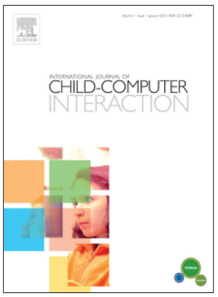

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SOCIALIZERS, ACHIEVERS OR BOTH? VALUE-BASED ROLES OF CHILDREN IN TECHNOLOGY DESIGN PROJECTS

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Abstract. We have examined value creation in projects aiming at teaching children design related skills. Our results show that in addition to the roles defined by adults for children in the technology design process children adopt various roles in situ by themselves. We utilized in our analysis a value creation lens, Schwartz's model of universal values, and Self-Determination Theory. We did this to see in what roles the children were successful in value creation and how this is related to children's motivation. We propose a five-step method for Role-based Value Creation Analysis (R-VCA). While our participants were 9-14-year-old children, we argue that the value creation approach and the R-VCA method are applicable to other age or user groups as well since the value creation lens is not in any way specific to children. We argue that value creation analysis can be an important tool in finding out what empowers and motivates design process participants. This knowledge can further help in planning new projects as well as offering new perspectives on existing research data.

Keywords. Children, roles, value creation, design, learning

1 Introduction

It is widely agreed among the Child-Computer Interaction (CCI) research community that children should have some role when designing technology for their use. Researchers have been inspired by the Cooperative Design [14], Participatory Design [44], and Contextual Design [4] traditions and have proposed a number of methods and tools for inviting children into technology design process. An ample literature base already exists related to the topic and a number of requirements elicitation, design, and evaluation methods have been created to be used with children (see [11, 17, 27]).

One focus of studies on children's participation in technology design has been roles of children in the design process. The most widely cited model has been proposed by Druin [9], in which she identified four roles for children: a user, a tester, an informant, and a design partner (for recent updates, see e.g. [2, 15]), of which the last three are particularly significant as regards technology design. The different roles have a strong connection to power relations between children and adult designers. Indeed, the effect of power relations in the design process has been under discussion for long (e.g. [8, 10]), resulting in practical guidelines on how to reduce power differences between children and adults (e.g. [8-10]). The most advocated role is that of an influential co-designer (e.g. [6, 9, 26, 37, 54]), but also other roles have been discussed. Children have been positioned as valuable informants in the design process, e.g., in the informant design model [43]. They have been given the role of co-researchers [8, 52, 53] utilizing different subject positions when informing the researchers [22] or heuristic evaluators [41]. Even the role of critical evaluators of the whole project results has been suggested for them [21]. The questions addressing children's role culminate in who has the decision-making power [21] as well as whose ideas are influential and taken into account [32, 38]. While ideals of equal collaboration between participants have been presented, researchers still ponder whether it is possible or meaningful for children and adults to act as equal participants [16, 21, 39, 43], relating to the long-standing discussion of empowerment of users in participatory design (e.g. [25, 47]).

We want to contribute to the current discussion with an approach to understand what kind of roles children adopt by themselves. We focus on design processes where children's learning of design related skills is the main goal (in contrast to those with a material outcome as the main focus, see [19]), and we therefore ask as

our research question *what kind of self-adopted roles of children can be identified in a technology design process that has a focus on children's learning*.

We chose to look at the roles through a value creation perspective, utilizing Schwartz's [45] model of universal values as a sensitizing device in the empirical analysis of our four projects where we conducted participatory design with children, one of the aims being children's learning of design related skills. CCI researchers have become interested in values during recent years (e.g. [1, 21, 26, 34, 40, 48, 54, 56]) and values have been argued to play a decisive role in the design process (e.g. [21, 26, 34, 40, 54]). Value creation lens has not been utilized in the extant research to make sense of children's roles in the design process, however. This study aims to show the suitability of such a lens for CCI research and practice and, while doing so, sheds some new light on the variety of roles children can adopt in technology design. We argue that the Role-based Value Creation Analysis (R-VCA) method we propose can be used with other age or user groups as well, as the value creation lens is not in any way specific to children.

In the following section, we present our theoretical and methodological basis. Then, we will present our research design and our data analysis process. Our empirical findings follow and, finally, the implications of our findings are discussed and possible paths for future work identified.

2 Theoretical lens

In this paper, both the concept of created *value* and the concept of *values* are used to analyze and make sense of children's roles in design process. The term "value" is challenging to define, and easily leads to confusion. Firstly, it is used in different meanings in different contexts, ranging from an abstract ideal to cost savings [36] and something seen to emerge from use of technology [28]. Second, the definition of value typically includes a strong subjective component, i.e., subjective evaluation of what is valuable, and how the value is experienced [42]. The exact definition of subjective experience of value is challenging due to its phenomenological nature. In this paper, we define value as something that people, individually or collectively, find worthwhile [5]. *Values*, on the other hand, according to Schwartz [45] can be seen as "concepts or beliefs that pertain to desirable end states or behaviours, transcend specific situations, guide selection or evaluation of behaviour and events, and are ordered by relative importance." See further discussion on values in technology development context e.g. in [31] and in [35].

