Raising Awareness of Stereotyping Through Collaborative Digital Storytelling: Design for Change with and for Children

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Raising Awareness of Stereotyping Through Collaborative Digital Storytelling: Design for Change with and for Children

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INTRODUCTION

"How can we promote a culture where being quiet, observant, thoughtful and contemplative strikes a balance with being a doer, entrepreneur, mover and shaker?". This quote from Edith Ackerman, inspires us to question the values that are often implicitly embedded in technology-mediated educational experiences, and how the design of such experiences often builds on culture-dependent and gender-related stereotypes. In addition, the quote highlights the important potential role of children as the main agents in cultural shifts, starting from being aware and acknowledging their inner beliefs and biases. From this perspective, we focus our attention on investigating ways of raising children's awareness of gender stereotypes.

The creation of gender-related norms and role models is based on social and cultural interaction [22]. Cultural artefacts such as books and media often offer a strict representation of gendered human behaviour and norms that become the basis of gender roles [38] and gender stereotypes. Although the creation of stereotypes helps very young children to understand boundaries and interact with the world [49], their perpetuation can generate a negative impact and result in inequalities for both sexes [47]. Indeed, the ways in which the internalization of negative stereotypes influence children's self-esteem and career path are well known [2]. This phenomenon is also well recognized by the United Nations and has been reported in The Global Sustainable Development Report 2019 [55], which clearly states that empowering women and promoting gender equality is crucial to accelerating sustainable development (Goal 5). Ending all forms of discrimination against women and girls is not only a basic human right, but also has a multiplier effect across all other development areas. Equal access to the educational system and resources (Goal 4) is essential to eliminating gender and wealth disparities. This disparity is also reflected in professional life, especially when it comes to male-dominated environments such as Computer Science. Gender is a major variable affecting identity and life opportunities from a young age and society has tended to have narrow definitions of what it means to be masculine or feminine. The research community has addressed this issue in multiple ways. For instance, IEEE Software recently devoted a special issue to the diversity crisis in software development [5] presenting research results and best practices for making the field of computing equitable for all. Participation conditions have to be improved by industry, open-source communities, tools, processes, products, and education frameworks. In our own work [41] we have provided examples of best practices, studies and recommendations about how to address the key challenges of attracting, retaining, encouraging, and inspiring women to pursue a career in Computer Science, aimed at the academic community, policymakers, industry and other stakeholders such as teachers and parents.

Moreover, internalizing negative stereotypes impacts on self-esteem and career path [2]; stereotypes and sexism can limit children's potential growth and development [53]. We decided to direct our attention to designing interventions that could help to mitigate the effect of negative gender roles on children's potential growth and development [53] through the production of cultural artefacts and by favoring social interactions. Despite a substantial number of studies that have addressed the issue of gender stereotyping in child development and education (e.g. [49]), less emphasis has been placed on the design of new processes and tools to attenuate stereotypical thinking in the production of digital artefacts created by children.

In our research, we look at how the collaborative production of Digital StoryTelling (DST) could help in raising children's awareness of gender stereotypes. Our work explores three main research questions:

RQ1: What type of stereotypes emerge in children's stories and how could these be detected?

RQ2: Which design concepts could be helpful to guide the design of a collaborative DST tool for raising children's awareness of gender stereotypes?

RQ3: How does the prototype developed to implement these concepts, help children to be more aware of gender stereotypes while creating collaborative DST?

In this paper, our main purpose is to give an account of the process of designing a DST tool that could: *help children to be more aware of gender stereotypes while they are creating a collaborative digital story.*

Our contribution is twofold:

- to provide knowledge on how awareness of gender stereotypes could be raised among children through the collaborative creation of DST,
- to spread insight on our approach and support the Human Computer Interaction (HCI) community in replicating it to challenge the negative effect of stereotypes.

The paper is structured as follows: we first review related work on gender stereotypes and DST. Subsequently, we describe the different phases of the project and their main outcomes. Finally, we discuss guidelines to address the design of a collaborative DST tool for raising awareness of stereotypes.

1   RELATED WORK

In what follows, we present a concise overview of the scholarly work that supports our research. It is important to mention that in the reported literature we have mostly encountered an interpretation of gender as a binary variable and, for pragmatic reasons (we worked with schools that were not open to other interpretations i.e. they were committed to the idea of gender as a binary), we took this approach in our study too. However, we are mindful that not all people identify as "female" or "male" and in future research we will expand beyond this binary distinction.

1.1   GENDER STEREOTYPE

As theoretical background, we based our research on the cognitive social learning [22] and gender-schema [44] theories according to which children actively make sense of their reality by organizing their knowledge on gender schemata which influence their attitudes and behaviours. This theoretical approach has been used in Information Systems to explain gender-related distinctions in the use of technology, e.g. [76] [39]. According to this theoretical approach, gender stereotypes and gender-related models are built through social and cultural interactions. Thus, the environment plays an important role [22] in children who, by the age of 4 or 5, begin to have a clear sense of gender boundaries [51] and stereotypes that help them to behave [49] and identify themselves as member of a group [31]. Indeed, gender attitude and behavior, as well as stereotypes, change with age [82]. These changes depend on cognitive development, cultural context, and on the social interactions that influence children's perception of their identity and the identity of others. Between 5 and 7 years old, children reach the highest peak of rigidity, in which they consolidate their beliefs and behaviors [82]. This phase is followed by another that is characterized by gender flexibility, with an open-minded attitude about gender roles [82]. Recent studies have shown how interventions during the gender flexibility phase can potentially impact on improving "gender relationships for children now as well as the adults they will later become" [79]. At the same time, early adolescence is associated with a gender intensification, with incremental "sex typing of others and of the self" [34]. At this age long-term gender bias has more influence on children's life [23]. Thus, this period is a critical window during which it is important to stimulate young people to reflect on gender-related issues.

The narrow definitions of society and the expectations created by scenarios about the appropriate behaviour of children can generate a negative impact on the child [47] and the perpetuation of stereotypes can result in disparities for both sexes. Stereotypes can be descriptive, "reflects a set of beliefs regarding the characteristics that men and women possess" [20], or prescriptive "a set of characteristics describing how men and women ought to be" [20]. The negative side of gender stereotypes perpetuated from childhood to adulthood is about creating implicit beliefs that lead to implicit attitudes.

This theoretical background highlights the importance of examining and considering the role of social interactions and cultural artefacts in creating and reproducing gender stereotypes in children. Given the strongly rooted nature of gender constructions, we are aware of the need to assume a humble perspective on the problem, as a specific intervention alone could prove not to be enough when addressing such a complex and deeply engrained way of thinking and behaving.

1.2   GENDER IN LITERATURE AND MEDIA FOR CHILDREN

Gender and its attendant social behavioural norms, is a cultural construction built on top of social interactions and gender representations in cultural artefacts. Indeed, it is "the cultural representations of gender and embodiment of gender in symbolic language and artistic productions that reproduce and legitimate gender statuses" [9]. The presence of gender stereotypes both in adult [49] and children's [46] [26] books has been extensively discussed in the literature [75]. Books are often the primary source for the presentation of societal values to the young child e.g. picture books are often populated by gender stereotypes that become the basis of gender roles [38]. Female characters are generally described as being socially skilled, and an emphasis is placed on their physical appearance [26], while male characters are portrayed as active, smart and brave in solving any kind of problem [26]. As far back as 19th century novels, gender had an impact on characters' behaviour [42]. Males were categorized as "the doers, this doing was also limited to appropriate actions; emotional, domestic, and passive actions would have been considered feminizing" [42]. The representation of gender through stereotypes has a strong influence on how children perceive themselves and on their

aspirations for future career paths [27]. Indeed, internalizing certain stereotypes impacts on self-esteem and career path [2]; furthermore, stereotypes and sexism can limit children's potential growth and development [53].

In view of evidence from the literature, we consider it extremely important to focus on children's books and stories as mediators in the process of constructing, reproducing or subverting gender stereotypes.

1.3 GENDER AND STORYTELLING

Storytelling is a primary function of human psychology and a fundamental aspect in the construction of meaning [19]. In this perspective, the production of a story for children is a way of mediating their organization of knowledge, and it follows a complex process in which the child elaborates their existing knowledge, external inputs and experiences, into new content in the shape of a story. According to the Narrative Activity Model (NAM) [29] the creation of stories starts from explorations such as direct or mediated interactions with the environment (e.g. a field trip, a book, or a movie). The process of exploration and internalization of external stimuli and their elaboration as story elements becomes particularly relevant when we talk about children: reflecting on past experiences helps children to elaborate the present and their understanding of their identity including gender. In addition to this prominent cognitive function, storytelling also has an important social and emotional role. It helps children to construct their identity and to express feelings that are otherwise too complex to describe [24]. Indeed, children's understanding of the many complexities of the world around them happens also through the creation of stories, individually or in groups, and this may affect their perception of gender stereotypes. The use of narrative to investigate gender identity has been extensively explored in social science with adults [16] as well as with children [52]. In addition, storytelling has the unique capacity to "cultivate sympathetic imagination" [61] and to allow the envisioning of the perspective of others[61]. Moreover, gender plays a role in the types of narratives that children build [57]: girls achieve a better coherence in their narrative and are "likely to focus on the links between characters in harmonious social relationships" [35] while boys tend to create "independent characters involved in conflict or aggression" [35].

The literature shows the strong potential of storytelling as a way for children to understand reality, elaborate personal experiences, cultivate sympathy, express thoughts and feelings, and envision the perspective of others by creating story characters and plot.

1.4 GENDER, COMPUTING AND DESIGN OF DIGITAL TECHNOLOGY

"Gender and computing" has been a central issue in the research community for many years [30]. In the last decades, this topic has been explored from different perspectives: female representation in computing [14], women in STEM [13], co-construction of gender and technical identities [65], virtual embodiment [6], and computing as a "masculinized activity" [58]. Moreover, the HCI community has been debating ways to improve gender inclusiveness by looking at methods and practices, e.g. [11] [21], as well as by developing software that concretely includes those values [43]. Feminist HCI [11] has provided a set of methodologies and principles (plurality, participation, self-disclosure, advocacy, and ecology) grounded in feminist theory that can guide the design. A more prescriptive approach to gender-inclusiveness in software design is provided by Burnett's work [21] with the "GenderMag" method. This approach aims at avoiding gender biases in the design of technology by the use of faceted personas and a gender-specialized Cognitive Walkthrough. When it comes to gender, children and technology, many contributions have been made regarding building initiatives to promote gender equality in: Computer Science (CS) and Science, Technology, Engineering and Mathematics (STEM) education [81], Coding [33] [78] and Making activities [59]. The underestimation of the bias in CS and STEM education and career paths has also been investigated extensively [18]. In particular, researchers raised the issue of girls' decreased interest in Information and Communication Technology (ICT) in middle and high school [83] when key decisions about future career paths happen. Justine Cassell and Henry Jenkins's work provided a deep reflection on the relationship between gender, computer games and technology and on "the movement to overcome the stereotyping that dominates the toy aisles" [25]. Also, in the area of child-robot interaction there have been investigations of "whether the perceived robot's gender" might affect the interaction between a child and a robot [86].

This background highlights the increasing importance of taking gender into account when designing and thinking in HCI. At the same time, it shows the multiple perspectives via which this topic has been approached.

