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Gender Differences in Aspirations and Attainment: Towards an Integrative Socio-Ecological Developmental Systems Approach

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ABSTRACT
Significant progress has been made regarding educational and occupational opportunities for women. Yet, gender segregation continues to exist in many domains, including occupational choices, division of household responsibilities, and differences in paid and unpaid labour. A number of explanations have been made to account for the enduring gender inequalities, including gender essentialism, socialisation experiences, prevailing stereotypes, as well as downright discrimination. In this paper, I consider an INtegrative socio-ecological DEvelopmental Systems Approach (INDESA) and argue that for a better understanding of and to effectively address persisting gender inequalities, one must consider the multiple influences that shape individual development over time and in context. Gender differences become evident in early childhood and are perpetuated through everyday interactions with significant others and the wider social context. Small biasing effects can accumulate across different situations and over time, resulting in distinct behavioural pathways for men and women, even for those with similar abilities and social backgrounds. To initiate change in perceptions and behaviour, it is crucial to address multiple interlinked inequalities that occur across the life course and to actively foster policies and institutional reforms that promote equality.

KEYWORDS
Gender; aspirations; attainment; integrative socio-ecological developmental systems approach

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INTRODUCTION

Significant progress has been made regarding educational and occupational opportunities for women. More women are attaining degree level qualifications and have entered the workforce in increasing numbers, including women with young children (DiPrete & Buchmann, 2013). Yet, progress has stalled since the turn of the millennium (England et al., 2020) – in particular in the aftermath of the COVID-19 pandemic (Fisher & Ryan, 2021; Kristal & Yaish, 2020; UN Women, 2022). There are persistent inequalities in the gender division of labour, with men doing more paid work outside the house, while women do more unpaid work inside (Craig & Churchill, 2021). When doing paid work, women continue to be paid less than men, even for doing the same task (Lažetić, 2020). Differences in the division of paid and unpaid work as well as the type of work men and women do are crucial determinants of unequal outcomes in the labour market. Men and women tend to pursue different occupational interests and choices, with women being underrepresented in well-paid occupations, including those in the fields of science, technologies, engineering, and mathematics (STEM) (OECD, 2023a; UN Women, 2022). The underrepresentation of women in certain STEM occupations such as engineering or computing has complex and multiple reasons ranging from differences in socialisation experiences, individual preferences and choices to downright discrimination (Ceci et al., 2014). In this paper, I introduce an integrative developmental systems approach, informed by socio-ecological models of human development (Bronfenbrenner, 1979) to account for multi-level influences, sociological life course theory (Elder, 1998; Elder et al., 2003) specifying the characteristics of the context, and psychological theories of motivation to specify the development of individual agency (Eccles & Wigfield, 2020; Heckhausen et al., 2010).

Towards an INtegrated socio-ecological DEvelopmental Systems Approach (INDESA)

Gender inequalities in aspirations and attainment are shaped by the intersection of multiple influences, including structural, institutional, as well as individual-level factors. Moreover, gender inequalities develop over time and in context. For a comprehensive understanding of persisting gender inequalities, it is not sufficient to focus on any single factor or process or developmental period, such as individual preferences or choice that manifest during adolescence or early adulthood, owing to the dynamic and interlinked nature of human development which is embedded in a changing socio-historical context (Schoon & Eccles, 2014a; Schoon & Heckhausen, 2019). A useful integrative framework for studying gendered pathways and decision making (Schoon, 2015) draws on assumptions informed by socio-ecological models of human development (Bronfenbrenner, 1979), sociological life course theory (Elder, 1998), and the situated expectancy-value theory of motivated choice and behaviour (Eccles & Wigfield, 2020; Schoon & Eccles, 2014a; Schoon & Heckhausen, 2019) to enable a more comprehensive understanding of the dynamic interactions between individual and context.

