# Empowered to Make a Change

## Guidelines for Empowering the Young Generation in and through Digital Technology Design

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## ABSTRACT

This paper scrutinizes how children can be empowered to make a change through acquiring skills in digital technology design. We propose a framework that integrates theoretical understanding from literature on nexus analysis, values, and value as well as empowerment and genuine participation of children, and a related tool for educators and researchers advocating empowerment and inclusion. They should benefit from this tool when planning, analyzing, and evaluating their projects. We argue that the tool is useful beyond studies with children and can be used as a practical tool when planning and implementing digital technology design projects with any group of people and as a theoretical tool when studying such endeavors, especially when working with vulnerable or underserved participants.

## CCS CONCEPTS

• Human-centered computing~HCI theory, concepts and models   • Social and professional topics~Children

## KEYWORDS

Children; Empowerment; Inclusion; Exclusion; Genuine participation; Protagonist; Design; Making; Digital fabrication

## 1 Introduction

This paper addresses how children can be empowered to make a change through acquiring skills in digital technology design – we discuss what this entails in practice as well as show a variety of options from which educators and researchers working with children can choose their approach to empowerment.

Our work is motivated by the ever-increasing digitalization of our society and everyday life. Despite digital technology being thoroughly embedded into all aspects of our everyday life, there is a huge variety in young people's skills and capabilities around making meaningful use out of it. This disparity is referred to as the digital divide or a polarization between those who have access to and ability to develop their skills related to digital technology, and those who do not [50]. This is a serious concern as regards the young generation, who will definitely be living their lives full of digital technology. It is pivotal to provide the young generation with equal opportunities to access, use, and gain benefit from digital technology [31, 50]. Thus, digital divide does not merely concern access to digital technology but also its meaningful use [44, 45, 66], i.e., being able to make use of digital technology in meaningful social practices, which requires a wide range of physical, digital, human, and social resources [66]. Lack of this may lead to digital exclusion that prevents full participation in society, controlling one's destiny and reaching one's full potential [31, 66].

We [31], moreover, maintain that it is not merely the access and meaningful use of digital technology that is important for digital inclusion and prevention of the digital divide, but the young generation needs to gain skills and capabilities to innovate, design, program, make, and build digital technology [3, 14, 25, 45]. We firmly believe that in the future world all citizens will need those skills; young people need abilities to manage and master in the ever-digitalizing world. It is not only computer professionals, who should be able to innovate, design, build, and reflect upon digital technology but it is increasingly important that ordinary people possess such skills and competencies. Digital, technological, and computer literacy as well as computational thinking and computer self-efficacy of young people are significant here [8, 15, 18, 19, 60, 65]; however, we see that design of and innovation in and with digital technology are also significant, in addition to computational aspects [2, 3, 59].

Overall, we should empower children to make and shape digital technology to suit their purposes and interests [3, 14, 25, 45] i.e., in relation to digital technology, children should adopt a protagonist role that entails understanding, critically reflecting on, and driving the development of digital technology [29, 36]. Inviting children to take part in digital technology development as testers, informants, and even in the powerful role of a design partner [17, 67] has been a long tradition in the Child Computer Interaction (CCI) research community. Programming, digital fabrication, making, and tinkering as done by children have recently been examined in the CCI community as well (e.g. [2, 9, 11, 28, 30, 36, 38, 59]). The tenets of the Maker Movement that emphasizes democratization of innovation and empowerment of people to make tools for themselves by themselves through free access to cutting edge digital fabrication and physical manufacturing technology [3, 16, 24] have given inspiration to the recent work within CCI community. However, it is acknowledged that the design, education, and empowerment aspects need further work even in Making projects with children [2, 9, 10, 28, 30, 36, 38, 59]. The role of the protagonist frees children from the role of a mere partner (cf. the role of the design partner) and empowers them to explore and develop the world on their own, as informed and skilled actors. So far, research on children's digital literacies and digital inclusion from this perspective is severely limited while badly needed.

