinking. Other designers also used the cards to help them navigate their competing priorities and interests, including those that they initially did not think were 'exciting' (P21) or a priority, after checking their design options against the principles.

Overall, we found that participants were keen to use the PbD principles to interrogate their design choices, which had initially been informed by design objectives and by their organisational settings. They also seemed motivated to align their processes more closely with the PbD principles:

> P30 (Company 2) *'You should actually take that feature, whatever you are designing, and go up against all of [the principles] and see how you actually fit each of them. So, you can't say that it should not be ethically correct, you can't say it should not be age appropriate. . . From a design principle perspective we use them as lenses that we look through when we start talking about the different new features and so on.'*

Some designers, as in the case of P24, also used the principles to fine-tune different elements in their design as if they were using a music mixer deck. Adjusting elements of their design in this way allows them to encompass different aspects of children's rights that are relevant to their products.

> P24 (Company 4) *'It helps to focus. You can bring something in and out of focus. So, like [P22] said around safeguarding and making sure that you're welcoming. . . those can be slightly pushed back a little bit*

> *because we know those are catered for within. . . the framework we're using. . . But are we looking at allowing children to experiment, are we looking at the discovery, and those areas which are the ones that we can suddenly sort of say hang on, have we really considered this? Are we just making assumptions that we've thought about it?'*

In addition, participants responded well to the thematic prompts designed to stimulate different modes of thinking:

> P4 (Company 2) *'I think I will do the flow that you have done [from Why? to What if. . . ? to How?] because the first one [Why? card] got me thinking. The next one [What if? card] started making it more tangible, as in, what could I do about it? And the act [How? card]. . . got me thinking, what can you do about it?'*

It can be inferred from P4's thought process that there is considerable value in a prompted activity that helps to make what would otherwise be abstract principles more tangible and practical. So, in order for a design tool to support designers to translate principles into design features, that tool needs to have a function to facilitate these different modes of thinking.

5.2 Tackling challenges while negotiating and navigating team-based design cultures

Participants found diverse ways of using the 'principle' and 'prompt' cards, including the raising of controversial or sensitive questions about challenges or tensions arising in their design processes in a non-confrontational way:

> P24 (Company 4) *'It's the devil's advocate, and sometimes we're not comfortable to raise a question like that in a meeting. And if a card is doing it, then it takes the pressure off somebody. . . so it doesn't come across as combative which it sometimes can do in a meeting.'*

> P21 (Company 5) *'It triggered more questions. It also triggered things that you might want to focus [on]. Or bring out to other people to get their thoughts on. . . Especially people who have been doing this for a long time, you have all these assumptions about things. And culture. We're all marinating our own culture and our experiences. So, it's helpful.'*

The ways in which P24 and P21 thought of using the 'prompt' cards indicated that they found the deeper conversations facilitated by the cards valuable. Here, P21's recognition of the influence of a designer's 'own culture' reflects institutional factors regarding the broader design ecology that can lock designers into particular design choices. By using the cards to challenge these institutionalised choices, without being confrontational, designers could be prompted, for example, to expand their engagement with children's rights beyond the remit of safety or child development. This way of using the PbD cards could also support designers from commercial game companies to challenge and balance their normative prioritising of compulsive design features (e.g., loot boxes [45, 66]) with features that encourage constructive child participation, as P27 suggested (see 5.1).

Participants also saw potential in using the PbD tool for onboarding new members and supporting principled discussions around company aims and values:

> P21 (Company 5) *'If you have somebody new on your team. . . You have so much knowledge of how the process works [in our company] that isn't explicit. It's not going to be in a handbook somewhere. But if you went with this process with someone new, a lot of that would [be] articulated, and they would be brought into the model that you all tend to lead.'*

> P22 (Company 5) *'The deck is useful for making the invisible, often malleable design process more concrete for novice designers. It also feels productive to the social development and process-sharing of partnership work, helping to concretely guide two or more teams to the same language, processes, goals and outcomes.'*

The ways in which these participants suggested the PbD cards could be used demonstrated the potential of a tool to facilitate learning across different design cultures – for example, between companies with expertise in designing for children's rights and companies that traditionally prioritise maximising user engagement [27, 45, 66]. In such ways, commercial design practices might be shifted to align more closely with children's rights.