Subjectively experienced value [42] is studied in this paper as emerging in an activity that takes place in schools, in the context of an event that focuses on the learning of design related skills. Our analysis recognizes the phenomenological nature of subjectively experienced value. We see value as a unique, context dependent parameter, which is subjectively interpreted by the stakeholder participating in the activity. Recognizing and understanding subjective experience of value always has its limitations – a personal experience can never be completely captured nor understood by another. Our analysis is based on data collected in learning activities taking place in schools, aiming at high 'experimental realism', i.e., a research setup where the experiment has an impact on the participants and involves them with the procedures under examination. This setup allows us to collect data about first hand experiences and descriptions of what the participants found valuable, reported directly by the participants themselves.

For the purposes of the current study, we borrow the concept of '*successful value creation*' from Service Science [50, 51] where successful value creation for the stakeholders is in a central role and marks a successful service [55], as we feel that it is useful in analysing and illustrating the emergence of different roles of children in the design process. We define 'successful value creation' in this paper as 'any value created in a learning situation for the participating children'. Consequently, there may be situations where certain type of value creation was hoped or expected to happen but for some reason it did not.

We consider *motivation* as an essential element in understanding how children can succeed in value creation through participating in technology design exercise, as motivational variables are highly related to learning [30]. Motivation, on the other hand, is tied to underlying *values* of children. We therefore took into use Schwartz's model of the ten universal *motivational types of values* (Figure 1) [45], which ties together "universal values" of people and their related motivational emphasis. It provides a tool to examine values through motivation of individuals in a structured manner. Schwartz [45] does not examine value creation but the experienced value in our data aligned well with the motivational types of values. The model has been previously used in the field of technology design, for example, for analysing value creation in the context of technology use [24] as well as for analysing 'user values', i.e., users' internal motivations affecting how they look at technology use [31].

Schwartz's ten universal motivational types of values [45] are illustrated in Figure 1. The arrangement of values in a circular form represents a motivational emphasis of value types. Values which are close to each other have same or similar motivational emphasis, and values on opposite sides have contradictory or very different motivational emphasis. For example, "power" and "achievement" values are both motivated by social superiority and esteem, whereas universalism is motivated by transcendence of selfish interests.

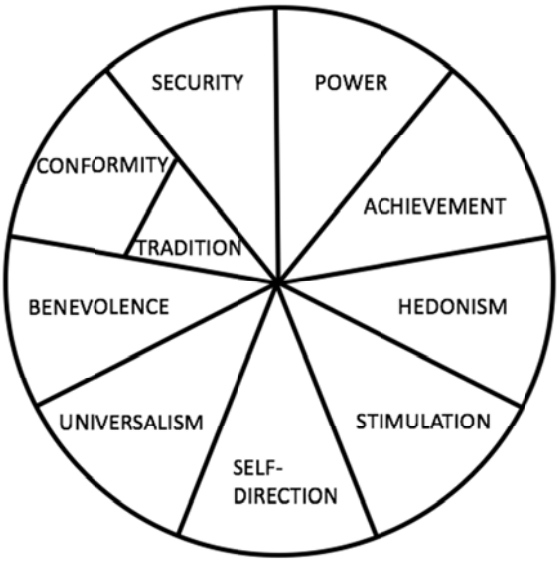

Figure 1. Schwartz's value types (adapted from [45]).

The value types of Power, Achievement, Hedonism, Stimulation, and Self-direction are value types which typically serve individual interests. "Power" includes values related to wealth, authority, social power, preserving public image, and social recognition. "Achievement" emphasises demonstrating of competence, especially with a view to obtaining social approval. "Hedonism" includes values related to pleasure and sensuous gratification, and the "Stimulation" value type is based on a need for arousal and variety. The "Self-direction" value type relates to independent thought and action, e.g., freedom, creativity, and choosing one's own goals. [45]

Benevolence, Conformity and Tradition are value types which typically serve collective interests. "Benevolence" refers to values contributing towards the wellness of other people, including, for example, helpfulness, loyalty, honesty, and responsibility. "Conformity" includes values related to not performing actions that are likely to harm others. "Tradition" emphasises respect towards practices that have been accepted to represent shared experience. [45]

We use the Schwartz value framework [45] as a theoretical tool for recognizing regularities and consistencies in the social behaviour of children when they take part in the design process. Identified

regularities in social behaviour can be mapped into construction of roles [18]. Our hypothesis is that, on the one hand, universal values of children and children's experiences are influential in constructing roles in social structures needed in the design process. On the other hand, these *values* are shaping what kind of *value* children experience/expect as emerging in the design process). To put it simply, personal values affect children's motives to act in certain ways in a design process, and therefore also their taking of different roles. A child who prioritizes Benevolence very high is motivated to act as a good teammate and therefore may take a role of a team worker as this role is rewarding to them, i.e., it is possible for them to experience value (worth) in this role. It is important to note, however, that we do not analyse children's *values* in this paper, only *value* they seem to experience. We only use the motivational types of values as a reflective lens to get a deeper understanding of the experienced value and through that the roles children take in the design process.

Our definition of a "role" does not only address "role-taking" of children adopting role expectations in the social context, but also takes into account the subjective role of children in "role-making" [18], addressing aspects where the subjective experience of children affects how the roles are formed and how they evolve in varying degrees of concreteness and consistency. Therefore, we define a role in this paper as 'a behaviour pattern that can be socially expected but also subjectively defined'. As children are in a constant process of making their roles during the design process, it is natural that their roles change, overlap, and evolve during the process.