Thus, we aim to show in this paper what empowerment of children in and through design and making means and how educators and researchers can strive for it in practice, particularly if they aim for the protagonist role for the children but also in any kind of project. In addition to various literature sources, this work is based on our interdisciplinary work with children in digital technology design projects for over ten years, inspired by Scandinavian Participatory Design tradition and Maker Movement. A central interest in our studies has been to understand what children's empowerment really means as well as can and should mean in relation to digital technology design and making. As our research framework, 'nexus analysis' [56] has provided valuable insights (see [30, 31]). Nexus analysis is suitable for studying complex topics in depth. In nexus analysis, the influence of various social, cultural, discursive and historical aspects on any social action is underscored [56]. Insights from the literature on genuine participation of children [7], moreover, have been particularly useful source of inspiration in considering what meaningful and effective participation of children should be (see [28, 30, 32]). More general literature on empowerment of people [22], additionally, has revealed interesting variety in the forms of empowerment one may aim (see [29, 41]). Our work has also been inspired by theoretical insights on value (e.g. [13, 63]) and values (e.g. [20, 34, 46]); these analytical concepts enable getting a wider view and understanding the value compositions, not only value chains related to the phenomenon of empowering children in and through design and making (see [30, 39, 40]). The guidelines presented in this paper, thus, are based on the insights gained during our work with children as well as on the various theoretical lenses and frameworks. The guidelines were developed collaboratively by the authors through careful analysis, reflection,

and discussion on the work done and insights gained. We discussed each theoretical lens and identified its specific contributions for our work and subsequently on the guidelines for empowering children in and through design and making. When presenting the theoretical lenses, these contributions will be highlighted in italics.

The paper is structured as follows: Next section introduces the theoretical background of this work in more detail: literature on nexus analysis, genuine participation of children, empowerment, values, and value are reviewed. Then we propose practical advice on what kind of aspects educators and researchers working with children should consider when they aim at empowering children in and through design and making. The last section concludes the paper by summarizing the results, discussing their implications for research and practice and identifying limitations of the results and associated paths for future work.

## 2 Theoretical Framework

In this section, we present our theoretical framework on which we base our advice.

### 2.1 Nexus Analysis

Nexus analysis is based on insights derived from various research fields and disciplines such as sociolinguistics, conversation analysis, anthropological linguistics, ethnography of communication, critical discourse analysis, practice theories, activity theory, social semiotics, multimodal discourse analysis, new literacy studies, and cultural geography [57]. Due to this background, discourses and their analysis play a central role in this research strategy. However, nexus analysis is interested both in discursive and non-discursive practices through which our social reality is being constituted [57]. Nexus analysis places social action as the unit of analysis [56]. Social action is seen as constituted by three facets: historical bodies of the participants, interaction order among them, and discourses in place, circulating around [57].

The concept of **historical body** was coined by the philosopher Nishida. This concept refers to the overall accumulated life experiences of people that are seen to shape and underlie their behaviour. Scollon and Scollon [56] see Bourdieu's [4] concept of habitus as referring to a similar phenomenon: habitus is formed through a social process and guides people's behaviour and thinking. However, in nexus analysis the concept of historical body is preferred as it is seen more explicitly to include bodily aspect compared to the concept of habitus. Overall, the concept of historical body makes visible how our background, histories, experiences, knowledge, skills, expertise and dispositions are shaping and underlying our action [56] [57]. Thus, nexus analysis informs us that *histories and backgrounds of actors shape what happens and what is even possible to happen.*

The concept of **interaction order**, on the other hand, was coined by Goffman [21]. Generally, it refers to social interaction among people and how it is constituted. In nexus analysis the attention is directed to participants of social action and how they

and their interaction shape the social action in question. The participants may be present or distant, still affecting the interaction. One may focus on socially situational aspects that include for example participants' involvement and attention but one may also consider various conventions, norms, and rules involved in maintaining social order. Generally, it is assumed we behave differently depending on who we are interacting with and the concept of interaction order enables us to examine this issue in social action [56]. Thus, nexus analysis informs us that *interactions and relationships between different actors (both present and distant ones) shape what happens.*