The socio-ecological perspective of human development provides a heuristic for understanding how multiple factors, ranging from micro-to macro-level influences affect individual development. Bronfenbrenner (1979) introduced the notion of development in context, which postulates that developmental outcomes are shaped by the interaction of genetic, biological, psychological, and sociological factors in the context of environmental support. Bronfenbrenner emphasized the need for a non-reductionist analysis of individual behaviour requiring the simultaneous description of several spheres of influence, thereby moving beyond simple cause and effect explanations of behaviour. Individuals are understood as living systems, striving to function under various conditions by purposively changing the environment and themselves (Bronfenbrenner & Evans, 2000). The goal-directedness of self-active systems includes the accommodation to external conditions and at the same time the adaptation to internal needs. Context and individual are in transaction, and developmental outcomes not only reflect previous levels of adaptation but also intervening contextual inputs (Schoon & Heckhausen, 2019). Specifying the characteristics of the context and processes of striving within this context, the integrative approach draws on sociological life course theory and psychological theories of motivation.

The life course perspective views the socio-cultural environment as a crucial influence on human development. Developmental processes occur in a multi-level context and are shaped by social institutions and through interactions with significant others such as parents, teachers, and peers (Elder, 1998). The life course is conceptualised as a complex normative structure as reflected in inter-related and institutionalized sequences of social positions and roles. Individual lives are guided through age-related legal norms as well as population-based norms and informal expectations regarding the type, timing, and sequencing of social roles, a patterning that has also been described in terms of "scripts of life" (Buchmann, 1989; see also Heckhausen & Buchmann, 2019; Heckhausen et al., 2010). These norms, values, and patterns of socialisation shape career choices and behaviours (Schoon & Heckhausen, 2019). Age-related norms and expectations can vary by gender, ethnicity, and social class – and are also highly responsive to social change. For example, changing labour markets requiring a highly skilled labour force led to the widening of educational opportunities in the 1960s, which in turn was associated with increased and extended education participation among previously disadvantaged groups, including women (DiPrete & Buchmann, 2013). Moreover, women's employment has increasingly become the norm, even for mothers with young children (England et al., 2020).

In addition, individual level variables matter. The situated expectancy-value theory (Eccles, 1987; Eccles & Wigfeld, 2020) highlights the importance of expectancies of success and subjective task values as two central drivers of motivated behaviour, including aspirations, goals, career choices, and engagement. The motivational theory of lifespan development (Heckhausen et al., 2010) specifies different strategies of motivational and volitional self-regulation during goal(re)selection, goal engagement, goal disengagement, and re-engagement throughout one's life. Like life course theory, these motivational theories emphasise that individual lives are shaped through ongoing interactions with the environment and significant others (Eccles & Wigfield, 2020; Schoon & Eccles, 2014a; Schoon & Heckhausen, 2019). Yet, while motivational theories primarily focus on how and why individuals choose, pursue, change, or give up certain goals, the main focus of life course theory is on the role of the wider

socio-historical context, institutional factors, social norms, and social inequalities in shaping individual lives. Integrating these frameworks into a socio-ecological developmental systems approach (INDESA) can provide a more comprehensive understanding of how developmental processes in human lives are shaped by the interactions of social structures, institutional factors, and individual-level processes.

INDESA conceptualises human development as a process, whereby individuals construct their own life course through the choices and actions they take within the opportunities and constraints of socio-historical circumstances (Schoon & Eccles, 2014a; Schoon & Heckhausen, 2019). The individual actively directs the developmental process, bringing to each new situation his or her attitudes, expectations, and feelings, which in turn are influenced by his or her history of earlier interactions with the social context in which they are growing up. Pathways through life are understood as developmental processes extending over time and being shaped by complex interdependent relationships, including links to biographical experiences, interactions with others, and the wider social context in which development takes place. Crucially, individual agency cannot be reduced to decontextualized universal principles of psychological functioning nor to a mere expression of structural constraints or regularities produced by societal institutions or social structures. Agency is understood as a relational construct that emerges through interaction with a wider socio-cultural context (Schoon & Eccles, 2014a; Schoon & Heckhausen, 2019).

