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Owning Your Career Paths: Storytelling to Engage Women in Computer Science

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Abstract

Motivation & challenge: Computer Science suffers from a lack of diversity that gets perpetuated by the most dominant and visible role models. The community is doing itself a disservice by upholding techno-solutionism, short-term efficiency, and busyness as central values. Those models are created and consolidated over time through social and cultural interactions that increase the perpetration of gender stereotypes. Exposing people to diverse types of role models and stories can contribute to making them more aware of the complexity of reality and inspire them taking better informed decisions-making on their career paths. Likewise, showing different role models to stakeholders in society and industry can contribute to increase the workforce diversity in the profession of computing as well as to make a shift towards the consolidation of different role models. This, in turn, may contribute to strengthen resilience and adequacy for solving issues related to diversity, equality and inclusion in Computer Science and more importantly allowing women take the ownership of their career path.

Goal: To encourage the dissemination, sharing and creation of stories that show diverse career pathways to address gender stereotypes created by dominant stories in Computer Science. We tackle this issue by developing a framework for storytelling around female scientists and professionals to show a diversity of possibilities for women in pursuing an academic career based on the ownership of their pathways.

Method: We apply a qualitative approach to analyse stories collected using the auto-ethnography and use thematic analysis to unpack the components of what in these stories contribute to building the academic path in the field of Computer Science. Authors used their own professional histories and experiences as input. They highlighted the central values of their research visions and approaches to life and emphasised how they have helped to take decisions that shaped their professional paths.

Results: We present a framework made of the nine macro-themes emerging from the autoethnography analysis and two dimensions that we pick from the literature (interactions and practices). The framework aims to be a reflecting storytelling tool that could support women in Computer Sciences to create their own paths. Specifically, the framework addresses issues related to communication, dissemination to the public, community engagement, education, and outreach to increase the diversity within Computer Science, AI and STEM in general.

Impact: The framework can help building narratives to showcase the variety of values supported by Computer Science. These stories have the power of showing the diversity of people as well as highlighting the uniqueness of their research visions in contributing to transformation of our global society into a supportive, inclusive and equitable community. Our work aims to support practitioners who design outreach activities for increasing diversity and inclusion, and will help other stakeholders to reflect on their own reality, values and priorities. Additionally, the outcomes are useful for those who are

working in improving the gender gap in Computer Science in academia and industry. Finally, they are meant for women who are willing to proceed into an academic career in this area by offering a spur for reflection and concrete actions that could support them in their path from PhD to professorship.

1 Introduction

Storytelling is a primary expression of human psychology and a fundamental aspect in the construction of meaning [8]: it is a way for humans to shape and understand their reality. Creating and sharing stories that show the diverse pathways in life it is essential to have a better understanding of its complexity. Quoting Chimamanda Ngozi Adichie from her TED talk "The danger of a single story" (2009) "The single story creates stereotypes, and the problem with stereotypes is not that they are untrue, but that they are incomplete. They make one story become the only story". Multiple stories show different perspectives and provide a more complete view of the reality and ultimately it is the key for deconstructing stereotypes. Sharing stories that show diverse pathways allow these pathways to be legitimated as well as creating a safe space for people to build their own stories on the basis on their own values contribute the transformation of our global society into a supportive, inclusive and equitable community. The creation of new role models is essential in certain contexts for instance in balancing the presence of women in science, technology, engineering, and mathematics (STEM) fields. In recent years, women's under-representation in STEM has captured the attention in public, academic, and policy circles. Computer Science is one of the most heavily affected areas. This strong imbalance is long enduring, and no significant progress has been observed in the past years, neither in Europe [13] nor in the US [54]. An analysis of CS literature [52] estimates that the gender gap in CS research (parity between the number of male and female authors) will not close for at least 100 years if specific measures are not taken. On average, in the whole of Europe, women take less than 15% of the full professor positions. Figures show that in 2016, an overwhelming majority (83.3%) of ICT specialists employed in the EU were men. 53% of European employers say they face difficulties in finding the right people with the right qualifications [26]. Since information technology has a direct impact on the lives of people in society, the lack of diversity among developers can cause limitations to people rather than support them in achieving the desired goals for the software. A recent study reports that AI can enable the accomplishment of 134 targets across all the sustainable development goals, but it may also inhibit 59 targets [51]. While there is not enough evidence on the relation between AI and sustainable development goal 5 (gender equality), the study claims that AI can work against the accomplishment of goal 5, like for example exacerbating existing gender stereotypes. There are numerous initiatives worldwide devoted to increasing awareness about the diversity problem in Computer Science and implementing measures to mitigate the problem. IEEE Software has recently dedicated a special issue [1] to the diversity crisis in software engineering. The community addresses a variety of diversity axes, such as how to include more young girls into Computer Science [43] and how to render hackathons trans-inclusive [33].

The idea of this work is based on the concept that stories that show diverse pathways can lead a change in the self-perception of women's role in STEM and have an impact on deconstructing stereotypes. In order to explore this topic we conducted a case study based on auto-ethnography, storytelling [8] and self inquiry [7] starting from us the authors of this chapter. The authors have all experience with Computer Science, Computing/ Informatics (field which includes Artificial Intelligence), having encountered these research areas at different turning points in our academic path. For simplicity, in the chapter we will refer to the areas of Computer Science, Computing/Informatics (which include Artificial Intelligence) as Computer Science using the acronym "CS". We are aware that CS might be reductive or considered a subarea of computing but for the sake of facilitating the reading we will adopt this approach but please keep in mind that with the term CS we mean a broader area that includes all the above. This paper is structured as follows. The Background provides an overview of the actual research and the socio-technical context. The Method section presents our qualitative approach to collect and analyse data based on auto-ethnography. In the Analysis and Results we present the thematic analysis outcomes that were elaborated into a frameworks which aims at making storytelling a regular practice to reflect upon our paths, and heading to the next step. Finally, in the Discussion and Impact section we provide our view on how this contribution may impact the broader context.

2 Background

IEEE Software has recently devoted a special issue to the diversity and inclusion in software development [1] that illustrates how dimensions such as geography, gender, socioeconomic politics, age, ethnicity, and disability shape who can participate in creating technology. In the following, we recapitulate women participation in CS, and then existing efforts to widen up female participation in CS.

2.1 Facts about women participation in CS

The Bureau of Labor Statistics (BLS) [14] projects CS research jobs will grow 19% by 2026. Yet, women only earn 18% of CS bachelor's degrees in the United States. Despite the high job demand, CS remains a male-dominated field in the United States. In response, many top colleges are making efforts to recruit female CS students, making it an ideal time for women to pursue CS degrees.