In order to further examine the role of motivation in value creation, we also look at our data through the lens of Self-Determination Theory (SDT) [7]. According to SDT, motivation may result from personal interest (intrinsic motivation) or from outside influence, like a reward or the fear of a punishment (extrinsic motivation). SDT assumes that all humans are innately curious and motivated to learn. However, an unfavourable environment can stifle this motivation if it fails to fulfil three basic needs: Autonomy, the need to be in control of one's life and in harmony with oneself; competence, the need to experience mastery and to be in control; and relatedness, the need to interact with and connect to others [7]. We will examine how these three *motivational needs* are related to value creation, and how fulfilling them helps in taking different roles as a result (see Table 1).

Motivational need	**Description**	**Examples of value creation fulfilling the need**
Autonomy	Control of one's own life and harmony with oneself	Thinking and acting independently Pursuing your interests Choosing to fulfill your desires
Competence	Experiencing mastery and being in control	Achieving your goals Being able to control the outcome
Relatedness	Interacting and connecting with others	Interacting in a prosocial manner Preserving group integrity Connecting through shared traditions

Table 1. Value creation and motivational needs in SDT.

There are obvious similarities between Schwartz framework on motivational types of values [45] and the innate motivational needs discussed in the SDT [7]. Focusing on participants' motivation, while useful in almost any project, is especially important when the focus is on learning, as motivation has been shown to have a great impact on learning (e.g. [30]). SDT further helps to explain possible reasons behind choosing certain roles and, as an extension, offers us tools to influence what roles people choose. An environment that fulfils a certain motivational need can also encourage value creation for values tied to said need, which in turn may influence roles chosen.

3 Research design

3.1 Data for the study

The four projects examined in this paper (Figure 2) have been all conducted in the context of Finnish comprehensive school, with varying general goals. In all the projects, HCI/CCI researchers together with their Masters' level students have collaborated with local schools for arranging learning interventions where the children learned technology design skills through participating in facilitated technology design process. Length of the projects was about 5 months and the total working time at school varied between 25-40 hours.

Project A: ***Children designing a learning portfolio application***
Arrangements*:* design workshops at school
Participants*:* 7 Master's students, ca 30 3rd graders (8–9 years) and 30 4th graders (9–10 years)
Data*:* project report, project management data, field notes of Master's students, interviews of children, two Master's theses
Reference*:* e.g. [21, 22, 32, 33]

Project B: ***Children developing an adventure game and evaluating a game editor***
Arrangements*:* design workshops at school
Participants*:* 4 Master's students, ca 30 7th graders (13-14 years)
Data*:* project report, project management data, field notes of Master's students, a teacher interview, children's interviews.
Reference*:* e.g. [19, 20, 29]

Project C: ***Children developing and evaluating an adventure game***
Arrangements*:* design workshops at school
Participants*:* 4 Master's students, 20 9th graders (14-15 years) and 7 8th graders (13-14 years)
Data*:* project report, project management data, field notes of Master's students, essays of children, 2 teacher interviews
Reference*:* e.g. [19, 20]

Project D: ***Children developing and evaluating a quiz game***
Arrangements*:* design workshops at school
Participants*:* 4 Master's students, 58 8th graders (13-14 years) and 37 7th graders (12-13 years)
Data*:* project report, project management data, field notes of Master's students, interviews of children, a teacher interview
Reference*:* e.g. [19, 20, 29]

Figure 2. Four studies of learning interventions in school context.

In **Project A**, two classes of children took part in two participatory design workshops (2 hours each) to design a user interface for a digital portfolio application for children's own use. Two Master's students continued the work after the design workshops and implemented a functional prototype of the portfolio application. In **Project B**, a class of children took part in developing an adventure game to promote literacy skills of children, utilising an existing game engine developed in our previous project. In this project, a game editor was added to the game engine to make it possible for children to create new games. The children took part in workshops on game ideation, design, and evaluation as well as editor evaluation, combining art and Finnish language lessons. In **Project C**, a class of children continued the adventure game development of Project B in connection with Finnish language lessons and some younger children acted as testers of the game. Older children arranged the tests. In **Project D**, all children took part in the development of a quiz game, combining history and Finnish language lessons. Ten older children took also part in coding the game and six younger children tested the game, three older children arranging the tests for them.

3.2 Data analysis

When analysing our data, we went through all the extensive documentation produced in the four projects, selecting data relevant for this study, and processed the material through content analysis. We recognized all statements of successful value creation for children, either created for themselves ("what did I get out of this project") or for the group of children ("what did I do to help others to get something out of the project"). We

primarily looked at the created value as reported by children themselves, e.g., children reporting what they had learned, what was fun in the project, or what they did in order to complete their own team's task. As secondary information, we examined value created for children as observed or described by teachers and designers/researchers, e.g., a teacher reporting about children's learning or what they seemed to have enjoyed.

In the first phase of analysis, the identification of successful value creation instances was done separately for each individual project, producing a document that included all relevant statements from the data. In the second phase, these findings were combined to form an overall understanding. In the third phase, the Schwartz universal values and the value types [45] were each discussed thoroughly among the analysts to act as an inspiration for novel findings from the data. In a collaborative data analysis session, we used the value types as a sensitizing device. We presented and discussed each statement of successful value creation and considered them in relation to the universal values: Is the statement a valid finding and which value type(s) does it correspond with? In many cases, the same statement fit more than one value type. At the same time, we discussed what these findings meant regarding the roles that children had adopted in the design exercises. The overall findings emerged in this data-driven manner through iteratively building, contesting, and refining the emerging role set. The process continued until all the statements of successful value creation found from the data had been examined in a similar manner.