Discourses are another significant element in social action. Nexus analysis emphasizes the complex interplay between discourse and action and one should ask related to any social action what is the role of discourse in that action [55, 57]. Both micro and macro levels are to be considered in the analysis of discourses: face-to-face interaction between participants in situ as well as broader sets of concerns circulating around in society. Nexus analysis sees as one of its central tasks to be to "explicate and understand how the broad discourses of our social life are engaged (or not) in the moment-by-moment social actions of social actors in real time activity" [55: 139]. The concept of **discourses in place** also forefronts that all social action takes place in real time and place by human actors and their bodies [56]. Overall, nexus analysis informs us that *discourses are part of what happens and powerfully shape it.*

Altogether, nexus analysis encourages the analyst to "avoid uprooting words and actions from the historical bodies of the individuals performing them, or disconnecting the discourses and actions from the sociocultural context of their formation and realization, or ignoring the history of these actions and discourses for the individual and in the situation. (...) The individual accumulates experience in the course of his/her trajectory across time and space, social orders open up and close and are rearranged, discourses in place are transformed as buildings are refashioned, innovative technologies are introduced, new texts and discourses circulate." [57: 72] Hence, nexus analysis emphasizes specific contexts – historical and social/societal, specific places and times in which social action happens and in which human actors and their bodies are engaged. Thus, central message of nexus analysis is that *everything happens in context.*

Overall, nexus analysis has provided us useful conceptual tools with which to make sense of the complex topic of children's empowerment in and through design and making (see e.g. [30, 31]): it has enabled us to see the complexity involved with it as well as offered tools to make visible and analyse the complexity from different perspectives. Nexus analysis has made visible how participants' (children's and adults' alike) background and experiences, their relationships and interactions, and various kinds of discourses circulating around shape the social action of empowering children in and through design and making.

## 2.2 Genuine Participation of Children

Children's genuine participation has been pondered on in different research fields. In this enduring research stream, various kinds of models and guidelines for children's genuine participation have been proposed. Those can be used for planning and evaluating projects involving children as well as for reflecting on the motives, values and practices underlying children's participation. Generally, children's participation usually aims at one or several of the following goals: to generate knowledge about children, to enable children's voices to be heard, to impact decision making, to empower children, to improve products and services for children, and/or to educate children. Researchers have tried to understand and evaluate children's participation as to whether it has real impact, i.e., it is genuine, or whether it is only tokenistic or decorative. The genuineness of children's participation has been defined from the viewpoint of the participatory process itself [23] or the resulting outcomes [27].

In the CCI field, there is a long history of developing methods for giving children a voice in technology design, starting already from 1980s [17]. From genuine participation point of view, researchers have examined roles of children in technology design projects (e.g. [1, 17]), called for foregrounding the values of researchers and practitioners when working with children [30, 35, 67], and discussed empowerment of children in and through technology design [28, 35, 36, 67]. They have considered negotiating values of both adult designers and children [62] as well as brought forth models for ethics and transparency in working with children [51, 53]. A broader reflection on what children's genuine participation means in technology design with children is still lacking, however, [28] even though some attempts to address this already exist [29, 30, 32, 36, 37, 41, 47, 54].

Of the various models for children's genuine participation proposed within other disciplines, we have found the one presented by Chawla and Heft [7: 204] as particularly useful in planning our work with children as well as in evaluating and analysing the projects afterwards (see e.g. [28, 30, 32]). The model comprehensively captures aspects to be considered when aiming at truly empowering children. That model is based on the results of a workshop interested in children's participation in community development projects. Chawla and Heft [7] in their paper discuss what "participation at its best" is and they present a set of conditions that should be considered when facilitating children's meaningful and effective participation – i.e., participation that actually has an effect (see Table 1). We interpret these conditions as criteria on how to empower children in design and making projects and argue that *these conditions need all to be considered when we want to truly involve children and want their work to have a genuine impact.*