1.5   DIGITAL STORYTELLING FOR CHILDREN

Children should learn that they can use computers not only as users but also as creators [7]. Thus, since the 90s, researchers have been working on digital tools to support children's storytelling [63]. StoryKit [17] allowed groups of children to create a story composed of photos, audio, text and drawings via a mobile phone. Fiabot! [66] is another tool based on the use of a mobile device that aims to facilitate the process of creating the plot of a story, defining the characters, and choosing the narrative media.

Some projects have focused on providing an interactive system to guide children through a workflow to support collaboration. For instance, Q-tales [45] is a platform for co-creating new or transforming available children's books. Moreover, ToonTastic [70] facilitated the collaborative creation of a story by using a multiple-pen display. Other projects are based on tangible interfaces and IOT. StoryMat [71] was based on a play mat that recorded the children's voices, noises, and spoken stories. POGO [29] offered an enhanced physical environment where children could use different artefacts to create the media content for their story. Similarly, Alborzi designed a story room [4], while the project StoryToy explored the use of sensors and toys to overcome the gap between "traditional toys and high-tech toys" [32]. Mobeybou, is an interactive app for use by pre-schoolers and primary school children alongside physical blocks to create multicultural narratives, with the purpose of promoting the understanding of cultural differences [81].

More related to children's identity, Marina Umaschi Bers' work was one of the first attempts regarding children exploring their identities through digital storytelling [15]. Moreover, SAGE [84] is a conversational storytelling system that has been shown to help children explore and communicate their identities by enabling them to design characters and create a story structure. Tappetina [37] is a game based on collaborative storytelling that aims to support children's understanding of characters' emotional states. Storytelling Alice [43] is a programming environment that supports the creation of 3D animated stories with social characters, with the purpose of teaching the basics of programming. A study demonstrated how the use of storytelling stimulates a higher motivation in programming in girls [43]. More recently, Rubegni's work investigated how gender stereotypes can be detected in the stories produced by children via Digital StoryTelling [68]. The authors developed an evaluation methodology made of five lenses (Role, Embodiment, Personality, Agency, and Emotion) and indicated implications for the design of a DST to stimulate children's discussion around gender-normative attitudes and behavior [68].

Inspired by these works, in our research we explored how to design a DST for children in order to stimulate their awareness of gender stereotypes.

2   RESEARCH APPROACH

The goal of the paper is to give an account of the process we followed to investigate how to raise children's awareness of gender stereotypes while creating collaborative digital stories. We present our pathway to designing, developing and evaluating a DST prototype. In addition, we aim at sharing our knowledge of the potential of collaborative DST for stimulating gender awareness in children.

The project is structured in three main phases:

1. Phase 1: Detection of stereotypes in children's multimedia stories.
2. Phase 2: Co-design of the concepts
3. Phase 3: Prototyping and Evaluation

Each project phase addresses a specific research question:
Phase 1. Detection explores RQ1: What type of stereotypes emerge in children's stories and how could these be detected?
Phase 2. Co-design aims at investigating RQ2**:** Which design concepts could be helpful to guide the design of a collaborative DST tool for raising children's awareness of gender stereotypes?
Phase 3. Prototyping and Evaluation concerns RQ3: To what extent, does the prototype, developed to implement these concepts, help children to be more aware of gender stereotypes while creating collaborative DST?

These three phases are connected to each other by a theoretical and methodological background grounded in the participatory design approach [72]. Overall, the project is based on a case study approach. In each phase we have used specific research methods according to the issues addressed and the context of the research, with each phase feeding the subsequent one. In Phase 1, Detection, we explored whether gender stereotypes are represented in DSTs created by children. Outcomes showed a large presence of gender stereotypes. In addition, a set of seven design challenges were elaborated. In Phase 2, Co-design, these

challenges were the basis for identifying design concepts with different stakeholders (adults and children). Some of the concepts produced were transformed into concrete design solutions in Phase 3, Prototyping and Evaluation, including both the development of the prototype and its assessment in a real context of use: a school. Outcomes from the assessment of the prototype in school suggested that the instantiation of the concepts could support children in raising this awareness. We also elaborated some concrete suggestions on how to design a DST tool with this purpose in mind. While phase 1 [68] and 2 [69] have been reported in other publications, this article is focused on providing an overview of the whole project and, as an original contribution, we report on the results of the prototype use by children in school.

In the following sections, we report the specific approach taken in each phase, the procedure and the main findings.

3 PHASE 1: DETECTION OF STEREOTYPES IN CHILDREN'S MULTIMEDIA STORIES.

DST is a way for children to mediate the world's construction of meaning [18], including gender identity [56], hence, the process of creating a story and the related outcome reflect the child's gender-related belief [81]. In this phase, we explored RQ1: What type of stereotypes emerged in children's stories and how could these be detected? To investigate this issue, we conducted a study in a school and built an ad hoc evaluation approach grounded in the literature.

3.1 METHODOLOGY

To answer our first research question, we ran a study with early adolescent children (11-12 years old) in a Secondary School in Switzerland. The study formed part of a larger research conducted in 2017 following 4 day-long storytelling seminars conducted by the teachers of two first-year classes of the school. In this educational system, pupils exercise storytelling as part of their curriculum. In addition, pupils had knowledge of how to create stories from previous experience in primary school. The story creation followed the workflow and approach described in [66] using an iPad^{TD}. The workflow is organised in three main steps:

I) Definition of story structure and plot;
II) Media creation and editing;
III) Sharing within the class and publication of the story.

The multimedia stories kept the fairy tale structure and were narrated using audio, text, images, video and photos. Children were grouped in teams (up to 4 each) by the teachers, with the aim of balancing their language, digital literacy, and drawing skills (as in [68]). Teachers also considered children's ability to collaborate within a group.

To analyze the produced stories, we devised an ad hoc evaluation approach made of five lenses: *Role, Embodiment, Personality, Agency,* and *Emotion* [68]. Each lens contributes to the unveiling of a specific aspect that is analysed using different metrics. Specifically, we triangulated the qualitative analysis of media, the narrative analysis of stories [38] and the psychometric analysis of text [60]. In what follows, we present the five lenses.

The Roles lens aims at identifying the relationship between a character's gender and function according to the fairy tale functions proposed by Propp [62]: Protagonist, Antagonist, Antagonist Helper, Protagonist Helper, and Magic Object.

The Embodiment lens aims at analysing how characters are described and represented through multiple formats (textual, pictorial, and audible) in the story. Specifically, it focuses on analysing the physical aspect of the characters represented in both pictorial and textual ways.

The Personality lens is about descriptions of attitude and morality [54]: data are collected on the basis of the adjectives used to describe characters' actions and beliefs.

The Agency lens focuses on understanding the level of characters' agency in the stories. This lens builds on considering agency as "the human capability to influence one's functioning and the course of events by one's actions" [10] and as a relevant variable for detecting the influence of gender-normative stereotypes on characters. To evaluate agency, two researchers independently coded the level of agency of each character in the story - from 1 (low) to 3 (high) - by looking at his/her engagement in the actions of the fairy tale. The coders based their score on the question: how much does the character give direction to the narrative? For instance, the protagonist who won a fight and moved the story to the next level received a high score (3). On the other hand, the character who had a passive behaviour received a low one (1).

The Emotion lens is concerned with the sentiments that emerged within the overall story. To evaluate this, we used a standardized psychometric analysis of the text performed by the LIWC (Linguistic Inquiry and Word Count) software [60]. This analysis assumes that the words that people use when they write, convey meaningful information about the authors' identity, as well as conveying their perception of the audience and the context within which the communication occurs. The text of the stories was analysed using an Italian dictionary. The software processed each piece of text independently and counted the number of times a stem occurred. This number was then expressed as a percentage of the total word count in the story. In this paper, we focused on accounting for emotional words and the specific presence of words expressing positive/negative emotions. This is due to the stereotype that describes girls as more emotional than boys, and favours emotionality as a female behavioural outcome. The values extracted from each story and for each emotional category were aggregated and averaged according to the group that authored it.

These five lenses are the main pillars of our approach for detecting gender stereotype elements in multimedia stories. Two coders separately conducted the analysis using these lenses. At the end of the individual assessment, they provided a final outcome by an inter-coder agreement on discrepancies. In what follows we present the outcomes of the lens analysis on multimedia stories made by children.

3.2   PHASE 1 OUTCOMES: THE DESIGN CHALLENGES
A total of 83 children (M=45, F= 38), along with three teachers acting as facilitators, participated in the study: 5 all-girl groups, 9 all-boy groups, and 10 mixed groups (for each mixed group M=2, F=2). Children produced 23 multimedia stories that were analysed using the five lenses. Stories revealed the same stereotypes as in children's books written by adults [26]. In fact, the role of the characters, their agency, the emotions expressed, and their embodiment were deeply grounded in the same gender stereotypes as those used by the authors of 19th century novels [42]. However, it was interesting to notice how our methodology allowed us to investigate how different elements of the DST process, such as, for instance, the composition and collaboration between group members and the creation of multimedia, can affect the presence of stereotypes. Through the *Role* and *Emotion lenses*, we could see how the persistence of these stereotypes was at times moderated by mixed-gender groups, who were more likely to envision a female protagonist helper, and, at the same time, were more likely to attenuate female emotionality and male aggressivity. This is known also in the literature [35]. However, the *Agency lens* showed a different trend. Male characters had strong agency in stories created by male and mixed groups. When created by female groups, the difference between female and male protagonists was less accentuated. A noteworthy exception is that of the female antagonist (the witch in traditional storytelling) who was as active as the male characters. Overall, a balanced gender presence of participants in the group did not mitigate the tendencies to represent female and male with gender-stereotyped behaviour. Similarly, through the *Personality lens*, we saw how the textual representation of characters, both in terms of attitude and morality, was strongly stereotyped, and that the gender composition of the groups had no influence on this. The *Embodiment lens* showed stereotyped representations produced by mixed and female groups. The exceptions were drawings made by male groups, where we found an evident masculine flavour even when depicting female subjects. The persistence of gender stereotyping in fairy tales narrated by early adolescents is perhaps not surprising as these tales are expected to portray stereotypical representations. Nonetheless, we believe that designing a DST tool could be a positive step towards counteracting stereotypical thinking by design.

Starting from these results and building on the knowledge derived from previous projects in which the team has been involved, e.g. [68] [66] [74], we identified a relevant design space to address stereotype awareness and distilled this into seven design challenges. Specifically: *Turn taking, Collaborative activities, Scaffolding with questions, Story recapitulation, Compliments and Encouragement, Supporting the overall understanding of the story,* and *Predefined toolbox for media mix*.

1. Turn taking. In general, across age groups and schools, we noticed how children often had a problem in collaborating in groups especially when resources were limited (e.g. using one single device (iPad[TD]) in the group). Some tended to exclude others by claiming exclusive use of the device. Thus, it is very important that children learn how to take turns when using the device to craft their stories. Having a way to help them to establish a turn taking mechanism would be helpful and would allow them all to contribute to the story more equally. Respecting turns is extremely important from our specific perspective on gender since it teaches children to respect one another regardless of gender.

2. Collaborative activities. Similar to "Turn taking", this challenge relates to the need of children to learn how to collaborate on the same story, distributing and negotiating tasks, establishing their role, etc. These

objectives are part of the school curriculum and are connected with children's self-awareness, self-determination toward the accomplishment of a task, and understanding the skill of others. Providing a good collaborative environment and collaborative activities is fundamental for expanding the opportunity for cognitive and social development and attenuating gender-typed behaviour [48].