In the fourth phase, the successful value creation evidence found in the data was captured into a set of archetypal 'roles' which the children adopted during the design exercises. Each role was based on evidence from multiple instances in the data and characterized in a way that tries to capture the involved variety while preserving the integrity of the role. The roles illustrate the motivational characteristics of children and how this relates to successful value creation in the examined cases. An example of successful value creation instance and 'converting' that to an archetypal role is the role of the Team Worker (in more detail below), related to children who reported, e.g., taking responsibility for the team work and advising other team members, therefore creating value for the whole team. When looking at that value creation through the lens of the universal values [45], the 'Benevolence' value type was clearly related and the role the children adopted in the process was well depicted in the archetype of a team worker. The creation of value can both influence and result in taking certain roles. A child who already appreciates creative freedom, for example, is more predisposed to take the role of an Artist (see below), which in turn feeds the value of Self-direction that is associated with this role. On the other hand, if a project setting results in creating the value of Self-direction for a child, they may take the corresponding role without such predisposition. Different parts of the project may create different value, resulting in changing roles; the same child can take the role of a Team Worker when working with their friends, but the role of an Underachiever if placed in an unfamiliar group, for example.

Finally, the three basic motivational needs identified in SDT (Autonomy, Competence, and Relatedness) [7] were applied to the roles to consider further how the created value and motivation of the participants were linked. For example, the role of the Team Worker and the needs of Relatedness and Competence may be linked (see below) as working in a team may fulfil the need for Relatedness and receiving favourable reactions to one's efforts in a team may fulfil the need for Competence.

4 Empirical insights

In the following, we present our empirical findings. In our projects, children were assigned the roles of testers, informants, and design partners [9]. All the children were also automatically in a learner role, as the projects were conducted at schools and were combined with the children's daily school routines; they had an explicit aim of giving children opportunities to learn technology design related skills.

However, in addition to these assigned roles, the children themselves adopted roles not limited to the ones described by Druin [9]. Utilising the theoretical lens of universal values [45], we were able to identify ten different roles, described below, that resulted from value creation: Eight where value was successfully created (Figure 3), and two where it was not (***cursive*** in Figure 3). These roles were not stable; the same child could take several different ones in the same project and even in the same sentence in the data, and the roles often overlapped each other. As one teacher said: *Some of the groups are apathetic, can't be bothered, […] but the first reaction may not last and their attitude can change.* The chosen role affected the way the children acted in a group, what parts of the work they enjoyed, how hard they worked, and how they rated their own work.

Figure 3. Archetypal roles of children identified when looking the successful value creation in a design process through Schwartz's [45] universal values.

The description of each role is based on our data and the analysis of it. Statements from our data reflecting successful value creation are used to picture the roles. Even though some of the statements can be related to several roles, they are used here to illustrate only one role specifically.

4.1 The Team Worker

The **Team Worker** role is related to the value type **Benevolence**. The Team Workers get enjoyment from making a contribution that is appreciated by others. They are ready to help the other team members and value their contributions and feelings. By taking this role, it is possible to fulfil the needs for both Relatedness and Competence [7]: Relatedness by focusing on team work and competence by receiving favourable reactions to one's efforts.

Team work is expected from children at school, so it is quite natural that such a role emerged from the data. Children who adopted this role reported that they, e.g., learned to take responsibility of the whole team's work and that they helped and advised other group members. In the words of one girl: *I learned [...] to take*

responsibility, because although you could freely make the game, it was group's responsibility to finish by the deadline. A boy also reported that he *tried to help and advise the other group members*. Children sometimes coordinated their work and shared their tasks, working in pairs, to get everything done. They also learned *group spirit*. Some even brought up the pleasure of others as something valuable for them. When asked about the nicest thing in the project, a boy brought up testing the game with other pupils, as *it was nice to see the result of your own work and to see others enjoying it.*

4.2 The Achiever

The **Achiever** role is related to the value types **Conformity** and **Achievement**. The Achievers conform to the rules and expectations set in the school context: They do what is asked for and expected of them. They take responsibility of their work - or even the whole group's work - and regard their own effort as well as the result as important. This role can fulfill the underlying need for Competence due to the focus on one's own achievements. Sticking to the known expectations and working hard can also help in meeting the need for Relatedness if it results in favorable treatment from one's supervisors or peers.

The children who adopted this role positively described their own input to the group work. One girl, who self-evaluated her work as 9 on the scale of 4-10, said: *I always did my best, and was all the time doing something for the completion of the game*. Another pupil described his work as *[doing] the given tasks with care*, self-evaluating his work as high as 9,5 (on a scale of 4-10). One boy even reported that he *did most of the work*, taking responsibility in a way similar to the Team Worker but more focused on his own contribution.

4.3 The Artist

The **Artist** role is related to the value type **Self-direction**. The Artists get enjoyment from being creative and doing things their own way: They appreciate the possibilities for creativity, inventions, and freedom of expression. Taking this role can fulfill the need for Autonomy, as freedom and self-direction are its defining characteristics in the data.

These children reported that the best thing in the project was *creative work*. *Expressing oneself* was also mentioned, and being able to do one's own job freely brought satisfaction: *You can make/invent something by yourself and bring that forth*. Another child reported similarly: *Freedom to do things (…) because the drawings and so on could look like you, and you could freely do your own job*.