## 2.3 Empowerment

Literature on genuine participation of children underscores giving children responsibility and a possibility to influence. However, literature on empowerment enables going deeper into what this means and into the variety that can be associated with this. Different forms of empowerment we have identified from the literature, i.e. critical, mainstream, functional, democratic, and empowerment as learning and competence development [41], show that this responsibility and influence can be interpreted in different ways. The mainstream form of empowerment sees

| Conditions of Convergence | Conditions for Competence |
|---|---|
| Whenever possible, the project builds on existing community organizations and structures that support children's participation. | Children have real responsibility and influence. |
| As much as possible, project activities make children's participation appear to be a natural part of the setting. | Children understand and have a part in defining the goals of the activity. |
| The project is based on children's own issues and interests. | Children play a role in decision-making and accomplishing goals, with access to the information they need to make informed decisions. |
| | Children are helped to construct and express their views. |
| **Conditions of Entry** | There is a fair sharing of opportunities to contribute and be heard. |
| Participants are fairly selected. | The project creates occasions for the gradual development of competence. |
| Children and their families give informed consent. | The project sets up processes to support children's engagement in issues they initiate themselves. |
| Children can freely choose to participate or decline. | |
| The project is accessible in scheduling and location. | The project results in tangible outcomes. |
| **Conditions of Social Support** | **Conditions for Reflection** |
| Children are respected as human beings with essential worth and dignity. | There is transparency at all stages of decision-making. |
| There is mutual respect among participants. | Children understand the reasons for outcomes. |
| Children support and encourage each other. | There are opportunities for critical reflection. |
| | There are opportunities for evaluation at both group and individual levels. |
| | Participants deliberately negotiate differences in power. |

**Table 1. Characteristics of meaningful and effective projects for children's participation [7: 204]**

empowerment as motivating people through increased decision-making power that is achieved through the powerful giving some power of decision to the power-weak, whereas the critical form sees this as insufficient and, instead, emphasizes the oppressed challenging the oppressing conditions of status quo, combating the oppressors, and gaining more power of decision this way [22, 26, 49]. The functional form of empowerment views empowerment in the sense of improving life conditions of people while maintaining the status quo e.g. through development of better tools for people to use, whereas the democratic form emphasizes people's ability to affect decisions concerning them [12]. Finally, empowerment as learning and competence development emphasizes giving people skills and competencies for the future to enable them to flourish in their full potential, participate fully in society, and to control their destinies [41]. The CCI research community has already pointed out that for children to grow up as protagonists in regard to digital technology they need to feel "empowered to shape technology development and critically reflect on the role of technology in their practices" ([29] see also [36]). We, however, emphasize that when organizing activities for children, it is central to explicitly ask *what kind of empowerment we want to aim for in this particular activity*.

## 2.4 Values and Value

The genuine participation literature is clearly driven by values. Researchers aim to enable children's voices to be heard, to impact decision making, to empower children, to improve products and services for children, and/or to educate children – motivated by value laden and ethical issues and questions. In addition, value to be generated for the participants is significant to consider for

sustainable practice. However, the frameworks discussed earlier do not address value or values in depth. Hence, we have extended the theoretical framework with literature on value and values (see [30, 39, 40]).

The importance of values in driving or underlying our behavior has been acknowledged within a number of disciplines and research fields (e.g. [5, 6, 43, 58]), including HCI and CCI (e.g. [20, 30, 33, 34, 35, 39, 46, 48, 68]. HCI research has shown values driving and underlying our research and design practice (e.g. [20, 30, 34, 35, 46, 67]) as well as values driving and underlying people's use of particular technology (e.g. [33, 48, 68]). Studies have also shown that both value compatibility and conflicts are possible in digital technology design and use – value compatibility contributing to the activity while conflicts hindering it [64]. Overall, it has been shown that *everything we do is affected by our (cultural) values* and that *compatibility or fit with cultural values is to be aimed for.* Indeed, in the CCI research, there have been specific calls for foregrounding the values when working with children [30, 35, 62, 67] as well as attempts to, for example, create practical tools for identifying, reflecting, and negotiating values in a design project [61, 62] and considering different ethical issues [52, 53].