3. Scaffolding with questions. During our extensive experience in class we have noticed how sometimes children struggle with how to create a story and how they benefited from the help of their teacher. In these cases, teachers would not provide a straightforward solution but would instead use questions to stimulate children to find their own solution e.g. "Why has the king been saved by the main character?". This helps children to reflect on the story elements including those related to gender.

4. Story recapitulation. Making children go over the story and then summarize it helps in improving the flow of the plot and the consistency of the characters. Repeating the story can support a better understanding of the plot and character behaviour, which are often biased by gender stereotypes.

5. Compliments and Encouragement. Children need positive reinforcement in order to understand that they are going in the right direction and should explore it further. This challenge is particularly relevant considering that girls sometimes can have low self-esteem.

6. Supporting the overall understanding of the story. This challenge is related to the need of children to have an overview of the story. Children grouped in teams sometimes work in parallel and independently on a specific aspect or part of the story. Therefore, providing a way to have an overview of the whole story, beginning, development and ending, would be highly beneficial. As in challenge 4, an overview can be helpful for reflecting on the overall story dynamics in terms of gender stereotype issues.

7. Predefined toolbox for media mix. Children enjoyed using the multimedia; in particular, audio inspired them when creating the stories. Moreover, children also liked to mix the media i.e. to create a talking image or to draw a picture. Providing a set of tools to facilitate the production of these media would help children to create content easily and to be inspired to create new combinations of media and new parts of the story. This is particularly relevant to supporting children's discussion about characters' gender features e.g. physical representation (including voices) as well as their attitudes and behaviour.

These seven design challenges fed into the phase 2 focused on **Co-design of the concepts.**

4   PHASE 2: CO-DESIGN OF THE CONCEPTS
In order to answer RQ2 - *Which design concepts could be helpful to guide the design of a collaborative DST tool for raising children's awareness of gender stereotypes?* - we implemented a Participatory Design-inspired process in which we involved relevant stakeholders (adults and children) [69] to envision potential design solutions.

4.1   METHODOLOGY
We used Participatory Design (PD) [72] and Creative Problem Solving (CPS) [40] as the main approaches in this phase. The PD approach aimed at including stakeholders' voices in the process of investigating the problem space and to concretize ideas. To this end, we organized three workshops during which we asked participants (adults and children) to brainstorm about potential solutions to the identified challenges and to describe their ideas in terms of scenarios [36]. The workshops were based on the CPS [40], which considers that the proper problem solution can be achieved within a dynamic process that stimulates creative thinking by alternating divergent phases and convergent phases.

In order to support the generation of ideas during workshops we provided a **toolbox** made of: **Personas** [3] and the **Design challenges** resulting from Phase 1. We built 9 fully developed personas based on real data gathered from interviews and observations that we ran during the first phase of this project [68] as well as from contributions collected in our past projects, e.g. [66] [67]. Specifically, we developed three personas for the teacher stakeholders (two female and one male) and six for children: three female and three male (aged 11-12). For each persona, we include personality and emotions as these are crucial in determining users' awareness and possible reactions to gender stereotypes. At the same time, for each of them, we addressed explicitly the level of awareness of gender stereotypes. During the workshops, these different personas were presented in an easy-to-consult format on a card with an evocative image and a description of the persona's profile. This format was chosen for easy use by both children and adults (Figure 1).

Amy: **Female student affected by gender stereotype without being aware**

Amy is 11 years old she is at the first year of the secondary school and she loves mathematics but her best friends (all girls) love literature and other humanities topics, thus she pretends not to like math. She wants to be a language teacher in primary school, she believes that no one influenced her in this decision.

Figure 1 Example of a child persona card

Alongside Personas, we presented the *Design challenges* identified in Phase 1 (i.e. *Turn taking, Collaborative activities, Scaffolding with questions, Story recapitulation, Compliments and Encouragement, Supporting the overall understanding of the story*, and *Predefined toolbox for media mix)*. Each challenge was represented in a card (example of three cards in Figure 2) and explained to participants at the beginning of the workshop.

Figure 2 Example of three Design challenge cards.

Three different workshops were conducted over a period of two months: we involved interdisciplinary and intergenerational members, specifically:

- 1st workshop: 22 adults (F=12, M=10), experts in: gender studies and ICT (6), learning. (5), child-computer interaction (6), and software development (5),
- 2nd workshop: 6 teachers (F=6); from primary (3) and secondary (3) schools,
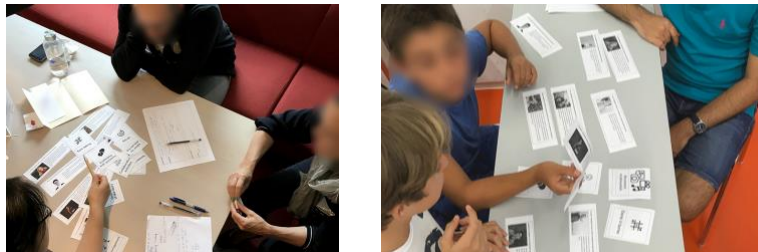- 3rd workshop: 9 children aged 11-12 (F=5, M=4) in the first year of secondary school.

Figure 3 Picture from W3: children and HCI researchers.

4.2 PHASE 2 OUTCOMES: CONCEPTS

Overall, stakeholders produced 50 ideas. Each idea was presented within a scenario in which the personas and challenges used were indicated. Those initial ideas were further elaborated by the researchers. During this process we selected, evaluated, merged, and modified the proposed ideas to turn them into solid design concepts [69]. Once all the concepts were developed, the researchers organized them using the Card Sorting technique [12] and clustered similar concepts into five broader dimensions: *Inclusive Collaboration, Resource sharing and division of work, Role models, Empathetic reflection,* and *Scaffolding the workflow*. This categorization helped to refine the concepts and to strengthen their connection with the related literature.

1. Inclusive Collaboration. Gender and connected norms, are developed on top of social interactions [9]. Thus, the production of digital storytelling in groups can stimulate children to discuss gender stereotypes and to mitigate gender-specific behaviours and attitudes. Indeed, the content of the narrative can be determined by the composition of the group [57], for instance, girls focus more on characters' relationships, while boys are more inclined to produce stories about conflict or aggression in which characters have an independent nature [35]. This can be solved by providing a more inclusive environment in which the collaboration between children is stimulated in the direction of including their perspectives in the creation of the story. The tool needs to ensure that each child feels comfortable about contributing to the story and about bringing their

own ideas without fear of being excluded or criticized. Individual contributions should be valued and a mechanism to combine them all should be in place.

C1. Forbidden words. This is a list of words, decided by teachers, that children have to avoid using in the creation of the story. These words could be connected to a different semantic field and have the purpose of preventing children from creating a story focused on violence. This can be particularly useful in the case of mixed gender groups and, for instance, in helping to prevent boys taking the lead and creating a story based on conflict or aggression.

C2. Inspiring words. Counter to C1, these types of words are recommended for inclusion. The purpose is to stimulate a narrative about topics that, for instance, could be focused on characters' relationships. These words can be decided by the teachers in accordance with a specific educational purpose e.g. increasing empathy.

2. Resource sharing and division of work. Social psychology research has clearly demonstrated that resource scarcity is a powerful predictor of conflicts [1] and needs to be properly considered in the design of artefacts by monitoring individual contribution (e.g. [8]). On the other hand, in a team, the obligation of sharing resources can lead to improved negotiation skills as well as distribution of tasks within the group. This can support a better understanding of individual children's abilities, can overcome gender-related models [22], and can break the cycle of creating negative implicit belief that leads to implicit attitudes regarding the use of technology. Promoting individual engagement allows children to share control and responsibility over the creation of more inclusive stories.

C3. Fairytale market. This market is a space where children can present and exchange characters' sketches. Each child creates drawings representing story characters, which they will present and ask to exchange with their peers. This will happen before the creation of the plot, with the purpose of allowing children to show their drawing abilities, starting to envision the plot of the story by collecting the characters, and, for those that are not good at drawing, to have attractive character images for their stories. The exchange process can stimulate children to recognize and appreciate the abilities of their peers and to take this into account when they distribute the work within the team.

C4. Distribution of story parts. The plot of a story is divided in different parts: introduction, conflict, resolution and end. Children do not contribute equally to the creation of the story parts, however, ideally they could participate equally in finalising the story. When the plot of the story is ready, the tool divides the text into sequences and assigns them randomly to group members. Children, individually or in pairs, revise the text and create/add multimedia elements. This will allow the story to be enriched by children's different perspectives in relation to gender.

3. Role models. Role models are important for child development, particularly with regard to the definition of their gender identity [85]. Positive examples are instrumental in breaking negative stereotypes and encouraging alternative ways of thinking and behaving. Accordingly, an inclusive DST tool should provide inspirational material showcasing a balanced set of male and female achievements and ensuring that no implicit bias is contained therein. In order to inspire children, the system should provide a rich variety of materials.

C5. Breaking stereotypes. Allowing children to consider different alternatives to the usual roles by offering them a number of counter role model associations. These examples should be provided during the plot ideation in order to inspire children and stimulate parallel and divergent thinking.

C6. Trompe l'oeil. Children play the "what if?" game for each character of the story selected by the system. Children will be asked to change the gender of each character and to reflect on how this affects the story. This aims to encourage children to change their perspective by looking at the characters' limits and opportunities, and the potential for growing their role in the story that might be inhibited by the biases of existing stereotypes.

4. Empathetic reflection. Empathy is the fundamental human ability to engage with and understand the feelings and perspectives of others [28]. This ability has the potential to encourage pro-social behaviour to moderate conflicts and antisocial attitudes. Empathy brings individual identity to the forefront of the attention, and may therefore decrease the negative effects of stereotypical thinking [74]. Reflection is linked to the development of critical thinking and is conducive to learning [31]. Thus, during each stage of the story-making process there should be moments for reflecting on character stereotypes and on the overall plot.

C7. Character emotions. The tool asks children to reflect and provide details of characters' emotions with the purpose of making children more aware of their feelings. Understanding characters' feelings could be the first step for children in developing empathetic behaviour that could lead to raising their awareness of stereotypical thinking towards characters.

C8. Role of characters in the story. As with C7**,** the system asks children about the role of the character in the story and the influence of the character's gender on the plot development. This will also make children reflect on characters' agency in the story.

5. Scaffolding the workflow. While children are the active players, it is important to provide them with help and with different forms of scaffolding that are suitable for general and specific needs. In particular, to flag if the story is imbalanced in terms of the presence of gender stereotypes in the story.

C9. Flagging the imbalance. If during character definition, the system detects strong imbalance towards one gender, a warning is issued, and authors have to address it if they want to continue. The same alert system should be in place to highlight characters' gender stereotypes when developing the plot e.g. the system will issue a warning if males are active and females are passive.

In Phase 3 we used these dimensions and concepts to develop a prototype that was tested in schools.

5   PHASE 3: PROTOTYPING AND EVALUATION

In this phase, we built a functioning prototype to explore how the concretization of the concepts into specific design solutions could support children's awareness of stereotypes. The key question (RQ3) of this phase is: How does the prototype developed to implement these concepts, help children to be more aware of gender stereotypes while creating collaborative DST? To develop the prototype, we selected five concepts to be implemented:

1. *Forbidden words,* a list of words, decided by teachers, that children have to avoid using in the story,
2. *Inspiring words,* a set of words, decided by teachers, that are recommended to be used by children,
3. *Breaking stereotypes,* a series of not-stereotyped inspirational characters,
4. *Trompe l'oeil* is based on the "what if?" game for each character of the story selected by the system. Children will be asked to change the gender of each character and to reflect on how this affects the story.
5. *Stimulating inquiries,* under this label we have collapsed two concepts (7 and 8) the system pushes questions to children in order to make them reflect on the characters' feelings (*C7 Character emotions*) and role in the story (*C8 Role of characters in the story).*

The selection of these five concepts over the others was opportunistic and mainly based on our interests in first investigating specific aspects such as inclusive collaboration, role models and empathetic reflection. In addition, on the methodological side, we wanted to keep the number of variables relatively low in order to have a better understanding of their interactions.