Conceptualising gendered behaviour patterns in terms of both structure and agency highlights the importance of understanding what becomes part of an individual's perception of possible choices. Although individuals choose from among several options, they do not consider the full range of objectively available options in making their selections. Their choices are circumscribed by their "horizon of perceived possibilities", i.e., the perception about what career options are available and appropriate to strive for (Schoon & Heckhausen, 2019). Many options are never considered because the individual is unaware of their existence. Other options are not seriously considered because the individual has inaccurate information regarding either the option itself or the individual's possibility of achieving the option. Still other options may not be seriously considered because they do not fit in well with the individual's gender-role schema or perceptions of social status. Indeed, a range of contextual influences such as social background, cultural norms, gender roles, or institutional pressures influence educational and vocational choices, in part through their impact on individuals' perceptions of viable options, but also through their impact on expectations, ability concepts, and subjective task values (Schoon & Eccles, 2014b; Schoon & Heckhausen, 2019).

In the following, the relevance of an integrated socio-ecological developmental systems approach (INDESA) for the study of gender differences in aspirations and achievement will be exemplified, outlining the contributions of the approach towards a better understanding of the multiple interlinked and dynamic processes shaping human development.

Biological foundations and gender essentialism

INDESA acknowledges the biological basis of human development, i.e., that our behaviour is embodied. However, unlike assumptions of gender essentialism,

which assume fixed and unchangeable qualities that characterise men and women (Eagly & Wood, 2013), INDESA takes into account the impact of the wider socio-historical context and developmental processes. According to assumptions of gender essentialism, men and women are innately and fundamentally different in their interests and skills (Charles, 2011; Charles & Bradley, 2009; Ridgeway, 2009). It is argued that evolutionary factors have predisposed women to prioritize family over careers and to prefer people-oriented work rather than tasks involving objects. Proponents of this view claim that these fundamental gender differences originate in the very structure of the human brain (Baron-Cohen, 2003; Brizendine, 2006; Pinker, 2008). Preferences for a "home-centred", "work-centred", or "adaptive" lifestyle transcend social class, education, and ability, although they may evolve throughout one's life course in terms of their significance and emphasis for work versus family orientation (Hakim, 2000). Moreover, to justify the underrepresentation of women in STEM-related careers, gender essentialists would argue that men inherently possess greater mathematical or spatial competences than women due to biological factors and that these differences are fixed and unchangeable (Eagly & Wood, 2013).

However, focusing on the biological underpinnings of individual preferences and choices diverts attention from the persistent gender inequalities arising from structural discrimination (Fine, 2010; Halpern et al., 2007), thus perpetuating and justifying existing gender disparities (Skewes et al., 2018). There is no consistent evidence supporting the assumption of significant gender differences in mathematical abilities (Eagly & Wood, 2013). On average, women (or female students) perform on par with men (or male students) in mathematics (Ceci et al., 2014; Schoon & Eccles, 2014a). There is evidence to suggest gender differences at the upper end of the mathematics ability spectrum, where men outperform women (Halpern et al., 2007), but this gap is not fixed and varies across time, across countries (Miller & Halpern, 2014), and is influenced by environmental factors and prevailing stereotypes and gendered expectations (Ceci et al., 2014). For example, cross-cultural differences in mathematics ability are large compared to gender differences within countries. In addition, there are no significant sex differences in general intelligence (Halpern & LaMay, 2000), and cognitive sex differences have been reducing since the 1970s or even disappearing (Miller & Halpern, 2014). The existing evidence points to significant influences from the wider cultural and socio-historical context and dynamic interactions between individuals and the contexts in which they are embedded (Eagly & Wood, 2013; Miller & Halpern, 2014).

Developmental processes

Studies examining the relative contribution of biological and environmental factors in shaping gender differences in cognitive abilities often focus on early life to determine the extent of these differences. The assumption is that if gender differences are identified early on, they are more likely to have a biological basis, since newborns have only limited exposure to social interactions. However, this assumption does not exclude the influence of early environmental factors. For instance, the prenatal environment has an impact on foetal development, highlighting the interaction between biological and environmental factors that can be difficult to distinguish in their effects (Halpern et al., 2007). Both biology and socio-cultural influences operate as inputs that initiate an interactive loop,

which at times generates sex differences and at other times sex similarities (Miller & Halpern, 2014).