More specifically, women are under-represented among doctoral graduates in the fields of information and communication technologies (ICT) and engineering, manufacturing and construction (21 % and 29 % respectively), while women are 68 % of doctoral graduates in education [54]. A temporal analysis of the European data shows that, on average, no significant progress in female participation in CS higher education has been observed over the past ten years in Europe [19]. The same is true for the US, as shown in [54], gathering data on college students for four decades, which highlights a persistent, sizable under representation of women in CS in the US. Beyond academia, the profession also inherits the male-dominated student population. Women are strongly underrepresented among ICT specialists in all EU Member States, a striking contrast with total employment, where the genders are broadly balanced.

Data for CS only is not available at the European level, however, a loose parallel can be drawn from data for Engineering and Technology where on average, in the whole of Europe, women take less than 15% of the full professor positions [13].

2.2 Existing efforts to widen up female participation in CS

Increasing representation of women in CS at all levels, from undergraduate and graduate studies to participation and leadership in academic and industry positions, is a grand challenge for academics, policymakers and for the society. While research has shed light on the issue, there is limited evidence on effective solutions and on what works. The following challenges are addressed by the community: How to attract more girls choosing CS as their higher education studies and profession? How to retain female students and assure they finish their studies and start successful careers in the field? How to encourage more female Ph.D. and postdoctoral researchers to remain in the academic career and apply for professorships in CS departments? How to support and inspire young women in their careers and help them to overcome the main hurdles that prevent women from reaching senior positions in industry and public sector [23]? Which communication and dissemination strategy to adopt in this field? Frequently applied measures are interventions to recruit more female students to studies. These interventions are run by volunteers in the IT industry, university professors, teachers, parents. Other types of intervention are mentoring programs for women scientists; equal representation in the recruitment processes; and work environment support. These interventions are often run by female actors.

The Horizon 2020 decision-making bodies has reached the objective that women now make up 55% of the advisory boards and 41% of the evaluation experts [13].

There have been several practical efforts to increase the interest in women towards CS courses and careers. For example, a study conducted by the University of California, Berkeley, to close gender gap in CS subjects revealed that the approach in which courses are marketed might not be suitable to attract girls [6]. In 2014, the university changed their course named "Introduction to Symbolic Programming" to "The Beauty and the Joy of Computing" which resulted in women outnumbering men in the class for the first time [6].

Furthermore, one of the biggest motivating factor in current times about CS careers for women could be the fact that CS careers are increasingly perceived to be lucrative [28] and the gender pay gap is very low as compared to other professions [14].

Positive initiatives from highly-regarded organizations can create ripple effects in the tech industry thus inspiring women to explore CS as a career option.Tech giants, like Apple and Google maintain reports Apple[1] and Google[2] to state that there is a requirement for increasing the diversity. Initiatives from tech giants like Apple and Google reduce gender disparity in their businesses by encouraging women to explore CS and gain success with the learned skills. Furthermore, in a study by Google, to access the indicators involved in a woman's decision to pursue CS degree, four key factors were revealed [21]:

- Social Encouragement: positive response from family and friends.
- Self-perception: belief that critical thinking and problem solving skills can provide a successful career.
- Academic Exposure: opportunities to participate in curriculum and/or extra-curricular CS courses/activities.
- Career Perception: positive thinking towards CS as a career with societal impact.

All over the globe, measures to encourage more girls to pursue CS studies are implemented. There have been several successful efforts such as the MIT Women's Technology Program [3] (WTP), which is a program running since 2002 with the goal to increase high school girls' interest to study engineering and CS in the future. In a summer camp held for a week, girls reported under representation of females (only 17% of the total participants) and they would have wanted to work together with more girls [50]. Camps focused only to girls would be more friendly and engaging to them [50]. Previous results also suggest that camps focused only for girls to be more friendly and engaging to them [50]. At the Norwegian University of Science and Technology, Kodeløypa (which means the pathway towards coding), a program running since 2014 [32] introduces boys and girls to programming by encouraging them to playfully interact with digital artifacts and create their own games with Scratch. Such artifacts allow students to learn by iteratively testing and rebuilding their designs while learning programming concepts. The study reported in [32] presents the results of an empirical investigation regarding students' attitudes and identify potential differences in attitudes among male and female students. In all the attitudes, male students' scores were significantly higher than females with the greatest difference in intention to participate in a similar activity.

The EUGAIN project aims at improving gender balance in Informatics at all levels through the creation of a European network of colleagues working on the forefront of the efforts for gender balance in Informatics in their countries and research communities [18]. Figure 2.2 shows the winner of the Minerva Award during the Workshop organized by EUGAIN in cooperation with Informatics Europe. The Minerva Informatics Equality Award recognises best practices in Departments or Faculties of European Universities and Research Labs that encourage and support the careers of women in Informatics research and education. At NTNU we also run the IDUN project [26], that proposes a framework to inspire female researchers in their path from PhD to professor. Figure 2.2 shows a picture of an event in the IDUN projects.

Further, Wang and colleagues suggest that girls may get more out of science and maths lessons if they are taught through the lens of a storytelling and gamified lessons since stories make the lessons more relatable [53]. The studies reported in [29, 11] introduce girls to stories and events that can influence their professional choice at an early age.

Research also suggests that the focus of game-based interventions should be on interest enhancement [49]. Their suggestions are backed up by the findings from Sadik and colleagues [39]. Finally, integrating a game design project into the participants' curriculum to evaluate girls' interest in the topic and might also impact their CS choices in the future [46].

2.3 Role-models

Another strategy is to introduce female role-models in CS to girls [4, 22].

Black and colleagues [4] cited Güre and Camp [22] to state that the lack of female role models in CS was found to be one most detrimental factors for young girls to stop relating CS; and hence they require a female

[1] https://www.apple.com/diversity/
[2] http://www.google.com/diversity/at-google.html
[3] `http://wtp.mit.edu/`

Fig. 1: The EUGAIN Chair Letizia Jaccheri (on the left)f gives the Minerva Informatics Equality Award to Claire Ordoyno (on the right) who received it on behalf of the EPSRC Centre for Doctoral Training in Robotics and Autonomous Systems (UK).

role model to be motivated to study CS or pursue a career in the field [4]. More specifically, a project called CS for Fun (CS4FN [16]) that has produced and made freely available (online) a booklet that showcases female role models and their groundbreaking work in CS. CS4FN [16] was aimed to address one of the biggest hurdles for women to consider CS as a viable field of study, that is the lack of female role models [4].