5.1   THE PROTOTYPE

To understand the impact of our intervention, we built two versions of the same prototype. One version, that we will call "gender sensitive", has been designed with the intention of promoting children's awareness of gender stereotypes in their stories. The other one, the "gender neutral", aims at not having any particular impact on children's representations of gender.

The prototype is designed as a mash up of digital technology and paper such as: a website, paper strips and an application for multimedia presentation (i.e. Keynotes). The website shows a sequence of pages that guide children on the storytelling workflow for shaping characters and creating the story plot. Paper strips were used for stimulating reflection during the creation of the plot. The multimedia tool was used to frame the storytelling items (text, images, audio, video, etc.), to build the stories and to deliver these to teachers, researchers, and peers.

The first page of the website showed children the *forbidden words* (C1) i.e. those that they could not use in the creation of the story. In the gender sensitive prototype the forbidden words are: war, death, blood, weapons. Teachers chose these words on the basis of their experience in supporting more fruitful and fair discussion among group members. They considered that when children used any of these words, the story typically tended to be dominated by masculine themes even if there were females in the group. Thus, by forcing the group to not use these words we expected to reduce the level of masculinity in the story and to attenuate this effect on the stereotypical elements of the representation of the characters. In a similar way, teachers also selected forbidden words for the gender neutral prototype such as: home, tree, book and swing.

Following the same approach, in the second step, children were presented with *inspiring words* (C2), those that they are invited to use. In this case, for the gender sensitive prototype, the teachers proposed words that could evoke positivity, such as: hope, unity, pride, accomplishment, and joy. Instead, in the gender neutral version, we used words that we expected to neither have a positive or a negative effect such as: growing, simplicity, tradition, inspiration, and normality.

The third step embeds the concept *breaking the stereotypes* (C5). From the workshops it emerged that it was important to provide some fairy tale characters samples and role models. We provided 9 role models shown as cards: 3 animals, 3 men, and 3 women. The types of characters differed according to the version of prototype. In the "gender sensitive" prototype we had non-stereotyped characters e.g. the lion who cannot make a decision, the prince who sacrifices his voice to save his sisters, the queen who travels far away to fight against the enemies and protect the kingdom. Our main objective was to push the children to think outside of the box and to inspire them in creating characters that are outside of stereotypical thinking. In the neutral version, we provided a list of characters that represent typical stereotypical thinking e. g. the lion is the king, the prince solved the seven riddles and freed the princess, the princess asked her father to find her a husband. These examples have been collected from the stories that children built in the first phase of the project. Children can flip the card to read the description of the role model behind. The idea is to inspire them while they are creating the plot and shaping characters.
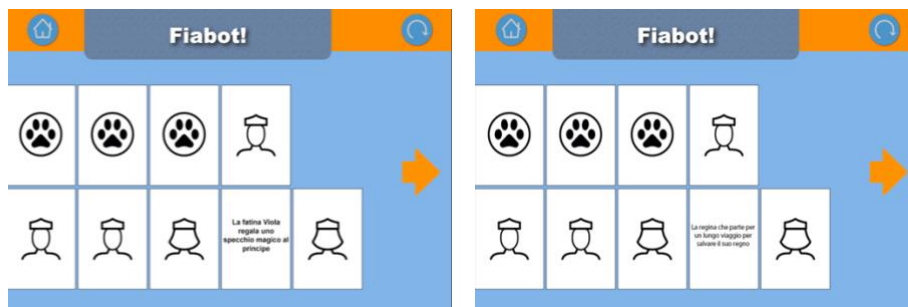

Figure 4 A screenshot of the third step: breaking the stereotypes.
On the left the gender neutral version and on the right the gender sensitive one.

In the fourth step, children have to provide a textual description about each character's role: protagonist, antagonist, protagonist helper, antagonist helper, and the magic object. For each they have to provide name, appearance elements (e.g. hair colour), and also talk about virtues such as the traits and quality of the characters' moral attitude. We expected that this element would make children reflect about the characters and create a sense of empathy for them. After they described all the characters, they could start with the creation of the story. From our previous experience, these steps will stimulate children in framing also the plot, thus at the moment of writing, they already have an idea about the story.

Figure 5 A screenshot of the fourth step when children describe of characters.

The fifth step concerns story creation using off-the-shelf multimedia presentation software (i.e. Keynotes). During the creation of the story, we provided them with a set of paper strips with *Trompe l'oeil* and *Stimulating inquiries* prompts (C7-8). The purposes of these prompts are twofold: to scaffold the writing and, further, to stimulate children in reflecting on the characters created, in terms of their feelings, their role in the story and the influence of their gender on the story. For each version of the prototype, we produced some paper strips with prompts that targeted characters' emotions and role in the story by applying the *trompe l'oeil* approach. For example, a type of prompt in the gender sensitive version is "*What if male characters*

became females and the other way around?". While the neutral one is *"What is the role of the protagonist helper?".* In the first case, the prompt is formulated by explicitly asking children to reflect on characters' roles with the perspective of gender, while in the second case, prompts are neutral. Each question, written on paper strips and placed in a folder, was available to children anytime during the process. Along with these questions, we also provided on paper all the material from the *forbidden and inspiring words* set.
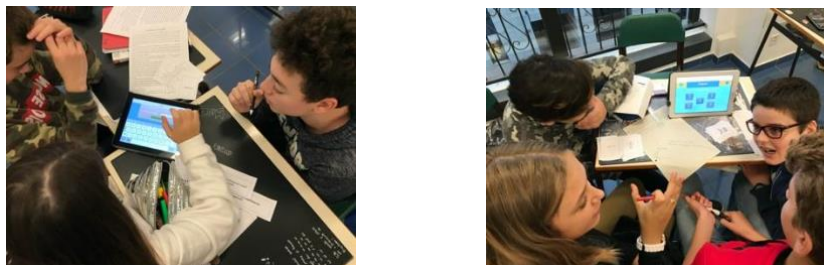

Figure 6 Children using paper strips with prompts produced following Trompe l'oeil and Stimulating inquiries.

The sixth step was to deliver and present the story to teachers and classmates. The multimedia story could be delivered as a video or as a presentation.

5.2   METHODOLOGY

To test the prototype, we conducted a study in two classes of a secondary school with children aged 11-12 years old in Switzerland. Half of each class was assigned to the experimental group and used the gender sensitive prototype and the other half acted as a control group using the "neutral" prototype. To make the activity sustainable we shaped the intervention according to the school's schedule thus we avoid causing any interruptions. Children worked on their story in regular class time for three weeks. The time distribution was as follow:

- Training on how to use the tool: 30 minutes,
- Story ideation: 4 hours,
- Story development: 6 hours,
- Debriefing: 3 slots of one hour each.

The debriefing session aimed at involving teachers and children in reflecting on the activity, was carried out in class. In particular, we conducted contextual inquiry with the teachers, and two focus groups with children, with one group drawn from each class. Interviewing teachers had the purpose of understanding from their perspective how the activity had an impact on children, and also on the other activities happening in class during the study period. However, our main purpose was to collect feedback from children about their experience with using the tool and, in particular, how they created characters and story plots. The discussion was general at the beginning and then moved on to focus on gender stereotypes.

5.3   PHASE 3 OUTCOMES

We recruited the school and the sample on a voluntary basis: we have worked in this school on earlier studies, and they had really enjoyed being engaged in research. We didn't have any specific entry requirements in terms of technology skills for inclusion in the study. Two teachers facilitated the activity. Children were grouped in teams by the teachers according to specific criteria: they had to be mixed in terms of gender, the members had to cover different knowledge skills and literacy as well as temperament (from collaborative to independent). Overall, 45 children (F=37.8%, M=62.2%) aged 11-12 years old from two classes (Class 2B=22 F=8, M=14 and Class 2C=23 F=9, M=14) of secondary school children participated in the study. They created 11 teams (6 in Class 2C and 5 in Class 2B). Each class was split in two with half using the gender sensitive prototype (experimental groups G1, G2, G3 in Class 2C and G4, G5, G6 in Class 2B), while the other half used the gender neutral prototype (control groups N1, N2, N3 in Class 2C and N4 and N5 in Class 2B). Each group consisted of 4 members (on average, 2.5 male and 1.5 female participants for each group). Gender sensitive groups were made of 24 children (F=37.5%, M=62.5%) and the control groups of 21 students (F=38.1%, M=61.9%).

A total of 9 multimedia stories were created by children (4 in the experimental groups and 5 in control group). Stories were composed mainly of text and images, just a few had videos and audio. In what follows we present a table with an overview of the stories produced by children including the storyline.

Sn	Title	Story Line	N/G
S1	Modern Fairy Tale	Two princesses and one prince are looking for love and a villain tries to stop them as he wants to steal their possessions. Everything ends well and each of them finds love, they get married and live happily ever after.	N
S2	Frank's Disaster	Frank finds a magic pen and uses it to cheat at school. When teachers find out, he promises to change and study diligently to become a smart computer scientist	G
S3	The Watch	Ethan discovers his grandfather left him a magic watch to travel in time. Thus, he meets one of his ancestors and brings him back to modern times, after fighting with an evil magic creature and a horror girl/doll.	N
S4	The perseverance of silence	Princess Clodovea saves her dad from his evil brother. She follows her dreams and feelings and overcomes trials with the help of a magic and kind she-bird and her voice. At the end she goes home happily with her dad	G
S5	The three Trials	Princess Kate needs to find a husband, and chooses one of three princes but the other two try to stop her and her prince will have to endure three trials before marrying her and live happily ever after	N
S6	The five trials and the broken hearts	Four friends, two girls and two boys are looking for true love. They will face five trials to then be told that nobody can force true love.	N
S7	Princess Vicky's adventures	Princess Vicky falls for Prince Romeo but merman Franco is very jealous. The prince has to fight for her and wins, so they marry and live happily ever after	G
S8	The adventure of Arthur and the black Knight	Arthur is to become a king but first he needs to marry Beatrix, the black knight kidnaps her and Arthur needs to fight to get her back, marry her and live happily ever after	N
S9	The Queen's trip	The wise queen needs to use her cunning to defeat the evil sorcerer and save her unicorn. Then she goes back to her country and lives happily ever after.	G

Stories were analysed following the same approach used in Phase 1. Specifically, we employed the 5 lenses developed during the first phase of the project: *Role, Embodiment, Personality, Agency,* and *Emotion*. Three researchers separately, and blind to condition, analysed each story focusing on the items identified by the proposed lenses. The analysis performed by each researcher was transcribed in a tabular format for subsequent interpretation and triangulation. Data collected through notes, focus groups with children and contextual enquiry with teachers were transcribed and analysed via inductive thematic analysis. In what follows we present the main outcomes of our analysis.

Role. The first step of the analysis focused on observing the gender representativity and roles that the different characters have in the stories (i.e. protagonist, antagonist, protagonist helper, antagonist helper, and the magic object). In both conditions, children tended to employ more male characters relative to female ones. Specifically, in the stories created by children assigned to the gender sensitive group, 66% of the characters were male and 24% were female. Similarly, in the "control group" group 56% of the characters were male and 28% were female. Within them, in both cases children had either male or female characters as protagonists (50%). However, the distribution of the other roles tended to privilege male characters, following a similar trend between the two conditions (see Table 1).