4.4 The Adventurer

The **Adventurer** role is related to the value type **Stimulation**. The Adventurers appreciate the changes and unfamiliar opportunities of a project, and enjoy doing new things. This role might fulfil the need for Autonomy, especially if it results in taking an active role in the project. Our data did not give clear indications of which motivational needs were linked here, however.

This archetype was quite common among the pupils: Many children reported that they especially enjoyed the change and variation to the normal school routines, and that it was the best thing in the whole project. One boy told that *doing this kind of project is fun and brings nice variety, especially to studying Finnish.* Several pupils also mentioned *visiting University* as the best thing in the project. A teacher reported that *the pupils enjoyed that the classes were different from normal and they had a possibility to work with new people. Especially the day at the University was very interesting.*

4.5 The Socializer

The **Socializer** role is related to the value type **Hedonism**. The Socializers appreciate the social opportunities of a project and get enjoyment from working with their friends. Quite like a team worker, they regard the input and opinions of other group members as important – but more for the social rewards. As such, this role answers to the need for Relatedness.

This role was also clearly seen in the data. The nicest thing in the whole project for several children was *group work* and *working with friends.* They also liked the possibility to *choose the group members by themselves*. They enjoyed seeing what other children had done and considered carefully what other children might think of their work, as was told in a master's thesis: *The messages written by other children interested [the children] and made them laugh. Contents of the message of their own was paid much interest and it was pondered together.*

4.6 The Pleasure Seeker

The **Pleasure Seeker** role is related to the value type **Hedonism.** To the Pleasure Seekers, the value of a project is that it fits their personal interests, which can result in strong intrinsic motivation with certain parts of the project. This could fulfil the need for both Competence or Autonomy: The children are more likely to be good at things they are already interested in, while choosing to focus on the enjoyable parts is an autonomous choice

This role was evident in the game development related projects. Some children reported that they enjoyed in the project most the possibility to *play games* or do something related to *game design* because they already liked to play games. One boy said: *I am interested [in the project] a bit because I like to play games myself.* Similarly, for one girl playing games was the most appreciated part of the project: *What should have been more in the project? Playing games.*

4.7 The Inspired

The **Inspired** role is related to the value type **Achievement**. This role is the result of a project creating new aspirations and a strong intrinsic motivation to pursue certain goals. By taking this role the need for Autonomy can be fulfilled by forming new goals and, as an extension, making decisions about one's life.

Some children became so interested in game design during the project that they started considering the Information Technology field for their future profession. This showed, e.g., as a keen interest in programming, *searching for tutorials,* and *creating games based on those on my free time* as well as considerations of *studies of game making in the future*, as one girl reported in an interview. Game design was *fun and challenging,* reported a boy. Children also noticed their own learning, e.g., when conducting game evaluations with younger children, as they *learned to focus on different things more and more* in the series of tests, as one of the children arranging tests told.

4.8 The Leader

The **Leader** role is related to the value type **Power**. The Leaders appreciate situations where they can wield power and act as decision-makers. As a Leader, one can fulfil the need for Competence and Autonomy by controlling both the outcome of one's own as well as of others' work. There is an unsavoury side to this role as well: When connected to a lack of **Benevolence** it can lead to unfavourable behaviour toward other group members, possibly making them feel less autonomous by taking too much control.

For example, one girl described how she learned in the project *to give clear instructions to other group members* and how she *and Ellen made most of the decisions*. Having the power to make decisions clearly

attracted children, as one boy described: *At first, I had a consideration whether we are just given instructions [for what to do] or can we affect [the game design] by ourselves*. On the flipside, Leader tendencies can be a negative influence if used to twist group dynamics. In one of the projects there was evidence of bullying disguised as democracy, as the input of a certain child was constantly blocked by voting on every decision, as reported in field notes from the project: *One child had good ideas and some mature vision of interface design but almost without exception the other group members disagreed, so the views of this child did not end up in the design. The group followed strict democracy and there was a vote on every decision.*

4.9 The Conformist

The **Conformist** role combines high **Tradition** and **Conformity** values. In this role, the children did not find, or were not allowed to find, a role where it would have been possible to achieve successful creation of the **Self-Direction** value. This archetype is the opposite of an **Adventurer** or an **Artist**, who actively seek new opportunities and experiences. The Conformists want to do things in ways they have been done before, and can be afraid of trying things on their own instead of being guided. A Conformist can aim to fulfil their need for Relatedness by sticking to known patterns, but the Autonomy need may remain unfulfilled.

One teacher saw that certain children were somewhat hesitant towards change and that they might be rather searching for comfort in the safe and familiar things: *For some children, this kind of projects may be challenging, it's not familiar and safe, [not] feeding knowledge to the pupils [as it usually is]*. One child expressed dislike at the change in routine, stating that *what was bad in the project [was that] there were no Finnish language lessons.* Taking the role of an Artist was sometimes challenging, as the same teacher described, possibly because it is sometimes different from the normal way of working at the school: *Some [of them] can experience it as difficult – creativity and self-imposed and active way of working, it can be challenging.*

4.10 The Underachiever

In the **Underachiever** role, **Hedonism** value is high. In this role, the children did not find, or were not allowed to find, a role where it would have been possible to achieve successful creation of the **Achievement** value. This is the opposite of the **Achiever** role. The Underachievers have low intrinsic motivation and they are not very interested in the project at hand. Underachievers might not concentrate well and their attitude can be a bit reckless or rebellious, as they appreciate having an easy time more than they appreciate doing proper work. The need for Autonomy could be met by, e.g., rebellious behavior, but the poor work results can leave the need for competence unfulfilled.