Concerning the toys that girls relate to, in 2010, Mattel, Inc. announced that the next Barbie will be a computer engineer, as this profession got the most votes (out of five options, i.e., architect, news anchor, environmentalist, surgeon, and computer engineer). Cheryan and colleagues argue that efforts to increase female participation in CS might benefit from changing masculine cultures and providing students with early experiences that signal equally to both girls and boys that they belong and can succeed in these fields [12]. Cheryan and colleagues argue that it might be difficult for women and girls to pursue fields with masculine cultures (beliefs and values encouraging and rewarding masculine characteristics in men) [12]. Similarly, in a survey conducted to study the attitudes of women towards the Computer Engineer Barbie by Martincic and Bhatnagar, 75% of the participants agreed that the doll could influence a girl's decision to enter the field of CS [29]. Martincic and Bhatnagar argue in favour of such toys that could be viewed as the experimental tool for future occupational choices for the children [29] [29].

We can observe that previous research has tackled the problem of improving and maintaining women's interest in CS studies and/or careers using a multitude of strategies. However, this has resulted in a scattered field of knowledge about the state-of-the-art in the field of serious games for this purpose. Therefore, we present a systematic literature review on the current status of research about the effect of the serious games on the girl's attitudes towards CS studies and careers.

3 Our Approach and Method

The main purpose of this work is **to make female computer scientists more visible in their diversity of possibilities for career paths and helping other women on their academic pathways**. With our goal in

Fig. 2: An IDUN project mentoring event lead at NTNU by Letizia Jaccheri the Project Leader (photo by Kai Torgeir Dragland)

mind we developed a storytelling framework using the auto-ethnography approach to collect data [25], and the thematic analysis (induction mode) to identify the main topics emerged. We decide to use auto-ethnography after a thoughtful reflection on the need of providing a description of experiences that include different type of paths, different cultural and educational background, highlights the interdisciplinary, reporting different level of experience (e.g. academic seniority), different social-economic-geographic settings, and to include different CS disciplines. Auto-ethnography has a long tradition in HCI [34] and, also, it has been applied specifically to investigate gender issues in technological infrastructures [45]. As well as the use of storytelling to investigate gender identity has been extensively explored in social science [3]. Narrative is a way for human being to give meaning to our world and make sense of the reality [8], thus using storytelling as a form to collect our experiences it seemed to be the most suitable approach. We expect that auto-ethnography and storytelling would help depicting the richness of our histories as well as to highlight the varieties of elements that characterised our academic career path in CS. Thus, after these considerations we decided to start from our stories as it would have been the most sensitive way to understand how to unveil gender-related issues within an academic career path. Thus, we identified a set of questions (see Tab. 1)and we asked each participants to answer via email. Each story was transcribed in a document and further analysed.

In the following, we present the results of the analysis. Based on those results, we propose a storytelling framework to support in outreach and educational settings around gender in CS.

4 Analysis and Results

Each author conducted the self-interview by writing down the answers and afterwards, two authors analysed the interviews in the vein of thematic analysis (inductive approach) by using NVivo software. One researcher had a first pass of coding the interviews that subsequently was revised by a second researcher in a blind mode. In the initial tagging were created 68 codes that were refined and tuned in further sessions (see Tab. 2).

Finally, these were grouped into nine macro themes: Visions, Values, Motivation, Communication, Processes, Research in CS, Success, Threats, and Suggestion.

1. What was your motivation to go into CS?
2. How and when did you first encounter CS?
3. What is your field of research and main research projects about?
    - Do you have experience with AI?
    - Do you have experience with robotics?
4. Did you have any role models when you started?
5. What was your picture of your future profession? Did you have a "dream" of being able to do something, answer a question, solve a problem, and similar that was not directly connected to one specific role model, but to the picture of a profession and its role or of a research field.
6. What was your ideal of a good life - professional and otherwise?
7. Were there any obstacles on your path?
8. What is your research vision?
9. What are the core values that support your vision?
10. Who are your role models today?
11. If you had to start all over, what would you tell your younger self?
12. What would you recommend to your colleagues to adopt a more inclusive behaviour towards their colleagues of other genders (female VS male and male VS female and including fluid gender)?
13. Looking from a systemic and global perspective, what do we need to improve the gender balance in CS?

Tab. 1: Interviews questions

Theme	**Codes**
Communication	communication
Motivation	external motivation, internal motivation, meaningful activity, motivation, connection with other disciplines, mentoring, new challenge, scholarship to study CS, role models, good teachers, scientist, spiritual
Process	family imprint, life as a process, spontaneous process
Research-CS	AI in our research, affected by AI biases, AI applied to research, AI ethics, AI literature, at the university, cognitive systems, CS as a new language of nature, CS first encounter, research topic, Study AI, teaching AI
Successes	curiosity for the topic, HCI fascination, humanities study, interdisciplinary research, positive experience studying CS, successful experience
Suggestion	Improving gender balance, changing atmosphere, cultural norms, educate, focus on humans, impact on society, interdisciplinarity, risk of AI gender biases
Role-models	recommendations for colleagues, consideration, language, listening, safe space, sharing and collaborating, speak up, suggestions
Threats	unfair treatment, CS not appealing as teenagers, external judgment, obstacles, external obstacles, internal obstacles, performance pressure
Values	confidence, inclusiveness, independence, intuition, open mindedness, respect, values
Vision	being a teacher, ideal of a good life, normal life, personal vision, vision, vision for future profession, vision in software engineering

Tab. 2: Themes and codes

4.1 Themes

These themes help us to see what are the main topics that emerged from our stories and highlighted the main issues encountered (e.g. Threats and Obstacles: "The other obstacle is not trusting myself enough" Id 3) as well as some similarities in our experiences that we had in our career path (e.g. all the stories have items related to Motivation and family imprint: "I was just full of optimism and self-efficacy thanks to my parents and teachers" Id3).

Following we provide a description of the themes, the related codes, and quotes from interviews that exemplify the several facets of each topic.

4.1.1 Visions

Visions can be related to the past, present and future guide. Through the interviews vision is connected to: being a teacher, ideal of a good life, normal life, personal vision, vision, vision for future profession, vision in software engineering (codes). This includes both personal perspectives as human beings "Contribute to something meaningful and follow my inspiration and intuition, while being playful and having fun. Keep growing, be connected with wonderful people, have a family. Inspire others. Carry on adventuring until I graduate from Earth" Id2. As well as "Better understanding of cognition, from basal cellular to the human-level via computational models can help us both better understand the functions of the basic living unit,- the cell, as well as phenomena of intelligence and decision-making under constraints" Id5.

4.1.2 Values

The word and concept of values is recurrent and relates to different aspects: confidence, inclusiveness, independence, intuition, open mindedness, respect, and principles. These values can refer to suggestions on how to build a more inclusive research environment: "First, by offering other cultural models and showing that empathy, fairness, strength can be as efficient as arrogance, egocentrism and competitive behaviour. Giving more space to these people in academia and making prizes that reward this behaviour" Id4. Values that drove the career path in the past: "the hope to find a job and become independent" Id1, "respect and open mindedness are crucial ingredients for collaboration that is the way to success" Id3.