Table 2 Distribution of roles in the story.

	Protagonist	Antagonist	Protagonist helper	Antagonist helper
GENDER SENSITIVE	50% Female 50% Male	**100% Male**	75% Male	60% Male
GENDER NEUTRAL	50% Female 50% Male	**75% Male**	100% Male	75% Male

Embodiment and Personality. To analyse characters' embodiment and personality, we identified the descriptions that children provided for each character within their stories, either addressing the physical attributes of the characters or their personality traits. Only a few stories explicitly described characters' characteristics either related to their embodiment or to their personality. In particular, children in the control group tended to use more attributes to describe the appearance of their characters. While in the stories produced by the experimental groups, we found more attributes to describe the personality of the characters,

hinting that perhaps children had been putting more effort into the creation of the characters and exploring their introspective dimension. In both cases however, characters' embodiment described the protagonists (either females or males) according to classical western standards of beauty (e.g. they are beautiful, with blond hair and blue eyes). Whereas, the antagonists were characterized by ugliness. The descriptions of the personality traits of the characters offered a more diversified panorama. In the control group for instance, female characters were described variously as: "simple", "with refined tastes", "malevolent", "kind", "kind and sweet". Conversely, male characters are described as: "evil", "obsessed with mystery", "very self-confident", "wise and smart", "clever", "ready to fight", "humble", "prepared". In contrast, in the experimental condition, female characters were described as "nice, kind and affectionate", "wise, smart" and male characters as "smart", "threatening and unpleasant". These descriptions highlight the tendency to continue to portray characters according to stereotyped views and suggests, how children tended to attribute different qualities depending on the character's gender, but at the same time had paid more attention to the introspection of characters and somehow moved out of the agency=action equation. This could be linked to the fact that they interacted with the prototype designed explicitly for that purpose. It is interesting to note that in S9, created by the gender sensitive group, one of the positive female characters is described as "wise and smart", i.e. with qualities that the rest of the stories attributed mainly to males. Also, that this character has the greatest agency in the story such that she passed the trials successfully and saved her kingdom by using her wisdom. Although this variation does not allow us to make any claims about the effectiveness of the prototype in reducing gender biases in children's stories, it is however relevant to highlight that this character was inspired by one of the role model cards proposed to the children in the gender sensitive prototype.

Agency. To analyse agency, firstly, two researchers independently coded the level of agency of each character in the story from 1 (low) to 3 (high) by looking at his/her engagement with the actions of the fairy tale. An overall comparison of agency in male and female characters showed a difference that was not statistically significant ($p > 0,05$). Subsequently, we plotted out the verbs employed to describe the actions of the different characters. This analysis allowed us to spot some subtle differences between the two groups. On the one hand, in the experimental group, all female characters showed a certain level of agency: in three stories, they actively contributed to the unfolding of the events and either embarked on a journey to resolve the conflict or used their wisdom to pass the trial. In the other story of the same group, both the male and female protagonists showed a balanced level of agency, and they worked together towards the solution of the trials. Whereas, in the 5 stories of the control group, only 2 described active female characters, with 2 of them describing the female characters as completely passive in the events that surrounded them ("*she must marry by the father's will, she is kidnapped by the antagonist*"). Finally, in the latter story, even though it started with a balanced distribution of male and female characters, the female characters ended up taking a secondary role and just acting as helpers ("*helps Giovanni to shear the sheep*"). On the other hand, in both conditions, male characters always showed a certain degree of agency and none of them was described as passive. Moreover, from a general perspective, it is interesting to notice that within the overall stories, only 2 of them (1 in the experimental group and 1 in the control group) had the female characters as active contributors to the positive resolution of the story. Instead, in all the other stories the male characters were those who were "in charge" of reaching the "happy ending".

Finally, by using the *Agency lens* to look at the ending of the stories, we noticed how two of the experimental group's stories proposed endings that diverged from the classical stereotypes of fairy tales. Specifically, in one of the stories there was no wedding, but the happy ending was a rich banquet to celebrate the coming home of daughter and father – S5. Similarly, in the same group of stories, another unusual happy ending was about a Queen going back to her kingdom and living there happily after - S9. Again, even if these findings do not allow support a robust claim regarding the effectiveness of the prototype, nonetheless they enabled us to identify subtle nuances in gender construction which may guide further exploration and research.

Emotions. This is a particular type of lens that provides an insight into the emotions expressed by the authors of the story and in this way gives an indication of how likely is that the text was composed by female or male authors. Thus, it signals how balanced the production of the narrative is. We used LIWC to analyse the emotions in the two sets of stories and did not see any meaningful difference. It is worth noting how all groups were mixed, composed as they were by an equal number of boys and girls, and, as they worked together, this had the effect of producing a more balanced set of emotions in all stories. We considered, as in our previous studies [68], the percentage of emotional words and the specific presence of words expressing positive emotions (more frequently used by women) and those carrying negative ones (more frequently used by

men). Our approach was based on work by Mehl and Pennebaker [50], describing how women tend to use words with more positive emotions while instead men express more anger, and by Newman et al. [56], who again reported how men tended to use more words linked to negative emotions than women, who instead preferred to use terms linked to positive emotions, and overall had a tendency to use more emotionally charged words. In our case, we found that there were no significant variations across the control and experimental groups; with positive emotions accounting for 3.9% in the control group on average, and 3.4% in the experimental one. In the control group, rage was detected as 0.5% while in the experimental group, 0.7%. This confirms the role of Emotions as a meta-lens, an indicator describing the balance or lack of among the members of the group creating the story.

The study provided interesting outcomes and highlights strengths and weaknesses of our approach. In particular, if we confront the proposed design concepts with the impact they had on children's stories, it is possible to extrapolate design considerations for future research (7). For instance, in both cases, children did not use the *Inspiring words,* indicating poor effectiveness of this concept. Instead, from our outputs, we can consider the *Breaking the stereotypes* concept as the one which had the strongest impact on the stories. Specifically, in two stories, S9 and S5, the high agency of female characters could indicate that the use of cards with role models had an impact. S9, the Queen who leaves for a long trip to save her kingdom, particularly reflects what was suggested by the *Breaking the stereotypes* cards. In other cases, i.e. S8, the main character is a male mermaid, as suggested by one card, however this is just a superficial break in the stereotypes because the character's attitude and behaviour do not reflect this shift just as the rest of characters do not break stereotypical thinking. Researchers noticed that children had used the prompts quite often "*especially when children were stuck in the plot development and needed an idea or a different perspective*" (R1 notes). Additionally, prompts on paper stripes were revealed to be a popular choice: children mentioned that it was quite "*handy to have these on paper*" (Id22). Therefore, the *Stimulating inquiries* concept appeared to be quite useful for supporting children's creative process. Nonetheless, it was not possible to understand whether it had a specific effect on gender stereotypes in their stories.

In the following discussion section we elaborate further on these aspects, presenting future directions for our research with the purpose of providing insights for anyone within the HCI community who wishes to explore similar research questions.

6   DISCUSSION

In our research, we explored how to design a collaborative DST tool to support children's awareness of gender stereotypes. We investigated this issue by involving early adolescents, as this age window is associated with a gender intensification [34], thus it is important to stimulate them to reflect on gender-related issues. In the paper, we described the process of better understanding how to mitigate the effect of gender-related stereotypes on young people by designing a tool that could help *them to be more aware of gender stereotypes while they are creating a collaborative DST.* Specifically, in the project we aimed at answering three research questions that following we summarised highlighting the main outcomes achieved.

RQ1: What type of stereotypes emerge in children's stories and how could these be detected?
In the first phase, it emerged clearly from the stories that children replicated the same stereotypes they learned from media and books written by adults [26]. To understand stereotypes in the stories, we built a set of 5 lenses that helped us to unveil specific aspects of those biases within storytelling: *Role, Embodiment, Personality, Agency,* and *Emotion* [68]. These lenses were extremely efficient in terms of providing a fine-grained view of the story features, depicting how the role of the characters, their agency, the emotions expressed, and their embodiment were deeply grounded in gender stereotypes. For instance, the *Agency lens* allowed us to highlight that the male characters have an active role in stories as well as the female antagonist, while female protagonists have very little agency almost in every story. This pushed us to reflect on how a DST should be designed to make children aware and to mitigate the preponderance of unconscious gender biases. These 5 lenses were used in the third phase of the project to assess the impact of the prototype in detecting stereotypes. Additionally, this first round of analysis allowed us to identify seven design challenges that have been refined in phase two.

RQ2: Which design concepts could be helpful to guide the design of a collaborative DST tool for raising children's awareness of gender stereotypes?
Leveraged on phase 1 outcomes, in phase 2, we explored the seven design challenges by conducting co-design workshops with Children-Computer Interaction (CCI)/HCI/education expert, adults and children. Each participant brought their own perspective, and these were elaborated on by the team to produce five broader dimensions: *Inclusive Collaboration, Resource sharing and division of work, Role models, Empathetic*

reflection, and *Scaffolding the workflow*. These dimensions aim to address stereotypes emerging during DST creation, e.g. collaboration and negotiation of meaning among children, the reflection on characters' feelings, emotions, status, agency, the challenging of traditional/more represented role models, etc. A further elaboration of these dimensions resulted in five concepts (*Forbidden words, Inspiring words, Breaking stereotypes, Trompe l'oeil, Stimulating inquiries on Character emotions* and their *Role in the story*) that were the guide for the development of a prototype in the phase that followed.

RQ3: How does the prototype developed to implement these concepts, help children to be more aware of gender stereotypes while creating collaborative DST?

The five concepts were implemented in a way that pervaded the entire process of creating the DST. In the study, we tested two prototypes, one gender neutral, that was supposed to not have any impact, and the other, gender sensitive, that we designed in order to raise children's awareness of stereotypes. As mentioned before, the short-term nature of the intervention in the school did not allow for impact on deeply internalized constructions such as gender stereotypes. However, some interesting aspects emerged from the application of lenses on story analysis. Children assigned to the experimental condition showed a more nuanced and less stereotyped approach both in the description of the characters' features as well as in the level of agency that they attributed to female characters. Although these findings cannot be considered as robust evidence, they nonetheless offer a starting point to reflect on the design features as well as on the pedagogical strategies that could be implemented in order to create digital tools and activities that allow further deepening of this research topic. The findings hence open paths for future research oriented toward designing interventions, digital technology, and materials to support children's awareness on gender stereotypes.

6.1 DESIGN CONSIDERATIONS TO RAISE CHILDREN'S AWARENESS ON GENDER STEREOTYPES

From our research process and findings it emerged that designing initiatives and digital artefacts to promote children's awareness of gender stereotypes during DST is a complex endeavour since it deals with deeply internalized biases which cannot be easily changed through quick interventions. Nevertheless, considering the importance of this topic for promoting a more equalitarian society, we believe that further research should be devoted to the design, development, and evaluation of tools, instruments, and strategies capable of taking into account gender stereotypes in children's cultural productions. In what follows we present a set of considerations for future research that we elaborated freely from what we learned in the study.