For example, there is evidence to suggest that sex differences emerge early in life, with girls outperforming boys in reading when entering kindergarten and small male advantages in the upper mathematics ability spectrum as assessed by standardised tests (Ceci et al., 2014; Halpern et al., 2007). Yet, there is also evidence to suggest that the male advantage in high mathematics test performance is reversed (female advantage) among Latino kindergarten children, emphasising the role of early socio-cultural influences (Miller & Halpern, 2014). Furthermore, environmental factors can influence the developmental timelines of biological processes that affect the timing of puberty and aging. There is persistent evidence to suggest that boys and girls develop similarly in terms of early cognitive skills related to quantitative thinking and object knowledge (Ceci et al., 2014; Halpern et al., 2007). However, by the end of elementary school, girls continue to outperform boys in verbal abilities, especially in tasks involving writing and language use, while boys tend to excel in certain visual-spatial tasks. During secondary school, girls tend to exhibit a more balanced profile of abilities compared to boys (Halpern et al., 2007), which provides them with more diverse choices in terms of subject choices and future careers. When making career decisions, young men and women consider not only their absolute level of ability but also their profile of abilities and their preferences and values (Eccles, 2009). For example, among individuals who excel in mathematics, those with stronger verbal skills are less inclined to pursue science and engineering fields (Wang & Kenny, 2014).

These findings imply that an individual's relative cognitive strengths play a significant role in shaping their educational and career decisions. However, other factors may also be relevant in explaining career choices such as family background, cultural values, or personal interests. For example, there is evidence to suggest that societal gender stereotypes, such as that girls have lower interest in computer science and engineering than boys, are endorsed early (i.e., as early as age six or first grade) by children and adolescents across large and socio-economically diverse samples spanning intersections of class, ethnicity, and gender, and can lead to gender disparities in motivation to pursue these studies (Master et al., 2021).

Moreover, adolescence is a period when gendered patterns and preferences start to diverge. A study analysing the relationship between teenage job aspirations for later entry into science-related occupations in a nationally representative British sample found that boys' aspirations to enter the sciences increase with age, whereas girls' aspirations increase between ages 11 and 12 but decline afterwards (Bagnoli et al., 2014). Teenage aspirations to become a scientist, in turn, are associated with a higher likelihood of entering a science career at age 28, emphasizing the importance of early career choices and their potential long-term consequences (Bagnoli et al., 2014). Moreover, young women are already aware of gendered divisions of paid and unpaid labour and gender inequalities in family-related responsibilities. While boys view careers in science as advantageous for their future status as family breadwinner, girls see science careers as something to embark on before starting a family (Bagnoli et al., 2014). Anticipated stereotypes and gender differences in future career opportunities can influence career choices, and lifestyle values (i.e., work-life

balance) can play a role in shaping carer decisions and the choice of college majors, along with factors such as family background, personal aptitude patterns, academic ability and self-concepts, occupational values, and interests.

Gender socialization

Early socialization processes play a significant role in shaping gender differences in motivation and achievement and are influenced by various factors within the socio-cultural environment. These factors include family demographics, cultural stereotypes, as well as socializers' beliefs and behaviours (Ceci et al., 2014; Eccles, 1987, 2009). For example, already in infancy, parents' choice of toys sends some of the earliest gender-based messages, encouraging engagement in activities associated with dolls or trucks (Boe & Woods, 2018; Todd et al., 2017). During the preschool years, differences in girls' and boys' experiences and attitudes to same- and other-sex peers significantly impact their peer relationships and stereotyping (Fabes et al., 2014; Kung, 2021). In elementary school, there is evidence suggesting that teachers' gender-stereotypical perceptions of children's abilities can influence their grading practices (Kriesi & Buchmann, 2014). Furthermore, teachers' perceptions of students' abilities and efforts are linked to children's ability self-concepts regarding mathematics and reading (Upadyaya & Eccles, 2014), their engagement with STEM subjects (Stephenson et al., 2022), and their subsequent career transitions (Schoon et al., 2007), in particular for students from less privileged backgrounds (Schoon, 2001).