4.1.3 Motivation

Motivation includes all the reasons that move us to pursue a CS academic career path, such as: external motivation, internal motivation, meaningful activity, connection with other disciplines, mentoring, new challenge, scholarship to study CS, role models, good teachers, scientists, and spirituality. Quite often external incentives move us "I was simply going to get a job and make my mum happy" Id3. In other cases role models had an important role. Both from family, "uncle who was an electronic engineer and fond of electronic gadgets" Id5, or researchers as "Brené Brown a social scientist well known for her research on vulnerability and leadership, bridges research, training practitioners, and public outreach - also a really fun human, dedicated family person, and fantastic community builder" Id2. Sometimes also bad experiences constitute a good stimulus to go ahead in order to make things different "The toxic environment where I did my PhD negatively impacted on my career path and my self-esteem. I had to work very hard to recover and to recognise those behaviours as misconducts" Id4.

4.1.4 Communication

Communication has been seen as one of the most important aspects to create an inclusive and respectful environment "By using a more thoughtful language. Thoughts are expressed using words, our language has an impact on others. Language can create new neurologic processes and, in the long term, can change our mental models" Id4. In addition, "First, educate yourself on common pitfalls (so you have the vocabulary to name and communicate it if something is off)" Id2.

4.1.5 Process

Process can concern with family imprint, life as a process and in particular spontaneous process. Regarding the first point, family has an impact on our way of growing such as: "I come from a family of athletes and my sisters and I have been doing competitions in swimming and running since a very early age. My father ran his last marathon 5 months before dying of cancer. We were also encouraged to be good at school, well dressed, slim, everything. When I look back and I listen to the discussion about how to raise children now, I wonder how we survived" Id1. Moreover, life has been seen as a process of "navigating dynamic white waters of real-world complex constraints, enjoying it, in spite of an effort of keeping balance between reasonable amount of control and unpredictability. That applies to both profession and real life – a dynamical balance between opposite constraints" Id5.

4.1.6 Research in CS

Research in CS includes several topics relevant for this study such as: AI in our research, affected by AI biases, AI applied to research, AI ethics, AI literature at the university, cognitive systems, computing as a new language of nature, CS first encounter, research topic, Study AI, teaching AI. Some of us had the purpose of studying CS from the beginning "Many of my peers were coming from technical schools and already knew how to program but I learned quickly and was always very comfortable sharing my strengths in maths and logics" Id3. As for others it was a casual encounter "the first year at the university and it was through the passion that a professor demonstrated about the subject" Id4. Approaching CS was seen as a natural extension of previous knowledge and background "I started to believe that computing is a new language of nature even more versatile than mathematics, that can help us build a new "real-time" natural philosophy where humans will be the organic part of nature, not the outside, "objective" observers" Id5. That was broadening the understanding of the concept of computing into multi-disciplinary models involving humans. Others broaden the approach to applications of CS to other domains: "CS and security, CS and creativity, CS and startups, and one in digital innovation" Id1.

4.1.7 Success

Success stories include several items, such as: curiosity for the topic, HCI fascination, humanities study, inter-disciplinary research, positive experience studying CS, and successful experience. The integration of different disciplines is definitely one of the most common across the interviews. Here some examples: "I try to combine CS and art, CS and social innovation, CS and children, now CS and gender" Id1, "I am also proud of having a classic background as it gives me a different perspective on CS" Id3, and "application of psychology in the design of objects and technologies was extremely fascinating for me" Id4. Often successful stories are related to external visibility "I applied for grants, got my own projects and students, and became visible again" Id3.

4.1.8 Threats

Threats emerged as having different nature, including: unfair treatment, CS not appealing for teenagers, external judgment, obstacles, both external and internal. External and internal threats have definitely different impacts on our career path. For instance, unfair treatment by a colleague can have a severe effect on our self-esteem but also on access to resources "Colleagues treated me like I were a wife looking for a side job, and showed no interest in my research, as they told HCI was not Informatics. The lowest point was the day I was not allowed to attend a seminar as it was only for professors" Id3. Being in academia makes us feel judged "I have been almost overwhelmed by this role model concept and paralyzed that I have to behave as role model." Id1. However, most of the obstacles are coming from our internal judgments "The other obstacle is not trusting myself enough. We have an inherent wisdom inside that guides us, and sometimes that voice gets drowned by the noise from outside (shoulds, have-tos, well-meant advice). We always have a choice, even though sometimes we may not like the options, but I have learned that for every committing Yes I give that means saying No to other opportunities, so now I am more aware of what I say Yes to" Id2.

4.1.9 Suggestions

Suggestions come from our personal reflections on how we could change the actual context and our past experience in order to create a healthier and supporting environment. Quotes were coded as: improving gender balance, changing atmosphere, cultural norms, educate, focus on humans, impact on society, interdisciplinarity, risk of AI gender biases, role models, recommendations for colleagues, consideration, language, listening, safe space, sharing and collaborating, speak up, and suggestions. Educating academics to use a more inclusive language and allowing them developing and growing more equal cultural norms addressed to the diversity and the interdisciplinarity. "To look at the problem as a structural and cultural issue which can have different nuances across countries and cultures, but that is grounded on a power mechanism. We need to demolish this mechanism of power in different ways and at different level" Id4, and "We must also work within different cultural norms and globally" Id5. It is a step forward for creating an academic work environment oriented to listening to each other, to focus on humans, and having safe spaces to speak up: "speak up for yourself or for any observed toxic behaviors in a kind and matter-of-fact way and always assume that people do the best they can" Id2.

4.2 The Role of AI

Before presenting the resulting framework, we wish to address the role of AI within this piece of research.

AI has played a different role in our individual paths. Some of us encountered AI when already established in their career, "When I was department head, we started an AI lab in cooperation with local IT" Id1.

It was inspirational when still at university as "AI was one of my electives and loved using Prolog and LISP to write simple parsers, I find it amazing AI is coming back so strongly now" and a way to feel recognised and legitimated too "then when I took the AI exam they offered me to work on my final project in a European research centre, and after that I started my doctoral research and build my academic career" Id3.

Nonetheless, AI is not only seen as a fascinating subject with great potential but we also approach it in a more critical way, specially when it comes to teaching and preparing next generations as we are "...exposed to some of its biases in ways that make me cringe ... but I see a lot of opportunity it can bring if we teach our software engineers and data scientists to adequately acknowledge and deal with the responsibility they have for the long-term impacts of the systems they put in place." Id2.

The same critical perspective proved valuable when reflecting on the impact AI has on research with a focus on "AI ethics and robotic ethics" and asking "in what way can intelligence, both natural and artificial be understood in terms of computing" Id5, and then moving on to more practical considerations on "children's fears and wishes about AI using AI critical literacy" to guide the design a innovative solutions with and for children, Id4.