Values can also be connected with value, i.e., worth. Values refer to what is considered important, good, and right in life (e.g. [20, 34, 46]) and this influences what is considered as value, i.e., as a benefit experienced – perceived and determined – by the beneficiary [63]: something that a person judges to be worthwhile [13]. Kujala and Väänänen-Vainio-Mattila [42] note that in order to understand users' perspective to value, one needs to understand what is important for them and what motivates them. Hence,

**Everything happens in context**

- What is the context? Why has this context been chosen?
- How the context possibly affects the participants?

- Is this the best context for the activity? Why / why not?
- What can be done to make the context more suitable?

**Interactions and relationships between different actors (both present and distant ones) shape what happens**

- Who are present? How are they related to each other?
- How does this shape the way they behave or it is possible for them to behave?
- Are there more distant stakeholders? Who are not present but still affect what happens or what is possible to happen in the activities? Do they shape the activities somehow?

**Histories and backgrounds of actors shape what happens and what is even possible to happen**

- What kind of people are the participants?
- What kind of knowledge and skills do they have?
- What are they interested in?
- Why do they take part in the activity?
- How does all this shape (direct, restrict, constrain, inspire, …) the activity?

**Discourses are part of what happens and powerfully shape it**

- What kind of discourses circulate in the society regarding the activity?
- How participants talk about the activity? Why?

- What kind of discourses are produced or relied on in situ in the activity?
- How these discourses shape the activity?

**Conditions of convergence**

- Is it easy and natural for children to participate?
- Are existing organizations and structures supporting children's participation relied on?
- Are the activities based on children's own issues and interests?

**Conditions of entry**

- Have the participants been fairly selected? Has somebody been excluded? Why?
- Is children's participation voluntary? Why? If not, why?
- Is the location and schedule for the activities easy to access for children and their families?

**Conditions of social support**

- Is the environment supportive?
- Are all participants respected?
- Do all participants act friendly and politely? How can this be encouraged?
- Is there team spirit? How can this be encouraged?
- Do children support and encourage each other? How can this be supported?
- Are everybody's opinions and thoughts considered valuable?

**Conditions for reflection**

- Do power differences exist between participants? Have the power differences been deliberately negotiated?
- Who makes decisions? Why?
- Do all participants understand reasons for decisions?
- Are there occasions for all participants for critical reflection on the process and the outcomes?
- Are there occasions for evaluation for all participants, on both individual level as well as on group level?

**Conditions for competence**

- What kind of responsibility children have / do not have? Why?
- Who defines the goals for the activity? Are children allowed to take part in defining the goals? Why / why not?
- Do all participants understand the goals?
- Do children have all information they need? How can they get it?
- Does everybody get a chance to contribute?

- Do all participants listen to each other?
- Do children's activities have real impact?
- Do children learn something? Does this learning build on top of previous knowledge/competences?
- Does the work process support children to initiate future projects by themselves?
- Does the project result in tangible outcomes?

**Different forms of empowerment**

- What is the form of empowerment aimed in the activity? Why? Is aiming for a certain form of empowerment more suitable in this activity? Why?
- Is the goal to empower children in the sense of supporting their learning and competence development so that they can fully participate in society and reach their full potential (empowerment as learning and competence development)?
- Is the goal to empower children in the sense of improving their life conditions through developing together with them better tools for them (functional empowerment)?

- Is the goal to empower children in the sense of motivating children to perform better by adults giving them some power to influence decision-making (mainstream empowerment)?
- Is the goal to empower children in the sense of more democratic decision-making processes that give children possibility to make decisions on issues that affect their lives (democratic empowerment)?
- Is the goal to empower children in the sense of encouraging children to challenge the oppressing conditions of the status quo and to combat their oppressors (critical empowerment)?