6.1.1 Design concepts to address gender stereotypes' awareness

Design concepts represent a useful way to formalize design knowledge and open spaces for multiple representations and implementations of similar ideas. In our project, the adopted design concepts (*Forbidden words, Inspiring words, Breaking stereotypes, Trompe l'oeil, Stimulating inquiries)* showed some strengths, weaknesses, and potential for refinement. Leveraging what we learned, we present some ideas for future research either aimed at exploring variations on the proposed concepts or at expanding the range of design concepts to address awareness of gender stereotypes.

Forbidden words & Inspiring words. In our study, both forbidden words and inspiring words had a limited impact on children's productions. Firstly, children did not employ any of the inspiring words. Secondly, although they didn't use the forbidden words (e.g. war, death, blood, weapons), they nonetheless employed similar concepts by including violence and murders in their stories. This weakness can, on the one hand, be understood in terms of the "don't think about the pink elephant" paradox. On the other hand, it could be related to the way in which these concepts were implemented in the prototypes. Design concepts such as "inspiring words" have a large tradition in story-telling (e.g. the "fantastic binomial" proposed by Rodari [64]) and could be a meaningful tool for moving children's stories away from stereotyped narratives. However, further research should deepen strategies to implement these concepts in ways that could be more attractive and relevant for children. Possible ideas could be found by employing multimedia prompts or in mechanics similar to the one of the StoryCubes games (https://www.storycubes.com/en/) in which a random dice roll suggests the elements for the creation of the story.

Breaking the stereotypes. As mentioned above, we believe that this concept can be a valuable input for raising awareness of stereotypes. Providing children with examples of characters that subvert the typical gendered attributions of fairy-tales allows them to use other references as inspirations and starting points for their stories. Nonetheless, for further design iterations, we consider that this concept may benefit from some improvement. On the one hand, for instance, in one case (the male mermaid), the breaking of the stereotype was only superficial. Hence, possible improvements could address including more details about attitudes and behaviour in the character description. On the other hand, one child during the focus group

complained that the number of examples was very few, and he wished to have more (Id18). Thus, a good direction would be to increase the number and type of character examples. Finally, other possible research directions could involve children in the creation of characters that "break the stereotypes", hence setting the stage for them reflecting on deeply internalized structured meanings.

Trompe l'oeil and Stimulating inquiries. These concepts proved to be quite useful to support children's creative processes, nonetheless it was not possible to observe effects related to the mitigation of stereotypes. Prompts have the role of pushing children reflect on characters' feelings, emotions and their role in the story, considering primarily issues related to gender stereotypes. For instance, making children reflect on the impact of characters' gender on their agency in the story, unveils the influential role of gender stereotypes. The heuristic value of this concept is also in providing an opportunity for children to have a common discussion about this topic and to share their opinion. Increasing the social discussion on this topic is of value as stereotypes are socially constructed. We consider that further research could deepen the exploration of these concepts both by more systematically analysing their impact on children's productions, as well as by exploring more optimized design solutions to exploit the potential of "what if" and inquiry questions in DST experiences.

6.1.2   Tools to examine gender stereotypes in children's productions

In our research, we highlighted the importance of tools to analyse and identify gender stereotypes in children's stories. To this end, we conceived five lenses and showed their usefulness as a heuristic to highlight stereotypes. In what follows we propose a few directions to further extend the lenses, while at the same time improving their heuristic value.

Agency as the pathway to a more equal and inclusive story. In our study it emerged that, as in 19th century novels [42], gender has an impact on characters' behaviour and attitude. The *Agency lens* demonstrated itself to be key to changing children's perception of a character's role in the story and it can have an actual impact on the perception of their own identity. In Phases 1 and 3 it emerged quite strongly how using this lens revealed some elements related to characters' agency that were not easy to detect otherwise. Furthermore, this lens unveiled certain aspects of how characters influenced the plot and took control of their destiny (e.g. the queen in S10). The *Agency lens* in fact has the power of showing how effectively characters impacted on the story, thus, their ability to shape the narrative and to lead events can be understood through that lens. Agency is key to stimulating children to create characters that lead the story, by having an attitude that breaks stereotypes and goes beyond these including giving a witty answer, being creative, pondering, empathizing, thinking out of the box, providing an example of virtue, or motivating others to act. It is not always necessary to: fight, defeat, imprison, get rid of and do something in order to cause positive changes. Our findings suggest that the *Agency lens* needs to be revisited to account explicitly for different types of interaction between characters, and to highlight who has most influence on the plot, not necessarily by acting in a classic warrior/prince way. We need to find ways to enrich the definition of agency so that it accounts for diversity in the way that characters can take control and be empowered within an inclusive spectrum of qualities and abilities.

Role Lens. Books are often the primary source for the presentation of societal values to young children, e.g. picture books are often populated by gender stereotypes that become the basis of gender roles [38]. We developed the *Role lens* in order to establish a connection between characters and the context in which they are acting, with a focus on the trial elements of the story as, traditionally, it is where most of the action takes place. The *Role lens* needs to identify the responsibility of each character and to weight it in the plot by also considering different types of agency in the lookout for the balance Edith Ackerman was describing in her quote at the beginning of this paper.

Narrative structure deviation as a way of detecting other non-stereotypical elements in the plot. Usually, the end of a fairy tale would be e.g. a big wedding and "happily ever after"; any alternative ending should be accounted for as less stereotypical, as for instance in S2. Thus, creating a new lens that can focus not only on the way in which trials are overcome, but also on the structural deviation from the norm of a fairy tale, e.g. type of ending proposed, would allow us to more precisely detect stereotypes (or the lack of) in the whole story. The inclusion of this lens in the process can allow children during the plot creation stage to consider different elements to enrich the story.

Embodiment and Personality. Gender, and connected behaviour norms, are built on top of social interactions and gender representations in cultural artefacts [9]. In particular, that embodiment of stereotypes shows female characters as being socially skilled and an emphasis is placed on their physical appearance [26], while

males are portrayed as active, smart and brave in solving any kind of problem [26]. In Phases 1 and 3 *Embodiment* and *Personality lenses* have shown their power in detecting those aspects. In stories produced using our prototype, personality traits are often embodied in the characters' physical appearance as provided in the textual description or depicted in the drawings. The *Stimulating inquiries* concept proved to be valuable in making children reflect about characters' physical aspects and personality. Questioning children during the creation of the plot, while making them reflect on how they depicted characters by addressing the stereotypes of physical appearance and attitudes, can raise their awareness of the different options and, eventually, help them to change their perspective.

Emotions as a thermometer for authors' feelings. The *Emotions lens* was conceived to identify the emotions of characters and the overall mood of the story. However, this is also a way in which to unveil authors' emotional status i.e. by observing how it is reflected within characters. Considering the production of DST as a collective effort, it would be even more interesting to understand how this was reflected in characters' emotions. In addition, it would be useful to refine the granularity of emotions in order to detect nuances, and to train the emotion detector specifically with children's stories in order to obtain a more reliable output. It would then be useful to integrate this lens within the creation workflow in order to make children aware about this aspect during the production of the plot, characters and other elements of the story.

6.1.3   *Strategies to plan ITC mediated interventions aimed at raising awareness on gender stereotypes*

The overall research did not only offer knowledge about design concepts and tools to identify gender stereotypes, it also provided insights to plan broader educational interventions on this topic.

1. Using the lenses to help children to spot biases in well-known tales and in their own creations. The presence of gender stereotypes in both adult and children's [26] [35] books is one of the main reasons for their reproduction in real life and in the stories produced by children. From Phase 1, the utility of applying lenses to detect the multiple layers of meaning that articulate these constructions was revealed, as was the fact that often these stereotypes are not immediately evident. Future research may therefore address the development of tools that can help children in spotting stereotypes within well-known tales (e.g. Snow White and the Seven Dwarfs) and in their own stories. We consider that this practice can be a valuable exercise to train children in critical reflection and "fine-tuning" their capacity to recognize stereotype representations and to be aware of them when they encounter these, especially in early adolescence when children are known to experience a gender intensification [34]. Furthermore, it may help them in understanding how biases are socially constructed, hence eventually reducing the risks of reproducing them unconsciously.

2. Integrating the lenses in the creation of story workflow. In our research, we treated the analytical tools (lenses) and the design concepts to support children's creation separately. However, as *a posteriori* reflection, we consider that the integration of these two dimensions has relevant design and educational potential. We consider that the standpoint offered by the lenses could be helpful for raising specific issues while children are creating characters and the plot, allowing children to think about the level of agency of each character and fostering examination and reflection on their ongoing creation. Further research may address strategies to integrate the lenses in the creation of the story to provide a specific support during the workflow. For example, the *Agency lens* could be integrated with the *Breaking the stereotype* concept to provide insights during the creation of the characters. When the child is outlining the female protagonist, the system could present a set of female protagonist examples who are engaged in actions, with the purpose of inspiring the author to create an empowered female character who is able to steer the direction of the narrative. In addition, some concepts aim to help children to achieve a level where the heroes will not necessarily have to take matters in their hands quite so literally, and prove to be stronger or mightier. Instead, they could use their empathy and creativity to solve problems in unexpected ways: a culture that respects and acknowledges different abilities, even those that do not scream at the readers but instead takes them by the hand and let them discover the many ways and facets of being human.

3. Fostering children's discussion of stereotypes by increasing collaboration and diversity within groups. The literature indicates that the creation of gender-related norms and role models is based on social and cultural interactions [22]. In Phase 1, it emerged strongly that positive collaboration within mixed gender groups had the power to mitigate the emergence of stereotypes in the story [68]. Thus, the production of digital storytelling in groups, based on diversity and inclusion, can stimulate children to face and discuss stereotypes by considering a wider perspective. If the discussion is supported by specific pathways where individuals are equally valued and group members are encouraged to reflect on their story production, it would mitigate gender-specific behaviours and attitudes. For instance, in our case, the implementation of the

Trompe l'oeil and *Stimulating inquiries* concepts, which were used to push children to consider a wider perspective and increase the discussion within the group in terms of allowing children to share their opinions, had both a positive impact.

6.2   Limitations and threats to validity

In order to comprehend the scope of the study results it is important to reflect on the threats to validity and limitations of our intervention. First of all, the short-term nature of our case study does not allow for a change of attitude or behaviour. In particular, considering that we are facing a social construction deeply internalized in humans, a single intervention cannot have a strong impact in shifting children's beliefs, attitudes or behaviour. We were aware of this threat, and we did not expect any strong and definitive impact on stories or children. However, the study can be seen as a proof of concept, providing interesting outcomes and indications on the potential of these concepts and the workflow we created. In the future, we expect to revise the prototype and to conduct a study in which children are exposed for a longer period to the use of the tool. This could give us a better chance to assess the long-term impact. Further, to avoid the trap of technological solutionism [73] children may benefit from the design of a diversified and more encompassing curriculum. One limitation concerns the number of users. In the future, we will increase the sample and include more teachers, children, and context (e.g. after-school programs).

7   CONCLUSIONS

The purpose of our research is to support children to become more aware of stereotypes in their own artefacts. Our choice was to focus on storytelling as it is a common and popular activity for children who engage with it both at home and at school, for pleasure and educational purposes. Storytelling also has the power to support children in the construction of meaning and to mediate their organization of knowledge [19]. Regarding the impact on the community, as we stated before Gender and computing has been a central issue in the HCI community for many years and recently the discussion has increased and broadened to explore how we could be more inclusive, respectful, welcome diversity and create a more equal environment. This is true when we address the design of digital technology as well as when we focus our attention on refining research methods to be more inclusive and support cultural change. Among the different research directions taken in the HCI and CCI communities (e.g. female representation in computing [14], co-construction of gender and technical identities [65], virtual embodiment [6], and whether the perceived robot's gender might affect the interaction between a child and a robot [86]) we aimed to provide a concrete reflection on how we could improve children's awareness on gender when they create digital artefacts, with the purpose of stimulating reflections on their own as well identity as well as on that of others. In respect of the current stare of art we have made a step forward to understanding the type of gender stereotypes emerging in children's stories, the type of analysis that could be used to highlight these stereotypes, as well as the design strategies that can be implemented to reduce gender stereotypes in the stories made by children, or, at least, to mitigate their impact on children.