4.3 Dimensions

One way to explore our stories in their richness is to look for the kind of Interactions and Practices, as described in [31] that made us the way we are: gave us the motivations to start the adventure pursuing CS, kept us focused, supported during the hard times and enabled us to see the beauty of our dream. Therefore, somehow fostered retention in CS for the authors of this paper. Therefore, we look into the roles played by peers, faculty and family/friends to account for interactions, and match the practices listed by Pantic [31] with those reported in the interviews.

4.3.1 Interactions

Our stories point out the importance of family in providing positive emotional, educational and practical support. In particular we read about mothers as inspiration and role models, uncles and godfathers providing school guidance and educational support. Faculty and teachers we met at different stages of our lives are also positive inspirational figures as well as peers as they also provided a sense of legitimacy by acknowledging our worth, and more importantly, helping us to recognise it too. Most of the quotes reporting positive or memorable interactions belong to the "Inspirations, Supporters, Facilitators" and the "Process" themes, showing how examples played a strong role in guidance towards pursuing career in CS.

4.3.2 Practices

Most interviewees commented on "good classes" often run by the "good teachers" mentioned above, to be the trigger for interest in CS. For instance, attending a course introduction to AI was a major turning point for one of the authors who decided to embrace a career in academia. Facing and overcoming obstacles made us more inclined to take on challenges, to the point that some of us were looking explicitly for complex, challenging situations to prove our worth to ourselves. We all have to accept abandoning perfectionism and instead set more realistic goals for ourselves. But what made us stay and try harder was finding jobs that were stimulating and challenging and helped us to be acknowledged as members of the CS community that in turn made us want to help others feel the same.

Both the 9 categories and the two pillars are used as structuring concepts for a framework that aims to make female computer scientists more visible in order to show a diversity of possibilities.

4.4 Storytelling framework

Our analysis showed how diverse an academic career path in CS could be for women, it highlights several gender-related aspects that impacted on shaping the pathways (e.g. family caring tasks). Some elements are recurrent across the five stories, and some were disruptive while others soothing our pathways. From these outcomes we elaborated a framework, Table 3, that has the purpose to support the use of storytelling as a regular exercise to reflect upon our paths, how far we have come, and where we aim to head for the future. The themes are the ones that emerged in our analysis, as well as the two dimensions of *interactions* and *practices*. The prompts for exploring them stem from a variety of resources for personal inquiry and growth.

We suggest using the prompts and activities in personal reflective practice as well as in workshop settings with students and the general public.

These items are not equal to each other, for instance values should be set up to drive the rest: values are included in the vision that is implemented in the research. Values are embedded in the motivation, as well as driving the communication and the process. At the same time they have emerged as outcomes of process, for example via family imprinting. Values provide at the same time lenses to look at threats and successes. They may also be the foundation for the suggestions. Moreover, values are not fixed entities but can change over time. In fact, they have to be flexible to changes, as they have to represent and respect our-selves and drive our actions in the world.

The vision interactions aims to lead to a reflection on how our broad impact and to envision on the potential paths that could bring us there. The motivation is also connected to the vision and it concerns with finding the main reasons that guide us across our journey. It could be related to a role model or to our inner inspirations. Communication is essential to succeed in any career path or just for being a decent human being. In particular, reflecting on our ability of listening (and not just with our hears) and answering using an empathetic language. A deep consideration on the process that brings us to advance or prevent our career can be a good practice that will bring to a more conscious pathway.

Threats and Success can be considered as two sides of the same coin. As understanding our obstacles (internal and external) will allow us to make a plan to achieve more success. Moreover, these latest should be assessed in terms of our vision and values. Constantly assessing how our research contributes to the community and how far are we from our vision is a good way of reflecting on this item. Finally, reflecting on the suggestions we got (from others and from our selves) and how these contribute to our actual status it is a god practice of self- assessment. All these parts are interconnected and one support the other, thus this framework should be considered as an holistic approach of supporting a self-reflection practices on academic career path.

Uniqueness for Women in IT. The framework was built from a reflection that has seen women as principal actors as their narratives contains unique elements that are specifically related to women. However, this framework can be used by any human being in general and computer scientists in particular. All choices at work and in our career are driven by our beliefs. In some cases this drive is visible more directly than in others, such as choosing to study how design can help achieve better gender balance in CS, or accessibility for all. Specifically, as both IT and STEM academia tend to be male-dominated environments, a reflection framework will open up creativity. In

	Interactions	Practices
Values	What are the values you base your life on? How do you live into these values? Who in your life has shown you integrity around the values they uphold?	Reflect on values and choose three to focus on living into for a period of time. Revisit. [40, 2]
Visions	Have you seen glimpses of better world instances where you came across sth. you wanted to contribute to? How can computing be supportive here?	Take time to journal about possibilities and paths. In writing, more insight unfolds. [20, 44]
Motivation	Have you experienced scenarios where you found ourselves engaging naturally and effortlessly? Who were/are your role models? Which supporters do you have in your life? What moves you?	Research and find people who inspire us. Engage with inspirational content on a regular basis. Morning inspiration sets the mood for the day which influences our efficacy and output. [42, 17]
Communication	Where in your life have there been instances gone well or gone bad in communication? Which elements of communication contributed? Language, gesture, facial expression, medium?	Practice active listening in all conversations. Listen as intently as you wish to be heard. Learn empathic communication or non-violent communication [36]
Process	Which steps have helped you along the way in developing your career so far? Which activities do you engage in for your work that contribute to your expansion? How does your personal background and family imprint sabotage or support these processes?	Take one hour at the end of the week to reflect upon the past week and what went well and what can be improved, and to plan the week ahead. Meta-reflection on processes and activities shows to pay off within a matter of weeks. [10]
Threats	What are the major obstacles and challenges you perceive in your life? What of those that are external and those that are internal?	Take an hour to reflect upon any fears and concerns that you have in your life. Spend time with each of them to draw out alternatives if they surfaced and came true.[4]
Successes	What successes have confirmed your intentions of pursuing your goals? What do you experience as your most significant accomplishments? How are these connected to your values?	Celebrate your successes. We often look only at what remains to be done, when there is also ground we have already covered. Make a list of achievements. [24]
Research	What are the research contributions you have made or aspire to make? How do you wish to serve the world?	Reading about research and having reflective conversations around new research methods and adjacent fields sparks the imagination [35].
Suggestions	What was the best advice you ever received? What suggestions have you found helpful? Would you suggest your past and future "you"?	Deep down we already know the answers. Write a letter to your younger self with three pieces of advice to give [48].

Tab. 3: Storytelling Framework based on Interview Themes

addition, as we are not defined by the two former context conditions, the framework is value-specific and bases all other reflections on the foundation of individual values.