**Everything we do is affected by our values; value fit or value compatibility is to be aimed at**

- What kind of values the facilitators have? How are they shaping the activity?
- What kind of values the participants have? How are those shaping the activity?
- Do cultural values affect somehow what it is possible to do?
- Do the values of the different actors/stakeholders (present or distant ones) affect the activity?
- Is some form of empowerment more suitable/acceptable in this culture? Why?

**The actors need to perceive and experience benefitting from the activity, i.e., derive value; the value gained may concern some tangible outcome but also learning and competence development**

- What kind of value should different actors (present or distant ones) experience? Why?
- What kind of value they gain? How is this evaluated?
- Is the process more important than the outcome or vice versa? Why? Should it be so?

**Figure 1. Tool for educators and researchers interested in empowering children in and through digital technology design: theoretical understanding and related questions**

values and value are intertwined. In the context of genuine participation, important is that *the work aligns with the values of the actors as well as that the actors perceive and experience benefits from the work, i.e., they derive value.* The genuine participation literature informs us that the value generated may relate either to the process or to the outcome, or to both. *The value gained may concern some tangible outcome but also learning and competence development* [7, 28, 40]

## 3   Guidelines for Educators and Researchers

In this section, we present our guidelines in form of a tool (Figure 1) for educators and researchers who work with children in the context of digital technology design and making and who are interested in empowering children in and through these activities, possibly even aiming for children to become protagonists in relation to digital technology. The tool is based on and inspired by the different theoretical sources presented above as well as by our empirical work with children. The tool includes a set of questions that help educators and researchers to reflect on, consider, and ensure aspects contributing to children's empowerment when planning, executing, or evaluating their digital technology design and making projects with children. Some of the questions are quite general without one and only correct answer, mainly aiming at arousing educators' and researchers' awareness of the variety of aspects shaping children's empowerment in and through design and making. Some of the questions, then again, are more empowerment specific, indicating what kind of issues should be ensured in case of striving for empowerment of children. However, also in the case of these questions, it is left open for the utilizer of the guidelines to decide how much and what form of empowerment can and should be aimed at.

The questions in the tool (Figure 1) show a variety of aspects involved in empowerment of children in and through design and making. Nexus analytic concepts emphasize that our work is always conducted in particular time and place and that should be critically reflected upon: why were those selected, how do they shape the activities and influence the participants? Nexus analysis also helps us to look beyond and behind single occurrences in time and place and open our eyes to see how there is a variety of, sometimes invisible, audiences and actors who nevertheless affect what is done. Similarly, our histories and backgrounds shape what we do and produce in the projects and what kind of interaction is born. The discourse perspective gives us a possibility to consider how the participants construct and constitute, e.g., participation and its effects. As can be seen from the exemplary questions in Figure 1, interactions, histories and experiences, and discourses intersect in any social action and shed different light on the same phenomenon. We feel that merely being aware of this complexity is significant. Researchers and educators can also try to anticipate these issues beforehand, observe how they intertwine and unfold during the work with children, as well as evaluate their impact after the work.

The lens of genuine participation of children brings forth many additional and complementary aspects. It also highlights the importance of existing life world of children and how we should take advantage of it and integrate beneficial aspects from it as much as possible. It also underscores that voluntariness, inclusiveness, and accessibility need to be paid serious attention to in any project aiming at empowering children. Moreover, it emphasizes social relationships, respect, and encouragement as essential to be nurtured also in this type of projects. Children's possibility to have a say and impact on the outcome are also forefronted: children need to be given enough information to be able to make informed decisions, they should take part in defining the goals of the activities, they should be allowed to have real responsibility and influence. We should also carefully consider the outcomes of the projects: both competence development and tangible outcomes are stressed. Finally, the lens brings in children's essential role in the evaluation and critical reflection on the project progress and outcomes. Power differences should also be critically reflected upon and negotiated in this type of projects.