6 DISCUSSION

This article has sought to understand how designers interpret and apply children's rights when developing digital products and services that children use, and the challenges they face in the process. Our workshop methods introduced the PbD principles and a related card-based tool as a way of engaging designers in identifying and finding ways to overcome barriers to the interpretation and realisation of children's rights in digital contexts [20]. Recognising that child development theories [26, 56, 63] set out what children need and why, while a children's rights approach [59] calls on society (the state, regulators, businesses, education, etc.) to deliver this and explains how, we operationalised a child rights approach to play in digital contexts that is grounded in child development. Taking a child rights approach to design can complement design approaches grounded in child development theories [22, 24, 36, 62] and value sensitive design [21] by expanding the parameters of design considerations in support of the provision of positive opportunities for children to flourish.

Specifically, by using the PbD principles, which encompass children's rights to play, safety and development, among other rights, and a tool by means of which they can be embedded in design practice, we invited designers to recognise children's rights holistically and to find new ways to encompass the full range of rights rather than trading off children's provision and participation rights against their protection rights, as has been common practice hitherto. From this research, we derived a range of insights about how designers understand children's rights, the challenges they face in embedding these into the products and services that children use, and the pressures under which they work. This illuminates the gap between child rights principles and design, and thereby provides a basis for our design recommendations.

6.1 Bridging the gap between children's rights principles and design

Broadly speaking, designers working on products intended for children are familiar with the child development theories that underpin both the UNCRC [48] and CCI [22, 24, 30, 36, 62, p.1]. Although they rarely foregrounded explicit consideration of children's rights, we obtained evidence from both workshops of designers' valuing of children's voices, as prescribed in Article 12 of the UNCRC, particularly among those designers operating in CCI. However, designers' alignment with children's rights was frequently partial, in part because a holistic or ecological approach throws up challenging tensions – between adult-led (often educational) and child-led (often open-ended and imaginative) values, or between risk (e.g., exploration and experimentation) and safety, especially if a rights approach also calls for inclusivity rather than for the tailoring of products to relatively privileged groups.

Faced with difficult demands, it appeared that designers found it expedient to refer to the demands of their product, product positioning, funding models or organisational expectations. Indeed, in these negotiations designers tend to begin not with theories or rights or principles, but with their own priorities, familiar practices and organisational settings,

using these as a reference point when determining which PbD principles might be relevant to their work. Such an approach is undoubtedly pragmatic, but could risk aspects of children's needs being subordinated, as priorities dictated by these familiar practices translate into digital features and have a tangible impact on children's experiences [21, p.29]. This makes going the extra mile to balance adult-led with child-led values even more difficult, even for those whose design approaches are grounded in child development theories [22, 24, 36, 62] and therefore are likely to be more appreciative of the added value of the child rights approach.

The additional ways in which designers proposed using the PbD tool (section 5), highlighted significant organisational pressures stemming from institutionalised design cultures and practices. According to participants P24 and P21, these factors could also limit the range of child rights that designers can anticipate and accommodate. Specific commercial norms that favour design features intended to prolong or maximise user engagement, as observed in the gaming industry, were cited by P27 as a constraint on designers' ability to respect children's rights. However, as P27 further suggested, design tools that could prompt reflective, exploratory and practical thinking could help designers negotiate a better balance, for example between meaningful participation and industry norms that demand prolonged engagement.

Given the influence of these proximal and distal factors [8] on designers' interpretation and application of the PbD principles, even CCI designers could miss or struggle to manage the importance both of ensuring safety and of enabling opportunities for children to explore and test boundaries. Especially if a product is classified as high risk, designers are pressured to adopt rigid safety mechanisms that infringe on children's agency. However, by applying the lens of child rights, PbD principles offer a formula for what works when negotiating between the qualities of play valued by child development experts [14] aand the digital features that children find enhance their playful experiences online [65]. This is, surely, a necessary step on the way to a more complex digital environment which can encompass more diverse places and groups, including an ever-changing array of child-led activities, and where social norms can be organically negotiated and regulated, as is largely the case with the traditional forms of play celebrated, rather than deplored, by specialists in child development.