We investigated stereotypes by treating them as a cultural product. As we set out in the introduction, our contribution is twofold:

1. to provide knowledge on how gender stereotype awareness could be raised among children through the collaborative creation of DST.
2. to spread insight on our approach and support the HCI community to replicate it to challenge the negative effect of stereotypes.

Our approach included both theoretical and practical aspects, during which we applied multiple methods to investigate the topic and design an intervention to explore the theoretical background and design options. During **Phase 1** we developed a mechanism based on the five lenses, to detect how, in their multimedia stories, children reproduced stereotypes they are exposed to every day via books, media and social interaction. In **Phase 2,** we looked at design solutions for making children aware of and to reflect on the presence of these stereotypes, and to push them to consider alternatives. By engaging with experts and different stakeholders, we elaborated 9 concepts. These guided the design of a new prototype to support children during the inspiration stage of the storytelling process by stimulating them to think out of the box. Finally, in **Phase 3,** we developed and assessed a prototype to spot any signs of change in the stories produced using the new prototype. In so doing, we observed some evidence of the 9 concepts having a certain efficacy in driving children towards a deeper reflection of characters' agency, role, emotions, embodiment, and personalities. Thus, we ended up revisiting some of the lenses with a view to making them an integral part of the ideation element of the overall storytelling system. This approach can be applied to unveil other types of unconscious biases and/or design system to raise children's awareness.

On our research journey, we explored the concept of gender stereotypes from theoretical, methodological, and pragmatic perspectives. We started by investigating literature in the field that allowed us to refine our research questions as well as creating a background against which to develop the study. The process led us to design and test two versions of a prototype used by children in class with the outcomes revealing interesting issues about the effect of the deployed concept on the stories. Our findings do not allow us to make robust claims about the effectiveness of the prototype in raising awareness and mitigating gender stereotypes but, considering the nature of the phenomenon under investigation, we didn't expect to have a quick shift. Instead, we consider our findings promising in terms of providing a direction of work in such a complex area of research. These findings clearly outline several future directions while providing useful insights for further theoretical, methodological, and pragmatic investigations.

We strongly believe that in the current climate, e.g. [77], talking about stereotypes and gender is extremely important and, this is even more the case if gender is considered not to be a binary value. However, working in local schools we felt we had to respect their view on this delicate issue, and did not feel free to introduce to children a non-binary view. Still, our tools and methods can be easily expanded and used in non-binary contexts. Finally, we are conscious that our background, values and experiences in a male-dominated environment provide us with a bias, but also a strong motivation, to explore this research area. Even this initial exploration provides interesting insights and food for thought. We feel that this research could shape the next generation of technology to being inclusive and catering for diversity as a valuable asset. At the same time, we hope that our approach could inspire more research with children as active agents of a cultural process towards a more inclusive and equal digital society. We feel that we are moving one step closer to provide a positive answer to address Edith Ackermann's request for *"… a culture where being quiet, observant, thoughtful and contemplative strikes a balance with being a doer, entrepreneur, mover and shaker"*.

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REFERENCES

1.   M. S. Turner J. C. Hogg M. A. Oakes P. J. Reicher S. D. & Wetherell. 1987. *Rediscovering the social group:* Basil Blackwell. https://doi.org/10.1111/j.2044-8309.1987.tb00799.x

2.   Olaiya E Aina and Petronella A Cameron. 2011. Why does gender matter? Counteracting stereotypes with young children. *Dimensions of Early Childhood* 39, 3.

3.   Cooper Alan. 1999. The inmates are running the asylum.

4.   Houman Alborzi, Allison Druin, Jaime Montemayor, Lisa Sherman, Gustav Taxn, Jack Best, Joe Hammer, Alex Kruskal, Abby Lal, and Thomas Plaisant Schwenn. 2000. *Designing StoryRooms: interactive storytelling spaces for children*.

5.   Khaled Albusays, Pernille Bjorn, Laura Dabbish, Denae Ford, Emerson Murphy-Hill, Alexander Serebrenik, and Margaret-Anne Storey. 2021. The diversity crisis in software development. *IEEE Software* 38, 2: 19–25.

6.   A Angeli and Sheryl Brahnam. 2006. Sex Stereotypes and Conversational Agents. In *AVI 2006 Gender and Interaction: Real and Virtual Women in a Male World Workshop paper*, 1–4. Retrieved from https://pdfs.semanticscholar.org/a300/47f9bf4b858e5162dbba82d0c9d76740766e.pdf

7.   Michal Armoni and Judith Gal-Ezer. 2014. Early computing education: why? what? when? who? *ACM Inroads* 5, 4: 54–59.

8.   Khaled Bachour, Frédéric Kaplan, and Pierre Dillenbourg. 2008. Reflect: An interactive table for regulating face-to-face collaborative learning. *Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)* 5192 LNCS: 39–48. https://doi.org/10.1007/978-3-540-87605-2_5

9.   Lori Baker-Sperry and Liz Grauerholz. 2003. The pervasiveness and persistence of the feminine beauty ideal in children's fairy tales. *Gender and Society* 17, 5: 711–726.

https://doi.org/10.1177/0891243203255605

10. Albert Bandura. 1989. Human agency in social cognitive theory. *The American psychologist* 44, 9: 1175–84. https://doi.org/10.1037/0003-066x.44.9.1175

11. Shaowen Bardzell. 2010. Feminist HCI : Taking Stock and Outlining an Agenda for Design. *Proceedings of the 28th International Conference on Human Factors in Computing Systems*: 1301–1310. https://doi.org/10.1145/1753326.1753521

12. A R Barrett and J S Edwards. 1995. Knowledge elicitation and knowledge representation in a large domain with multiple experts. *Expert Systems with Applications* 8, 1: 169–176.

13. David N. Beede, Tiffany A. Julian, David Langdon, George McKittrick, Beethika Khan, and Mark E. Doms. 2011. Women in STEM: A Gender Gap to Innovation. *Ssrn*. https://doi.org/10.2139/ssrn.1964782

14. Tessa Berg, Alexander Sharpe, and Emma Aitkin. 2018. Females in computing: Understanding stereotypes through collaborative picturing. *Computers and Education* 126: 105–114. https://doi.org/10.1016/j.compedu.2018.07.007

15. Marina Umaschi Bers and Justine Cassell. 1998. Interactive storytelling systems for children: using technology to explore language and identity. *Journal of Interactive Learning Research* 9: 183–215.

16. Susan Birrell and Mary G. McDonald. 2012. Break Points: Narrative Interruption in the Life of Billie Jean King. *Journal of Sport and Social Issues* 36, 4: 343–360. https://doi.org/10.1177/0193723512442203

17. Elizabeth Bonsignore, Alexander J Quinn, Allison Druin, and Benjamin B Bederson. 2013. Sharing Stories "in the Wild": A Mobile Storytelling Case Study Using StoryKit. *ACM Trans. Comput.-Hum. Interact.* 20, 3. https://doi.org/10.1145/2491500.2491506

18. Philipp Brauner, Martina Ziefle, Ulrik Schroeder, Thiemo Leonhardt, Nadine Bergner, and Birgit Ziegler. 2018. Gender influences on school students' mental models of computer science: a quantitative rich picture analysis with sixth graders. In *Proceedings of the 4th Conference on Gender & IT*, 113–122.

19. Jerome Bruner. 1991. *The Narrative Construction of Reality*. https://doi.org/10.1086/448619

20. Diana Burgess and Eugene Borgida. 1999. Who women are, who women should be: Descriptive and Prescriptive Gender Stereotyping in Sex Discrimination. *Psychology, Public Policy, and Law* 5, 3: 665–692. https://doi.org/10.1037/1076-8971.5.3.665

21. Margaret Burnett, Simone Stumpf, Jamie Macbeth, Stephann Makri, Laura Beckwith, Irwin Kwan, Anicia Peters, and William Jernigan. 2016. GenderMag: A method for evaluating software's gender inclusiveness. *Interacting with Computers* 28, 6: 760–787.

22. Kay Bussey and Albert Bandura. 2004. Social cognitive theory of gender development and functionning. *The psychology of gender*: 92–119.

23. Elizabeth A Carlson, L Alan Sroufe, and Byron Egeland. 2004. The construction of experience: A longitudinal study of representation and behavior. *Child development* 75, 1: 66–83.

24. Justine Cassell. 1998. Storytelling as a nexus of change in the relationship between gender and technology: A feminist approach to software design. *From Barbie to mortal kombat: Gender and computer games*: 298–326.

25. Justine Cassell and Henry Jenkins. 2000. *From Barbie to Mortal Kombat: gender and computer games*. MIT press.

26. Madoda Cekico. 2013. Gender Stereotypes in selected fairytales:Implications for teaching reading in the foundation phase in south africa. *Journal of Sociology and Social Anthropology* 4, 3: 201–206. https://doi.org/10.1080/09766634.2013.11885597

27. Andrei Cimpian, Yan Mu, and Lucy C. Erickson. 2012. Who Is Good at This Game? Linking an Activity to a Social Category Undermines Children's Achievement. *Psychological Science* 23, 5: 533–541. https://doi.org/10.1177/0956797611429803

28. D. J Cuff, B. M., Brown, S. J., Taylor, L., & Howat. 2016. Empathy: a review of the concept. *Emotion Review* 8, 2: 144–153.

29. Françoise Decortis and Antonio Rizzo. 2002. New active tools for supporting narrative structures. *Personal and Ubiquitous Computing* 6, 5–6: 416–429. https://doi.org/10.1007/s007790200046

30. A. Durndell and K. Thomson. 1997. Gender and computing: A decade of change? *Computers and Education* 28, 1: 1–9. https://doi.org/10.1016/S0360-1315(96)00034-6

31. Susan K Egan and David G Perry. 2001. Gender identity: a multidimensional analysis with implications for psychosocial adjustment. *Developmental psychology* 37, 4: 451.

32. Willem Fontijn and Philip Mendels. 2005. StoryToy the interactive storytelling toy. In *Second International Workshop on Gaming Applications in Pervasive Computing Environments at Pervasive*.

33. Alexandra Funke and Katharina Geldreich. 2017. Gender differences in scratch programs of primary school children. In *Proceedings of the 12th Workshop on Primary and Secondary Computing Education*, 57–64.

34. Nancy L Galambos and David M Almeida. 2016. Masculinity , Femininity , and Sex Role Attitudes in Early Adolescence : Exploring Gender Intensification Author (s): Nancy L . Galambos , David M . Almeida and Anne C . Petersen Published by : Wiley on behalf of the Society for Research in Child Develo. 61, 6: 1905–1914.

35. Nicole Gardner-Neblett and John Sideris. 2018. Different Tales: The Role of Gender in the Oral Narrative–Reading Link Among African American Children. *Child development* 89, 4: 1328–1342.