This framework is created from women histories with the purpose of supporting other women in the creation and development of their own narrative and feel empowered to design and develop their own path in academia. The framework is shaped by considering the diversities of women pathways in CS and by embedding the peculiarities of these paths. The strength of the framework stays in the way all these features are transformed into a method that allows the creation of a narrative for shaping career pathway. In doing so, it brings a strong message that there are many and diverse ways to be successful in CS.

The final purpose of this framework is to support women in being more assertive in the way they freely design their career path to suit their needs, inclinations and preferences, to own and be the main agent of her pathways to academia in CS. This reflection tool aims at creating a safe space for women to take the agency and the ownership of her career.

Is it possible to make the framework more specific to women in CS? When grappling with the question of how we could make it more specific for this particular audience and purpose we found several aspects mostly linked with the CS values. And the urge to conform, at least initially, to what was perceived as one monolithic set of principles, somehow defined by a male dominated community where total dedication to technology seemed to be a must. First and foremost the framework naturally deals with the need of legitimization and recognition endemic in the CS community.

Being members of the CS community has been clearly an important achievement in our early career, by looking at the two dimensions of interactions and practice we can see how we thrived to prove our worth to ourselves and others around us. But then we each developed our paths in different, fulfilling and at times unorthodox ways, and in so doing realised that there are many ways to be part of the same CS community, and of its many sub-communities each with their own philosophy and modus operandi, shared values and ad hoc ways to communicate these. Therefore, our frameworks is naturally infused with a variety of ways to be a member of the CS community while keeping our own principles and views.

There is a differentiation between working life and private life, and yet a common set of values will underlie both of them if the responding human being has a sense of congruence. For example, we bring our values with us everywhere, but sometimes the environment around us, people and work ethics, may not be accepting of them. Still, when we reflect about our research and attitude towards teaching and supervising students, these values may reflect who we are and choose to be in the world. That would mean we are in congruence within the different contexts - we are in tune value-wise, or in alignment.

5 Discussion and Impact

5.1 Tie-in with Related Work

As recent research [27] convincingly argues there is ample evidence of gender bias in the whole of academia. Although it is well documented that the engineering and computing [15] is not gender balanced, there is a lack of agreement about the underlying causes, the critical barriers faced by students, educators, researchers, and practitioners, and the interventions and practices that may help. Moreover, the community tends to focus on one diversity dimension without considering it in combination with other aspects. In order to question and counteract the stereotypes in the field of computing in a similar way as envisaged by [37] for children, our article suggests the diversity of paths female students can take in pursuing a career in CS. It also exemplifies possible barriers, hurdles and ways around them as well as motivating factors.

The strategy of using the female histories as role-models in CS has been used in the past [4, 22]. Indeed, the lack of female role models in CS [4] [22] is still an issue and it has been recognised as one of the most detrimental factors for young girls causing them to stop relating to CS; and hence they require a female role model to be motivated to study CS or pursue a career in the field [4, 11]. More specifically, a project called CS for Fun (CS4FN [16]) can be mentioned, that has produced and made freely available (online) a booklet that showcases female role models and their groundbreaking work in CS. CS4FN [16] was aimed to address one of the biggest hurdles

for women to consider CS as a viable field of study, that is the lack of female role models [4]. In this perspective we aim at providing a more complex and yet reachable depiction of women pathways with the intention of giving back not just role models but a rich set of interactions and practices that could inspired other women without forcing them to take a predefined path or even scare them by portraying unobtainable standards. Likewise, our framework offers a support to the implementation of four key factors that involved in a woman's decision to pursue a CS degree [21] (Social Encouragement, Self-perception, Academic Exposure, and Career Perception). The framework's elements aim at supporting females in CS by pushing them to reflect on past, actual, and future interactions and practices. For instance, the Social encouragement factor is connected with the Motivation and Suggestions. As we pointed out the social context (including family imprinting) is an important driver to support and encourage women in their career path. The factor of Self- perception is related to Values but also to Threats and Successes. While Academic Exposure is connected with the ability to Communicate and put in places fruitful process. Finally, the Career Perception factor is connected with the Vision and the Research implemented. Thus, it would be possible to use the framework to motivate woman's decision to pursue CS degree.

5.2 The Significance of Role Models

The strategy of using these female histories as role-models in CS is not new, see [4, 22]. Indeed, Black and colleagues [4] cited Güre and Camp [22] to state that the lack of female role models in CS was found to be one most detrimental factors for young girls to stop relating CS; and hence they require a female role model to be motivated to study CS or pursue a career in the field [4]. More specifically, a project called CS for Fun (CS4FN [16]) that has produced and made freely available (online) a booklet that showcases female role models and their groundbreaking work in CS. CS4FN [16] was aimed to address one of the biggest hurdles for women to consider CS as a viable field of study, that is the lack of female role models [4].

Role models can inspire us - they are not here to confine us or put us into new boxes. With all due respect to the great role models that are available once the search is started, we also wish to acknowledge that inspiration by a role model, and vision resulting therefrom may be there or not, and both is fine. There are many successful professionals that discovered their path one step after the other. Passions can be known, or developed. As Newport describes in his book 'So good they can't ignore you' [30], passion can be a result of deliberate practice over time that comes with the fruit of labor of success. One of the authors of the chapter at hand sometimes still questions how she ended up becoming a CS professor. Multiple stories showing the diversity of academic career pathways can enrich existing role models and inspire the creation of new one. Throughout the framework we aim at helping everyone to build their own story and become a role model themselves.

5.3 Threats to Validity

In terms of limitations we have identified three main validity issues: construct, internal and external. Following we provide details for each.

Construct validity: in the methods section we have extensively explained the motivation behind the use of auto-ethnography as a way of providing a self-reflection output and to create a storytelling.

Internal validity: The two researchers who coded the interviews were also interviewees. This introduces a potential bias. However, we made sure that the primary coding of an interview was done by the researcher who was not the interviewee.

External validity: Our results are not intended to be generalized but to show one expression of how experience as female researchers in CS can manifest. Therefore our only measure is whether the results are useful to trigger discussions and inspire action in settings when gender in CS is a relevant topic of conversation, see the following subsection.

5.4 Outreach and dissemination opportunities

We discuss how this can inform science communication, dissemination to the public, community engagement, education and outreach to increase the diversity within CS and STEM in general. One of the initial hunches we had in this research was that our stories might be useful in several ways:

- Use the stories as warm-up or illustrative scenarios to speak about gender in CS and associated benefits and challenges. This might help admissions officers who cannot share their own story.
- Use the range of experiences and development paths to show the breadth of what is possible. Research has shown that exposure to role models helps to reduce the gender gap in STEM [5] and for leadership [41].
- Use the examples to discuss challenges when people are not comfortable sharing their own stories (yet). Especially in work environments that do not yet have established a safe space for such conversations.
- Use the framework to allow women who are or are willing to proceed to go for an academic career to reflect and make a plan for their path. Questions about interaction and practices aim at making them reflect on their past and present situation towards the definition of a clear future pathway.
- Develop a workshop to craft own stories. It is possible to use the questions we had for our interviews, and propose additional questions. Stories depend on our personal upbringing, so they are strongly influenced by cultural contexts.