6.2 Practical considerations for embedding child rights in design

The HCI community has long been committed to developing good design practices for children. Such care primarily focuses on designing digital products and services intended for use by children. However, children use many digital products and services not necessarily intended for them, for example, search, maps, shopping, video conferencing, games and social media, sometimes in parallel with products dedicated to them, as reported by P4 (section 4). Problematically, outside the HCI and CCI communities, many mainstream digital products and services that children use are influenced by industry norms that appear to sideline children's developmental needs [37, 40], as remarked on by P27 (section 5). It may even be argued that, by paying little regard to their potential child users, these mainstream digital products and services risk, through their design, children's safety, privacy, development and wellbeing [19, 35, 47].

We observed that designers whose products were intended for children more readily captured a broader range of PbD components, beyond safety and age appropriateness, that contribute to the protection agenda of child rights, for example, accounting for the diverse or neutral representation of children (see Company 1, section 4) and for children's experimentation (see Company 3, section 4). Companies whose products were not intended specifically for children, although children do use them, such as games, appeared to struggle to balance retention through prolonged engagement with ethical commercial models, as alluded to by P27 (see section 5). These contrasts reinforce our concerns about the importance of a broader application of child rights beyond HCI and CCI communities.

Given the proximal and distal factors shaping designers' work [8], we learned that hard and fast rules would be futile. Instead, flexibility in applying the principles is needed in order to allow for negotiation between PbD principles and designers' priorities within the constraints of their products and organisational settings. Playing to the strength of a holistic approach to implementing Convention rights, PbD principles invite designers to problematise the narrow interpretation of child rights, which tends to prioritise protection and empower designers to expand the protection agenda of child rights by ensuring both protection and provision, in this case providing opportunities for children to develop and exercise their agency and participation rights through play, reflecting also an ecological approach to children's rights. This invitation can be seen as expanding the parameters of designers' consideration of design features that support children's flourishing [21], incorporating protection against harm and provision of positive opportunities for children's agency, creativity, expression, sociality, learning and development.

Given the holistic lens of child rights, combined with the interplay among contextual factors that shape designers' diverse practices, there is a need to think broadly and creatively to achieve good design that is also good for children. To this end, we call on designers, irrespective of their practices, organisational settings, products and intended users, to (1) reflect on the impact of their design choices on children's experiences and (2) expand their thinking before homing in on alternative design solutions that could accommodate protection, provision and participation rights, thus facilitating children's exercise of agency.

7 CONCLUSION

Amidst commercial design trends driven by a digital economy incentivised to maximise engagement, outreach and hyperconnectivity, which put children at risk 'by design' [19, 47], the HCI community, particularly through its CCI agenda, strives to set standards for good design interfaces and interactive systems that support children's development. However, as observed in the challenges that our participants and their fellow professionals are grappling with, designing for children's diverse needs is complex.

This article highlights opportunities for the HCI community to envision design tools to help designers expand their interpretation and application of children's rights, including but not limited to a concern with child protection [61], building on insights regarding the factors that shape designers' competing priorities and complicate their decisions. These insights are beginning to show that rights-respecting design can deliver greater enjoyment in digital play than the more common freemium or premium designs [41], challenging assumptions that what is beneficial to children is necessarily at odds with commercial imperatives, or at least pointing to the potential for a positive alignment between children's and businesses' interest.

As regards the design process, while beginning with a design brief that reflects organisational priorities and only later considering children's rights is understandable, we suggest that it is preferable to begin with children's rights, develop a design brief and address organisational priorities accordingly. Indeed, a tool that allows sufficient clarity yet flexibility in interpreting and adapting child rights principles across diverse product lines could lend itself to fostering designers' imaginative, iterative and rigorous product development [2], ensuring the thoughtful balancing of designers' products, organisational settings and industry norms with children's best interests [39].

Given that HCI and CCI designers and developers variously find themselves navigating competing professional, commercial, organisational, regulatory and ethical priorities, we hope that our development and deployment of the PbD tool will encourage further experimentation to promote children's agency, sociality, privacy and creativity on a par with safety. Such experimentation would ideally provide designers with both a compelling rationale for and a practical means of implementing children's rights, and potentially also product metrics useful [36] for evaluation against child

rights as well as commercial expectations. In this way, the design of digital products and services intended for or likely to be used by children can be more closely aligned with and supportive of children's rights.

8 SELECTION AND PARTICIPATION OF CHILDREN

No children participated in this research. However, all designers who participated in this research developed digital products or services for or used by children.

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