Children's self-concepts, which encompass their perceptions of their skills and competences, along with their personal values and goals are important indicators of their gender identity, which in turn contribute to the development of gender differences in aspirations and attainment. According to the expectancy-value theory (Eccles, 1987, 2009; Eccles & Wigfield, 2020), individuals' choices regarding their education and career paths are influenced by their expectations of success and the importance and value they place on various options they perceive to be available to them. Previous research suggests that girls tend to underestimate their abilities, especially in mathematics and science, which are generally understood as a critical filter regulating access to high status and high income occupations (Ceci et al., 2014; Correll, 2004; Eccles et al., 1998). Despite the fact that young women perform just as well as young men in mathematics- and science-related courses, gender differences in self-perceptions persist (Parker et al., 2018; Schoon et al., 2007). Notably, when individuals feel confident in their ability to learn and to succeed in a particular subject, they are more likely to actively engage with and persist in that subject, which in turn is associated with higher academic achievement and course enrollment (Eccles & Wigfield, 2002, 2020). For example, research suggests that male and female students who believe that most people can be good in mathematics are more inclined to choose a STEM major than those who do not, even when controlling for family social background, ethnicity, and academic experiences in high school (Perez-Felkner et al., 2014).

Girls tend to express less interest in mathematics and the physical sciences and more interest in literature and reading than boys – and vice versa (Eccles, 2009). Girls also tend to have lower expectations of success (Wang & Kenny, 2014), and compared to men, the career choices of women remain focused on a narrow set of options (Francis & Skelton, 2005; Watt & Eccles, 2008), often involving lower

paid occupations (Lažetić, 2020). Gender differences in occupational choices and attainment are understood as an example of social reproduction processes due to gendered perceptions of both one's own capabilities and interests, where males and females have been socialized to have different goals for their lives (Schoon & Eccles, 2014a; Schoon & Heckhausen, 2019). The extent to which boys or girls value particular goals, such as attaining a university degree or getting into a career, depends on how significant others in their social context (e.g., their parents, teachers, or the peer group a youth identifies with) view these goals (Eccles & Wigfield, 2002, 2020). In Eccles' model of motivated behaviour, an individual's expectations for success and the importance or value the individual attaches to the various options are considered to be the most important influences on the choices people make. These two sets of beliefs (i.e., expectations for success and task value) are in turn shaped by cultural norms, social roles and social experiences, by personal experiences and one's interpretations and memories of these experiences, as well as one's aptitudes, talents, personalities, and temperamental characteristics (Eccles & Wigfield, 2002, 2020).

Understanding the processes shaping individuals' perceptions of their strengths and weaknesses, their preferences, and their perceived field of viable options is essential to our understanding of the dynamics leading men and women to make different life-defining choices. Furthermore, INDESA assumes that choices are made within life contexts that present each individual with a wide variety of choices, each of which has both long range and immediate consequences (Schoon & Eccles, 2014a; Schoon & Heckhausen, 2019). For example, majoring in engineering or mathematics rather than in education might make it more difficult to return to the same level employment or the same position after a career break due to childbirth.

Gender discrimination

Despite efforts to remove inequalities for women's participation in education and the labour market (such as employment equity and equal pay legislation), there is persistent evidence about continuing gender discrimination (England et al., 2020). According to the World Economic Forum (2022), women make up only around 37 percent of leadership positions and continue to be disproportionately represented in low-status, low-paying occupations (UN Women, 2022). Data from the UK and other high-income countries (including those at the forefront of gender equity) reveal a stark gender divide, with men doing more paid work outside the house, women doing more unpaid work inside the house, and when women do paid work, they are paid less than men (OECD, 2023a). For example, in the UK, women earn around 14% less than men, compared to around 3% in Bulgaria and Columbia, and gender gaps from around 20% in Cyprus, Japan, and Latvia (OECD, 2023b). Inequities regarding paid work have increased during the COVID-19 pandemic, with women reducing their hours of paid work more than men (UN Women, 2022), in particular mothers with young children (Collins et al., 2021). During the initial phase of the pandemic, women also assumed a larger share of domestic work (Sánchez et al., 2021), a trend that continued for those families with dependent children where the man recovered working hours (Zamberlan et al., 2022).