Additionally to this, the literature on empowerment enables us to reflect upon what form of empowerment is actually aimed at: Whether empowerment means motivating children through giving them some decision-making power by the powerful ones; improving their life conditions through developing useful means and tools for them with them; enabling them to engage in more democratic decision-making processes; supporting their learning and competence development for the future; or encouraging them to criticize the status quo and combat their oppressors. Some of these goals can also be combined in one project only, while some are quite conflictual in nature and cannot be integrated (e.g. mainstream vs. critical one).

Finally, we wished to explicitly include considerations on value and values into this tool. Here important is to remember that each participant should perceive as deriving some kind of value from participation – otherwise their participation will not last long. What each participant considers as value is shaped by their values. Their values are underlying their actions – this applies both to adult and child participants. We adults should also critically consider what kind of values are underlying and driving our actions and the compatibility of our values with those of other participants and the context. Sometimes value conflicts are unavoidable, e.g., when radically changing how children are taught in schools, while many times value compatibility is something that should be aimed at to ensure smooth operation, high quality outcomes, and the participants perceiving as deriving value from it.

Overall, when using the tool you should answer the questions in the tool and then reflect on your answers in relation to 1) the context and the participants – would it be possible to do things in another way in this context, with these participants who have certain histories and interact in certain ways; 2) the aspects of genuine participation – what are you aiming for and does it seem possible to reach that with your choices; 3) forms of empowerment – are your answers in line with the form of empowerment you are aiming for; 4) your values – are your answers in line with them; 5) value to the participants – are your answers in line with what kind of value you wish the participants to experience. You need to always ask yourself "why has this approach been chosen."

We propose using the tool presented in Figure 1 when planning the activities, during the activities, and when evaluating and reflecting on the activities. When planning the activities, it can be used both as a check list and as orienting lens on issues considered important in the context at hand. During the activities, the ongoing process can be critically reflected on based on the tool. When analyzing the results, the tool can once again be used for focusing the analysis on how the aimed form of empowerment was reached.

## 4   Conclusion

In this paper, we have presented literature as well as practical guidance on how to empower children in and through digital technology design and making, having in mind an ultimate goal of children becoming protagonists in relation to digital technology. The guidelines have been inspired by the theoretical insights presented in this paper as well as by our extensive work with children, spanning over ten years, having children's empowerment, inclusion, participation, and impact as central goals. As can be seen from the tool in Figure 1, many aspects we introduced are overlapping and intertwined. This indicates we are addressing a complex phenomenon and context. For the purposes of this paper we have analytically separated them according to the lens from which they emerged.

We argue that the working practices in design and making should be critically examined, throughout the process. We want to stress that if the intention is to empower children to make a change, if we want them to adopt a protagonist role [29, 36] as regards digital technology, it is central to consider what kind of conditions and contexts support this aim and what can possibly hinder it – how the theoretical issues presented in this paper should be reflected on practice.

As to the limitations to this study, even though the tool we propose in Figure 1 is based on the existing understanding on human behavior as well as practical studies on children's participation in digital technology design and making, it has not been empirically evaluated. Thus, we invite other researchers as well as practitioners to try out the tool to see whether it helps them in finding ways to empower children in and through digital technology design and making. We acknowledge that children actually represent a diverse group of people in many respects, their age being one of the obvious aspects. The guidelines are general and should be applicable with different age groups, but the utilizer of the guidelines needs to carefully consider how children's age and associated skills and abilities affect the work. We also want to make it clear that even though we see the protagonist role as an important goal, we still acknowledge that it is not realistic to expect every project to aim for that, and that in many contexts the thoughts presented in this paper may feel rather idealistic and even utopian. We also acknowledge that even if the tool has been constructed with children in mind, it should be valuable also in projects with other kinds of participants – especially with different kinds of underserved, marginalized or vulnerable participants. Finally, we think that the guidelines are useful even in projects aiming at empowering children through some other means than digital technology. We think the questions proposed in our tool are pivotal in any endeavour aiming at empowering children – or people in general.

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