36. Michail Giannakos, Michael Stephen Horn, and Elisa Rubegni. 2020. Advancements on Child–Computer Interaction research: Contributions from IDC 2018. *International Journal of Child-Computer Interaction*: 100170. https://doi.org/https://doi.org/10.1016/j.ijcci.2020.100170

37. Javier Gomez, Letizia Jaccheri, Manolis Maragoudakis, and Kshitij Sharma. 2019. Digital storytelling for good with Tappetina game. *Entertainment Computing* 30: 100297. https://doi.org/https://doi.org/10.1016/j.entcom.2019.100297

38. Angela M Gooden and Mark A Gooden. 2001. Gender Representation in Notable Children's Picture Books: 1995–1999. *Sex Roles* 45, 1: 89–101. https://doi.org/10.1023/A:1013064418674

39. Dennis Hummel, Sinja Herbertz, and Alexander Mädche. 2018. Biological Sex vs. Psychological Gender-Roles in Online Channel Choices: Evidence from Two Studies in the Financial Services Industry. In *Proceedings of the 4th Conference on Gender & IT* (GenderIT '18), 199–208. https://doi.org/10.1145/3196839.3196870

40. Scott G Isaksen. 1987. *Frontiers of creativity research: Beyond the basics*. Bearly Limited.

41. Letizia Jaccheri, Cristina Pereira, and Swetlana Fast. 2020. Gender Issues in Computer Science: Lessons Learnt and Reflections for the Future. In *2020 22nd International Symposium on Symbolic and Numeric Algorithms for Scientific Computing (SYNASC)*, 9–16.

42. Matthew L Jockers and Gabi Kirilloff. 2016. Understanding Gender and Character Agency in the 19th Century Novel. *Journal of Cultural Analytics*: 1–11. https://doi.org/10.22148/16.010

43. Caitlin Kelleher, Randy Pausch, and Sara Kiesler. 2007. Storytelling alice motivates middle school girls to learn computer programming. *Proceedings of the SIGCHI conference on Human factors in computing systems - CHI '07*: 1455. https://doi.org/10.1145/1240624.1240844

44. Lynn S Liben, Rebecca S Bigler, Diane N Ruble, Carol Lynn Martin, and Kimberly K Powlishta. 2002. *The developmental course of gender differentiation: Conceptualizing, measuring, and evaluating constructs and pathways*. Blackwell Boston.

45. Bonnie Thompson Long, Tony Hall, Michael Hogan, Owen Harney, Theodoros Doukoulos, and Chita Murray. 2017. Using a Collective Intelligence Scenario-Based Design approach to develop a collaboration ecosystem supporting the authorship of pedagogically valuable e-books for children. *Journal of Literacy and Technology* 18, 2.

46. Patricia Louie. 2012. Not so Happily Ever After? The Grimm Truth about Gender Representations in

Fairytales. *UBC Women's and Gender Studies Undergraduate Journal* 4, 1: 74–82.

47. Diane M Mackie, David L Hamilton, Joshua Susskind, and Francine Rosselli. 1996. Social psychological foundations of stereotype formation. *Stereotypes and stereotyping*: 41–78.

48. Carol Lynn Martin, Richard A. Fabes, Laura Hanish, Stacie Leonard, and Lisa M. Dinella. 2011. Experienced and Expected Similarity to Same-Gender Peers: Moving Toward a Comprehensive Model of Gender Segregation. *Sex Roles* 65, 5: 421–434. https://doi.org/10.1007/s11199-011-0029-y

49. Carol Lynn Martin and Diane Ruble. 2004. Children's search for gender cues: Cognitive perspectives on gender development. *Current directions in psychological science* 13, 2: 67–70.

50. Matthias R Mehl and James W Pennebaker. 2003. The sounds of social life: A psychometric analysis of students' daily social environments and natural conversations. *Journal of personality and social psychology* 84, 4: 857.

51. M. A. Messner. 2000. Barbier Girl versus Sea Monster: Children Constructing Gender. *Gender & Society* 14, 6: 765–784. https://doi.org/10.1177/089124300014006004

52. Jenna Lee Moore. 2008. The Impact Of Participation In School Choirs On The Construction Of Gender Identity : An Autobiographical Narrative Jenna Lee Moore Westminster Choir College of Rider University. *GEMS – Gender, Education, Music & Society* 4, 2008. Retrieved from www.queensu.ca/music/links/gems/moore5.pdf

53. May M Narahara. 1998. Gender Stereotypes in Children's Picture Books.

54. C. Nathan Dewall, T. William Altermatt, and Heather Thompson. 2005. Understanding the structure of stereotypes of women: Virtue and agency AS dimensions distinguishing female subgroups. *Psychology of Women Quarterly* 29, 4: 396–405. https://doi.org/10.1111/j.1471-6402.2005.00239.x

55. United Nations. 2019. *The Sustainable Development Goals Report 2019*. https://doi.org/https://doi.org/https://doi.org/10.18356/55eb9109-en

56. Matthew L Newman, Carla J Groom, Lori D Handelman, and James W Pennebaker. 2008. Gender differences in language use: An analysis of 14,000 text samples. *Discourse Processes* 45, 3: 211–236.

57. Ageliki Nicolopoulou. 2014. The elementary forms of narrative coherence in young children's storytelling. *Narrative Inquiry* 18, 2: 299–325. https://doi.org/10.1075/ni.18.2.07nic

58. A.S North and J.M Noyes. 2002. Gender influences on children's computer attitudes and cognitions. *Computers in Human Behavior* 18, 2: 135–150. https://doi.org/10.1016/S0747-5632(01)00043-7

59. Johanna Okerlund, Madison Dunaway, Celine Latulipe, David Wilson, and Eric Paulos. 2018. Statement Making: A Maker Fashion Show Foregrounding Feminism, Gender, and Transdisciplinarity. In *Proceedings of the 2018 Designing Interactive Systems Conference*, 187–199.

60. James W. Pennebaker, Ryan L. Boyd, Kayla Jordan, and Kate Blackburn. 2015. *The Development and Psychometric Properties of LIWC2015*. https://doi.org/10.1068/d010163

61. Louise G Phillips. 2010. Young Children's active citizenship: storytelling, stories and social actions.

62. Vladimir Propp. 1968. *Morphology of the Folktale*. https://doi.org/10.1038/025257a0

63. Bernard R Robin. 2016. Digital Storytelling : A Powerful Technology Tool for the 21st Century Classroom Digital Storytelling : A Powerful Technology Tool for the 21st Century Classroom. *Theory into practice* 5841, November: 220–228. https://doi.org/10.1080/00405840802153916

64. Gianni Rodari. 2001. *Grammatica della fantasia*. Einaudi.

65. Jennifer A Rode and E Shenan Poole. 2018. Putting the gender back in digital housekeeping.

66. Elisa Rubegni and Monica Landoni. 2014. Fiabot ! Design and Evaluation of a Mobile Storytelling Application for Schools. In *Idc 2014*, 165–174. https://doi.org/10.1145/2593968.2593979

67. Elisa Rubegni and Monica Landoni. 2018. How to design a digital storytelling authoring tool for developing pre-reading and pre-writing skills. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems*, 395.

68. Elisa Rubegni, Monica Landoni, Antonella De Angeli, and Letizia Jaccheri. 2019. Detecting Gender Stereotypes in Children Digital StoryTelling. In *Proceedings of the 18th ACM International Conference on Interaction Design and Children* (IDC '19), 386–393. https://doi.org/10.1145/3311927.3323156

69. Elisa Rubegni, Monica Landoni, and Letizia Jaccheri. 2020. Design for Change With and for Children: How to Design Digital StoryTelling Tool to Raise Stereotypes Awareness. *Proceedings of the 2020 ACM Designing Interactive Systems Conference*: 505–518. https://doi.org/10.1145/3357236.3395470

70. Andy Russell. 2010. ToonTastic: a global storytelling network for kids, by kids. In *Proceedings of the fourth international conference on Tangible, embedded, and embodied interaction*, 271–274. https://doi.org/10.1145/1709886.1709942

71. Kimiko Ryokai and Justine Cassell. 1999. StoryMat: a play space for collaborative storytelling. In *CHI'99 extended abstracts on Human factors in …*, 272–273. https://doi.org/10.1145/632716.632883

72. Douglas Schuler and Aki Namioka. 1993. *Participatory design: Principles and practices*. CRC Press.

73. Natasha Dow Schüll. 2013. The folly of technological solutionism: An interview with evgeny morozov.

74. Sindre B Skaraas, Javier Gomez, and Letizia Jaccheri. 2018. Tappetina's empathy game: a playground of storytelling and emotional understanding. In *Proceedings of the 17th ACM Conference on Interaction Design and Children*, 509–512.

75. Cyd Skinner. 2013. Gender and language in best-selling children's picture books: Who gets to speak? Retrieved from http://search.ebscohost.com/login.aspx?direct=true&db=psyh&AN=2013-99240-205&site=ehost-live

76. Rabea Sonnenschein, André Loske, and Peter Buxmann. 2016. Gender Differences in Mobile Users' IT Security Appraisals and Protective Actions: Findings from a Mixed-Method Study.

77. Katta Spiel, Os Keyes, and Pınar Barlas. 2019. Patching gender: non-binary utopias in HCI. In *Extended Abstracts of the 2019 CHI Conference on Human Factors in Computing Systems*, 1–11.

78. Bernadette Spieler. 2018. Reinforcing Gender Equality by Analysing Female Teenagers' Performances in Coding Activities: A Lesson Learned. In *Proceedings of the 4th Conference on Gender & IT* (GenderIT '18), 209–219. https://doi.org/10.1145/3196839.3196871

79. Lauren Spinner, Lindsey Cameron, and Rachel Calogero. 2018. Peer Toy Play as a Gateway to Children' s Gender Flexibility : The Effect of (Counter) Stereotypic Portrayals of Peers in Children ' s Magazines. 314–328.

80. Storydice-creative-story-ideas. 2020. Storydice-creative-story-ideas. Retrieved from https://davebirss.com/storydice-creative-story-ideas/

81. Cristina Sylla, Vítor Martins, Gabriela Sá, Ana Paula Caruso, Bruno Amaro, Douglas Menegazzi, and Francisco Sylla. 2019. Mobeybou-A Digital Manipulative for Multicultural Narrative Creation. In *Extended Abstracts of the 2019 CHI Conference on Human Factors in Computing Systems*, VS15.

82. Hanns M Trautner, Diane N Ruble, Lisa Cyphers, Barbara Kirsten, Regina Behrendt, and Petra Hartmann. 2005. Rigidity and flexibility of gender stereotypes in childhood: Developmental or differential? *Infant and Child Development: An International Journal of Research and Practice* 14, 4: 365–381.

83. Jennifer Tsan, Kristy Elizabeth Boyer, and Collin F Lynch. 2016. How early does the CS gender gap emerge?: a study of collaborative problem solving in 5th grade computer science. In *Proceedings of the 47th ACM technical symposium on computing science education*, 388–393.

84. Marina Umaschi and Justine Cassell. 1997. Storytelling Systems: Constructing the Innerface of the Interface. *Second International Conference on Cognitive Technology - Humanizing the Information Age*: 98–108. https://doi.org/10.1109/CT.1997.617688

85. Susan D. Witt. 1997. Parental influence on children's socialization to gender roles. *Adolescence* 32, 126: 253.

86. Korlan Zhumabekova, Altynay Ismailova, Daniyar Kushkinbayev, and Anara Sandygulova. 2018. Exploring the Effects of Robot Gender on Child-Robot Interaction. In *Companion of the 2018*

ACM/IEEE International Conference on Human-Robot Interaction, 287–288.