As all researchers involved in this series of interviews were raised and predominantly work in Europe, there is a limited range of experiences represented. We encourage readers to run their own focus groups with a cohort of like-minded interested researchers.

6 Conclusions and Future Work

The rise of new technologies, in particular AI and their convergence with the physical world, is affecting millions of citizens, companies, as well as social and governmental organizations. New technologies have triggered a global race for investment, talent, knowledge and research. However, this development also increases the diversity gap and regardless the efforts done in addressing this issue it is still present. Filling this gap is an important step towards the development of this field as the lack of diversity in CS can cause serious limitations. We address this issue leveraging on storytelling to break stereotypes and disseminate diversity in career pathways.

In this chapter we present a study that produced as outcome a conceptual framework for supporting women in their career path by offering cues for storytelling, internal inquiry and reflection.

The framework was derived from an auto-ethnography study conducted on the histories of five women in CS (the authors). Stories were studied in the vein of thematic analysis and the findings elaborated were developed as a framework. The framework can be used in numerous contexts. For instance, it can be a helpful resource for women when planning their career path. Additionally, it can prove useful in outreach and workshops about balancing gender in CS when participants may be new to the opportunities and challenges of this topic, or when in a setting where participants may shy back from revealing personal experiences with their challenges in gender balance.

This work offers the unique opportunity to highlight the importance for five women in CS academia of a personal and cultural background as a legacy on which to build future perspectives. Considering that all interviewees are in academia this framework would strongly benefit from more variety in terms of including other stories for instance to inquire CS alumni who went into industry or that worked in other areas of computing. Moreover, we will include stories also outside Europe as the authors are all from European countries. In the future, this direction would offer the opportunity to broaden the impact and to strengthen the framework.

Additionally, in order to assess and improve the framework we aim at organising a first workshop in which we will use the framework with women in CS with the purpose of creating their narrative and owing their career path. For instance, the workshop could use the dimensions and prompts of the framework to ask the participants to create their own story as a starting point for building a bigger vision and more detailed plan.

We expect that using the framework in a concrete context in which we could observe the implications will provide concrete feedback that will help to enhance it. Definitely, these two actions (to include data from more histories and the usage in the context) will support its improvement and broadening of its scope.

Another potential development for the future concerns the gamification of the framework [29, 11, 12], as gamification can influence professional choice at an early age. Storytelling and gamification together have the

potential to appeal to a young audience and help inducing behavioural changes as discussed in Rubegni et al. [37]. The study reported there was followed by an exercise in the explicit use of gamification described in a related Master thesis [9], where a number of game based activities were devised to help female students in group bonding and boost creativity and resulted in the production of more gender balanced and less stereotypical multimedia stories [38].

As stated by Chimamanda Ngozi Adichie in her TED talk "The danger of a single story" (2009), providing more than one story can lead to increasing the diversity and eventually to building a more inclusive society in which women have equal voice and power in shaping our reality as academics as well as human beings.

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References

[1] Khaled Albusays, Pernille Bjorn, Laura Dabbish, Denae Ford, Emerson Murphy-Hill, Alexander Serebrenik, and Margaret-Anne Storey. The Diversity Crisis in Software Development. *IEEE Software*, 38(2):19–25, 2021.

[2] Barrett Values Center. The Barrett Model. `https://www.valuescentre.com/barrett-model/`, 2021.

[3] Susan Birrell and Mary G McDonald. Break points: Narrative interruption in the life of billie jean king. *Journal of Sport and Social Issues*, 36(4):343–360, 2012.

[4] Jonathan Black, Paul Curzon, Chrystie Myketiak, and Peter W. McOwan. A study in engaging female students in computer science using role models. In *Proceedings of the 16th Annual Joint Conference on Innovation and Technology in Computer Science Education*, ITiCSE '11, pages 63–67, New York, NY, USA, 2011. ACM.

[5] Thomas Breda, Julien Grenet, Marion Monnet, and Clémentine Van Effenterre. Do Female Role Models reduce the gender gap in science? Evidence from French high schools, 2021. halshs-01713068v5.

[6] Kristen V. Brown. Tech shift: More women in computer science classes. `https://www.sfgate.com/education/article/Tech-shift-More-women-in-computer-science-classes-5243026.php`, February 2014. Accessed: 2018-12-10.

[7] Jerome Bruner. Life as narrative. *Social research*, pages 11–32, 1987.

[8] Jerome Bruner. The narrative construction of reality. *Critical inquiry*, 18(1):1–21, 1991.

[9] Jelena Budakovic. Using design for fighting gender stereotypes in digital storytelling for children, 2019. Master Thesis, USI.

[10] Brendon Burchard. *High performance habits: How extraordinary people become that way*. Hay House, 2017.

[11] Sapna Cheryan, Allison Master, and Andrew Meltzoff. Cultural stereotypes as gatekeepers: Increasing girlsínterest in computer science and engineering by diversifying stereotypes. *Frontiers in psychology*, 6:49, 02 2015.

[12] Sapna Cheryan, Sianna A Ziegler, Amanda K Montoya, and Lily Jiang. Why are some stem fields more gender balanced than others? *Psychological Bulletin*, 143(1):1, 2017.

[13] European Commission. She Figures 2018. https://ec.europa.eu/info/publications/she-figures-2018_en, 2018.

[14] ComputerScience.org. Women in computer science: Getting involved in stem. https://www.computerscience.org/resources/women-in-computer-science/, 2017. Accessed: 2021-11-20.

[15] Christianne Corbett and Catherine Hill. *Solving the Equation: The Variables for Women's Success in Engineering and Computing*. ERIC, 2015.

[16] cs4fn. Computer science for fun. http://www.cs4fn.org/.

[17] Benjamin J Drury, John Oliver Siy, and Sapna Cheryan. When do female role models benefit women? The importance of differentiating recruitment from retention in STEM. *Psychological Inquiry*, 22(4):265–269, 2011.

[18] EUGAIN. EUGAIN COST ACTION CA19122 European Network For Gender Balance in Informatics. https://eugain.eu, 2021.

[19] Informatics Europe. Informatics Europe Higher Education Data Portal. https://www.informatics-europe.org/data/higher-education/, 2020.

[20] Natalie Goldberg. *Writing down the bones: Freeing the writer within*. Shambhala Publications, 2005.