The children who adopted this role described their working in more negative terms, e.g., *just fine to my mind but sometimes not managing to concentrate*. When considering what could be done differently if the project was started anew, another boy reported that he would *concentrate better*. These pupils gave themselves lower grades: One boy gave a grade 7 with a comment: *even though sometimes it went bad, but to my mind I worked also well*. Several pupils mentioned that the best thing about the project was that *there were no Finnish language lessons*, and one pupil brought up *shorter school days*. The teachers' comments also indicate the existence of this archetype in the classroom: *Most of the pupils were genuinely interested in the project. There are also pupils whose commitment for the work in general is quite weak. These pupils' 'match fatigue' started to show pretty soon after the first crush … The challenge from the teacher's perspective are pupils whose perseverance does not remain sufficient until the end of the project.*

5 Concluding discussion

In this study, we wanted to understand in more depth what kind of roles children have in such a technology design process where children's learning is the main goal of the process (see [19]), particularly, what kind of roles children adopt by themselves during the process. We chose a value creation perspective to see in what roles the children were successful in value creation and thus motivated to participate. We analyzed the empirical data from our four projects utilizing Schwartz's [45] model of universal values as a theoretical lens, which helped us to extract archetypal roles of children participating in technology design process. We identified ten different archetypal roles children adopted during our projects, eight with successful value creation (the Team Worker, the Achiever, the Artist, the Adventurer, the Socializer, the Pleasure Seeker, the Inspired, and the Leader) and two where the value creation did not happen (the Conformist and the Underachiever) (Table 2). These results show that in addition to the roles defined by adults for children in technology design process (e.g. [2, 9, 39]), children adopt various roles *in situ* by themselves. Roles of the Team Worker, the Adventurer, the Artist, and the Achiever were the most commonly adopted roles among the children. This may be related to the Finnish school context that possibly affords those roles; a different analysis would be needed to understand this better. In addition, we examined the motivational characteristics of each role through the lens of Self-Determination Theory (SDT) [7] and identified which basic motivational needs (Relatedness, Competence, and Autonomy) adopting a certain role can possibly fulfil or leave unfulfilled.

Archetypal role	**Related universal values**	**Related motivational need**	**Description of the role**
The Team Worker	Benevolence	Relatedness Competence	"I'm doing my share for the team."
The Achiever	Conformity Achievement	Competence	"Working hard leads to great results."
The Artist	Self-direction	Autonomy	"An opportunity to express myself."
The Adventurer	Stimulation	Autonomy	"I love new experiences."
The Inspired	Achievement	Autonomy	"I didn't expect this to be so interesting!"
The Socializer	Hedonism	Relatedness	"It's fun to do projects with friends."
The Pleasure Seeker	Hedonism	Competence Autonomy	"When do we get to the part I like?"
The Leader	Power	Autonomy Competence	"This is how we will proceed."
The Conformist	Tradition *Self-Direction*	*Autonomy*	"Can we do things the way we've always done?"
The Underachiever	Hedonism *Achievement*	*Competence*	"When do we get to go home?"

Table 2. Archetypal roles of children. Text in *cursive* indicates that the value is not being created or the need is not being fulfilled.

We have examined value creation in projects aiming at teaching children design related skills. Children's learning has been a central value in the CCI community for long [56], and children's learning of design skills has also aroused interest within the community (e.g. [3, 49]). We maintain that at least some of the roles identified in the current study can definitely be found from other projects as well, particularly ones conducted in the school context, but depending on the project goals and what kind of value it succeeds to

create for its participants, some of the roles very likely differ as different value creation processes emerge and therefore also different roles. Naturally, similar type of findings as ours are likely to appear in projects of similar nature and with similar goals. We also argue that while all of our participants were children, the value creation approach is not limited to be used only children but is applicable to adults as well. We suggest value creation process approach and use of the Role-based Value Creation Analysis method (R-VCA), discussed later, for researchers and practitioners interested in empowering and motivating design process participants.

5.1 Roles of children in design projects

Our findings indicate that children's roles in technology design are much more various and subtle than the existing models suggest (cf. [9]). The roles identified in this study can be seen as complementary to the ones identified by Druin (a user, a tester, an informant, and a design partner) [9], which focus on the child's role in relation to technology design. We show that in addition to roles directly related to technology and design, one can identify motivation and value driven roles for children in technology design process, indicating reasons why children behave the way they do and what they derive out of that. Interesting question concerns the emergence of these roles. In line with Iivari and colleagues [22], we maintain that children, when given an equal task assignment, still may adopt a number of different kind of roles, the process being shaped by their background knowledge and experiences as well as by *in situ* interactions and relationships (see [46] and [33] about participants' historical bodies and interaction order between them shaping the results in design projects). The role adoption may be shaped by children's genuine interest in the arts, technology, or gaming, or it may be influenced by their attitude and approach towards schoolwork or situation in general. Children's personalities as well as their relationships to other children as well as adults present *in situ* may also be shaping this.