[21] Google. Women who choose computer science–what really matters. https://static.googleusercontent.com/media/edu.google.com/en//pdfs/women-who-choose-what-really.pdf, May 2014. Accessed: 2021-11-20.

[22] Denise Gürer and Tracy Camp. Investigating the incredible shrinking pipeline for women in computer science. *Final report–NSF project*, 9812016, 2001.

[23] Lucia Happe and Barbora Buhnova. Frustrations steering women away from software engineering. *IEEE Software*, pages 0–0, 2021.

[24] Helen Happer, Joanna McCreadie, and Jane Aldgate. *Celebrating success: what helps looked after children succeed*. Social Work Inspection Agency, 2006.

[25] Stacy Holman Jones. Autoethnography. *The Blackwell encyclopedia of sociology*, 2007.

[26] Letizia Jaccheri, Cristina Pereira, and Swetlana Fast. 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)*, pages 9–16. IEEE, 2020.

[27] Anaïs Llorens, Athina Tzovara, Ludovic Bellier, Ilina Bhaya-Grossman, Aurélie Bidet-Caulet, William K Chang, Zachariah R Cross, Rosa Dominguez-Faus, Adeen Flinker, Yvonne Fonken, et al. Gender bias in academia: A lifetime problem that needs solutions. *Neuron*, 109(13):2047–2074, 2021.

[28] C. Brett Lockard and Michael Wolf. Occupational employment projections to 2020. *Monthly Labor Review*, 135(1):84 – 108, 2012.

[29] Cynthia Jo Martincic and Neelima Bhatnagar. Will computer engineer barbie® impact young women's career choices? *Information Systems Education Journal*, 10(6):4, 2012.

[30] Cal Newport. *So good they can't ignore you*. Hachette UK, 2016.

[31] Katarina Pantic. *Retention of Women in Computer Science: Why Women Persist in Their Computer Science Majors* . Utah State University. All Graduate Theses and Dissertations. 7794., 2020.

[32] Sofia Papavlasopoulou, Michail N Giannakos, and Letizia Jaccheri. Creative programming experiences for teenagers: attitudes, performance and gender differences. In *Proceedings of the The 15th International Conference on Interaction Design and Children*, pages 565–570, 2016.

[33] Rafa Prado, Wendy Mendes, Kiev S. Gama, and Gustavo Pinto. How trans-inclusive are hackathons? *IEEE Software*, 38(2):26–31, 2021.

[34] Amon Rapp. Autoethnography in human-computer interaction: Theory and practice. In *New Directions in Third Wave Human-Computer Interaction: Volume 2-Methodologies*, pages 25–42. Springer, 2018.

[35] Simone M Ritter, Rick B Van Baaren, and Ap Dijksterhuis. Creativity: The role of unconscious processes in idea generation and idea selection. *Thinking skills and creativity*, 7(1):21–27, 2012.

[36] Marshall B Rosenberg and Deepak Chopra. *Nonviolent communication: A language of life: Life-changing tools for healthy relationships*. PuddleDancer Press, 2015.

[37] Elisa Rubegni, Monica Landoni, and Letizia Jaccheri. Design for change with and for children: How to design digital storytelling tool to raise stereotypes awareness. In *Proceedings of the 2020 ACM Designing Interactive Systems Conference*, pages 505–518, 2020.

[38] Elisa Rubegni, Monica Landoni, Laura Malinverni, and Letizia Jaccheri. Raising awareness of stereotyping through collaborative digital storytelling: Design for change with and for children. *International Journal of Human-Computer Studies*, 157:102727, 2022.

[39] Alaa Sadik. Digital storytelling: A meaningful technology-integrated approach for engaged student learning. *Educational technology research and development*, 56(4):487–506, 2008.

[40] Shalom H. Schwartz. An Overview of the Schwartz Theory of Basic Values. `https://scholarworks.gvsu.edu/orpc/vol2/iss1/11/`, 2012.

[41] Ruth Sealy and Val Singh. The importance of role models in the development of leaders' professional identities. In *Leadership perspectives*, pages 208–222. Springer, 2008.

[42] Ruth HV Sealy and Val Singh. The importance of role models and demographic context for senior women's work identity development. *International Journal of Management Reviews*, 12(3):284–300, 2010.

[43] Kshitij Sharma, Juan C Torrado, Javier Gómez, and Letizia Jaccheri. Improving girls' perception of computer science as a viable career option through game playing and design: Lessons from a systematic literature review. *Entertainment Computing*, 36:100387, 2021.

[44] Paul J Silvia. *How to write a lot: A practical guide to productive academic writing*. American Psychological Association, 2007.

[45] Katta Spiel. " why are they all obsessed with gender?"—(non) binary navigations through technological infrastructures. In *Designing Interactive Systems Conference 2021*, pages 478–494, 2021.

[46] Elizabeth Sweedyk. Women build games, seriously. In *Proceedings of the 42Nd ACM Technical Symposium on Computer Science Education*, SIGCSE '11, pages 171–176, New York, NY, USA, 2011. ACM.

[47] Marianna Szabó and Peter F Lovibond. The cognitive content of naturally occurring worry episodes. *Cognitive Therapy and Research*, 26(2):167–177, 2002.

[48] C Szedlak, MJ Smith, and B Callary. Developing a 'letter to my younger self'to learn from the experiences of expert coaches. *Qualitative Research in Sport, Exercise and Health*, 13(4):569–585, 2021.

[49] Robert H Tai, Christine Qi Liu, Adam V Maltese, and Xitao Fan. Planning early for careers in science. *Life sci*, 1:0–2, 2006.

[50] Timothy Urness and Eric D. Manley. Generating interest in computer science through middle-school android summer camps. *J. Comput. Sci. Coll.*, 28(5):211–217, May 2013.

[51] Ricardo Vinuesa, Hossein Azizpour, Iolanda Leite, Madeline Balaam, Virginia Dignum, Sami Domisch, Anna Felländer, Simone Daniela Langhans, Max Tegmark, and Francesco Fuso Nerini. The role of artificial intelligence in achieving the sustainable development goals. *Nature communications*, 11(1):1–10, 2020.

[52] Lucy Lu Wang, Gabriel Stanovsky, Luca Weihs, and Oren Etzioni. Gender trends in computer science authorship. *Communications of the ACM*, 64(3):78–84, 2021.

[53] Ming-Te Wang and Jessica L Degol. Gender gap in science, technology, engineering, and mathematics (stem): Current knowledge, implications for practice, policy, and future directions. *Educational Psychology Review*, 29(1):119–140, 2017.

[54] Stuart Zweben and Betsy Bizot. Taulbee Survey–Total undergrad CS enrollment rises again, but with fewer new majors; Doctoral degree production recovers from last year's dip. *Computing Research Association*, 2019.