The children also smoothly switch between different roles. When describing their experiences in the project, different roles could be identified even from one sentence alone. That is natural for us as human beings as we construct our identities continuously (see [12] and cf. also [22] about children taking different subject positions). Naturally, children can occupy several of these roles in a single design session; however, one can still assume that there are more prominent ones for a certain child. Moreover, some of the roles are in clear contrast with each other, in which case they likely are not adopted by one and the same child.

5.2 Use of value creation approach

When researchers want to better understand the emergence and adoption of children's roles as well as roles' part in defining children's motivation, we recommend utilizing the value creation lens and, if applicable, the Role-based Value Creation Analysis method (R-VCA) presented in this paper. Recognizing the roles that result from value creation can help examine what motivational needs might be left unmet, and what kind of value creation should be supported in order to fulfil those needs. This can be helpful in deciding how to approach children who appear unmotivated.

To us, the value creation lens made it possible to focus on what children themselves considered as being valuable – of worth – in the project, and how it motivated their participation. It also provided a tool for identifying general settings where children could successfully participate in the technology design process, i.e., to create value for themselves through active participation. Overall, this lens enabled us to appreciate the children's self-adopted roles, not the ones given or assumed by researchers or teachers – although we do acknowledge that all participants in any social action are shaping the roles each participant adopts (see also [22, 46]). The value creation lens guided us to examine value creation among children as a subjective experience [42], appreciating each individual child's own perspective. The ten universal values [45] helped us to examine the created value, group the value instances, and recognize underlying similarities and differences, and therefore to recognize archetypes of the value-based roles of children.

Figure 4. R-VCA method – Role-based Value Creation Analysis.

When doing value creation analysis of existing data utilising Schwartz [45] universal values, the following five-step process of Role-based Value Creation Analysis (R-VCA) method can be followed (Figure 4):

1. **Prepare.** Familiarize yourself with the Schwartz [45] value types and their descriptions. Check that your data comes from situations with high experimental realism, containing information of the participants' reactions (e.g. video data) and the participants reporting directly their own experiences. The value experience needs to be anchored to a real-life situation, not to a laboratory experiment, as contextual parameters have a strong effect on subjectively experienced value.

2. **Analyse.** Collect from your data with content analysis all occasions where a) the participants self-report successful value creation for themselves or for others (examples: having fun, learning something, helping others, using creativity), or b) some other participant reports of successful value creation for other participants (examples: a teacher tells what children had learnt or describes how children seemed to have fun). The occasions can vary from single sentences related to fleeting moments in time to understanding of even whole projects.

3. **Compare.** Consider which components of the Schwartz value model each occasion corresponds to; it can correspond to more than one. Ask yourself what kind of value is created for either the persons themselves or other people and then consider which value types that could be related to. Examples: using one's creativity can be linked to Self-direction, or enjoyment of working in a group of friends can be linked to Benevolence or Hedonism.

   You can end the analysis in this phase if you are only interested in the generated value in general. This information can be helpful, for example, in interpreting why the project had produced certain kinds of results.

   If you are interested in what kind of roles the participants have adopted, continue to the next phase.

4. **Define roles.** Consider in what role(s) it is possible in the given context to create certain kind of value that bears resemblance to the Schwartz value types and create a name and a description for the role, similarly as in personas used in user experience design (see e.g. [13]). An example from our data: Self-direction was one of the value types we found. In the role of the Artist it is possible to create Self-direction value; the Artists have a freedom to invent new things and choose how they want to express their thoughts and ideas. Artistic expression of oneself was also specifically mentioned in our data.

   You can end the analysis in this phase if the adopted roles are your interest. This information can be used, for example, to get a deeper understanding of the participants' subjective experience and their identity construction during the project as well as for deciding how to approach participants who appear unmotivated

   If you want to encourage certain roles in the future, continue to the next phase.

5. **Apply.** Different roles and related guidelines can be suggested to the participants if those are seen as useful from value creation point of view. See below for a more detailed discussion of this. It is also useful to consider which basic motivational needs identified in SDT (Autonomy, Competence,

Relatedness) [7] need to be fulfilled in order to encourage said roles and then try to set the environment so that it helps in fulfilling those needs. This is particularly important if learning is in the focus, as motivation and learning are strongly related [30]. For example, in an environment where Autonomy is encouraged, common roles could be the Artist, the Adventurer, and the Pleasure Seeker, as those roles are tied to the values closely linked to Autonomy: Self-Direction, Stimulation, and Hedonism. Discouraging Autonomy, on the other hand, could result in a lot of Conformists, who are less likely to offer new ideas or explore the full possibilities of a project.

5.3 Value-creation approach in different phases of a project

By focusing on the subjective experience of value [42] we accept the fact that value is contextual. It needs to be interpreted and understood in context, and it always changes with time [23]. Therefore, when aiming to understand value-based roles, we need to take into account their temporal nature. The value experiences in the beginning of the design process might be different from those reported after the process has finished [23]. The design process itself can – either intentionally or unintentionally – affect how the experienced value will develop during it. Especially when design is intertwined with the process of learning, it is natural for the process to unfold as learning progresses and for the participants' subjective experience of value to develop as skills and knowledge about the topic increases.

The value creation approach can be taken into use already when **planning a project** by examining what value expectations the participants have, or, as Isomursu et al. [24] suggest, by identifying relevant values and modelling the value priorities of different user groups, and, by extension, making predictions about what kind of an approach could motivate them. This alone could guide the selection of suitable methodology in order to direct the process towards creating such value for the participants that fits the value expectations of the project organizers (see [24]). Promoting certain types of behaviour can create a certain kind of value, as well as the other way around. In order to do this, one can create a setting where participants can create value through desired behaviour, or offer more opportunities for a certain type of value to be created (see Table 2 for the possible roles to use). However, we do not claim that this process can be entirely managed or directed.

The goals and value expectations of the project affect what kind of roles participants can have in the process; not only the roles that are pre-defined for them, but also the roles they can adopt themselves. Forcing participants into pre-defined roles might lead to sub-optimal results, as failure in value creation is likely to result in lack of motivation because of certain motivational needs being unfulfilled. Iivari and Kinnula [19] have examined design projects with children from this viewpoint and state that designers should consciously decide and make visible their goals and value expectations. They describe the design process as continuum: At one end children's learning is considered a valuable result in itself, and in the other end the material outcome (e.g., a new product for children's use) is what gives the process value. For example, if the goal of a project is to create a usable product, the creative freedom of the participating children might be restricted. This means that they are less able to adopt roles related to Self-direction and Power, which can result in a lack of Autonomy and, by extension, a lack of motivation. It is of course possible and even likely that they still succeed in creating some other kind of value, e.g., related to Benevolence in this case.

Our analysis shows that when allowed to find their own roles in the technology design process, children choose to adopt various roles, and are successful in value creation through those roles. We think that when researchers or practitioners are aware of the value creation process they can also try to facilitate the design process so that successful value creation can take place through different roles of participants. When choosing to work with children as, e.g., informants, it is possible to get better quality research data if children themselves are motivated to take part as they see value created for themselves and therefore choose to adopt roles that support goals of the project. The Team Worker archetype (Table 2) could be one such

kind of role. Researchers could also give children guidelines on the variety of roles they can adopt, play with, as well as make themselves. By making the roles visible to the participants, it could be possible to promote the change of, or entirely avoid, roles that appear harmful for project goals, for example, children's learning of design skills (in our data, the Underachiever and the Conformist). With an open discussion of roles, it might also be possible to inspire children's participation and arouse their interest in exploring the different available roles. The roles of Table 2 could be presented for the children as a 'toolset' from which to choose their own favourites (see also [22]), and children could even be invited to innovate alternative roles based on their own interests and dispositions. Certain things need to be considered if adopting this approach, however. It is yet an open question how understandable, interesting, or motivating children would perceive this type of toolset. It could be that the toolset is more useful for teachers or other facilitators of the learning process to support and understand various value creation conditions. One should also keep in mind that some kind of roles emerge no matter what; all the roles identified in this study emerged without any intentional effort by the adults. Additionally, it is possible for a certain role to become a stigma or a source of uncertainty for the child if they identify, or their peers identify them, too strongly with it. It is also possible that if a child does not see value created in a project and therefore chooses to adopt a role with a value set conflicting with the project goals, they may choose, for example, the role of the Underachiever even when researchers treat them as empowered design partners.

Another interesting possibility is to analyse the situation **in the middle of the project**, to see what kind of value has been created for the participants and what kind of roles have emerged so far, and what this means for the project results. Is the created value the kind you were seeking and do you feel it is beneficial? In this phase, it can still be possible to promote certain kind of value creation and to increase participant motivation. This can be done directly by proposing the adoption of certain roles, or more subtly by influencing the setting.

When **analysing the project results**, interesting and potentially unexpected findings can be derived with this type of analytic lens as value creation, by nature, is not directly manageable in any kind of a project. As subjective experiences are dynamic, using a combination of methods before, during, and after the project [23] offers an opportunity to understand how the experience of value evolves, and how it affects the advancement of participants' role-making process.

5.4 Conclusion

This exploratory study succeeded in revealing the existence of a number of interesting roles children adopted in design process. While our participants were 9-14-year-old children, we argue that the value creation process approach and the Role-based Value Creation Analysis (R-VCA) method are applicable to other age or user groups as well. As a conclusion, we think that value creation analysis can be an important tool in finding out what empowers and motivates design process participants. This knowledge can further help in planning new projects as well as in offering new perspectives on existing research data. We hope that future research will offer a deeper understanding on how different roles relate to each other and what the precise process behind choosing one could be, as well as define and experiment with more practical applications of this approach. The questions that should next be addressed by quantitative research concern the generality and coverage of the role set.

As to the limitations of the study, it has been conducted in Finland and in other countries different value may be created and different roles for children may emerge. The application of SDT in combination with the ten values is based entirely on our own interpretation. We also wish to point out that using the universal values [45] needs a lot of interpretation and in order to utilize them, the research team should be prepared to collaboratively scrutinize the model to create a shared understanding. There is the danger of over-interpreting the results of a study as the scope of Schwartz's value model is very broad; we tried to overcome

this by discussing the results and interpretations together. It needs to be noted that we, the analysts, bring into the analysis process our own historical bodies (see [46]) as former pupils in school, current teachers at the university, and researchers with design experience and understanding, and therefore the archetypal roles identified in this study also reflect our perceptions and understanding of what the roles can or even should contain. The roles we show in the current study are also specific to the setting. With different analysts, in other settings, and with different participants, alternative roles can surely be identified and the archetypical role set expanded. Moreover, the focus of this study was in successful value creation in the context of school and learning of design skills; with a different focus, a different kind of value creation may emerge.

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