Gender differences in the division of paid and unpaid work (including childcare, other care work, and housework) as well as the type of work men and women do

are crucial determinants of unequal outcomes in the labour market. Undoubtedly, the gender wage gap has declined considerably since the 1970s, following the introduction of equal pay legislation, more women earning college degrees, joining the workforce in greater numbers, and entering historically male-dominated professions (England et al., 2020). Yet, there has been a shift in gender wage inequalities over the past 60 years. The largest wage gaps no longer are concentrated among lower-educated workers, but among the highest-paid, highly-educated workers (England et al., 2020; Quadlin et al., 2023). Moreover, the economic returns to higher education are highly dependent on field of study (Bol & Heisig, 2021; Kim et al., 2015; Webber, 2016). However, recent evidence from U.S. census data suggests that the explanatory power of field of study is weakest among the highest-paid workers who are driving total inequality trends (Quadlin et al., 2023).

Notably, field of study continues to be highly segregated by gender, given gendered expectations, socialization experiences, and constraints that steer men and women towards different fields (Charles & Bradley, 2009; Quadlin et al., 2023; Riegle-Crumb et al., 2012). Women tend to opt for majors such as education, the humanities, and some social sciences which are often low-paid, while men disproportionately select into higher-paying majors such as STEM fields, economics, and finance (Charles & Bradley, 2009).

It has been suggested that increasing the supply of women in the "pipeline" for various career fields (in particular the highly paid STEM occupations) should result in proportionate increases in the number of women in these fields and promote greater gender equality in the workplace (Avolio et al., 2020). However, resolving persisting gender inequality requires attention to other issues as well. There is evidence to suggest that the pipeline is not the only issue given the continued devaluation of female work and a deficit view of female competences and motivation.

The "leaky pipeline"

Based on previous evidence, it has been argued that women who choose science-related fields during secondary school are more likely than men to leave the pipeline at multiple time points from graduation of high school through to academic tenure and promotion (Alper, 1993; Berryman, 1983). A range of multiple interlinked factors, in particular individual preferences (fertility decisions and work-life balance preferences) and cognitive abilities are considered to explain these gender differences in attrition (Ceci et al., 2009), as well as bias and discrimination regarding promotion and pay (Ceci et al., 2014). This assumption of a leaky pipeline has become a fundamental theoretical framework used to explain the underrepresentation of women in STEM fields. Yet, drawing on evidence from the U.S. National Survey of College Graduates and the Survey of Doctoral Recipients and comparing cohorts completing their studies between 1971 and 2000, Miller and Way (2015) argued that while in the 1970s and 1980s women who earned bachelor degrees in STEM fields were less likely to pursue a STEM PhD than men, this gender gap closed in the 1990s. Hence, while the leaky pipeline metaphor applied to past gender disparities in the U.S., it no longer accurately characterizes current gender differences in the transition from a bachelor degree to a PhD in STEM fields.

Devaluation of female work

Since the 1970s, women have increasingly made inroads into male-dominated fields, entering high-status and highly paid occupations (Charles & Grusky, 2004; England, 2010), including STEM occupations (Ceci et al., 2014). For example, the share of women in life and physical sciences has gone up. Evidence from institutional data from over 2,000 universities around the globe suggest that in 2022, more women (57%) than men study life sciences, and physical sciences is 5% below parity (UNESCO IESALC, 2022). Yet, as more women entered previously male-dominated occupations (including STEM), the status of these occupations has been devalued and average pay reduced (Mandel & Rotman, 2021), suggesting that the feminization of occupations reduces wages and status (Busch, 2018; England et al., 2007; Levanon et al., 2009). For example, evidence from U.S. census data from 1960 to 2015 shows that across seven decades, a higher proportion of women in occupations is negatively associated with average earnings, although the process of devaluation is manifest mostly in highly skilled professional and managerial occupations (Mandel & Rotman, 2021). In the UK, the salaries for those employed in the health sector (in particular medical doctors and nurses), social care, or education have stagnated and workers see themselves forced to take strike action to safeguard their living (Smith et al., 2023).

Within the sociological literature, it has been argued that the devaluation of female dominated occupations is based on patriarchal cultural norms that see female characteristics as less valuable than male ones and thus values female work less than male work (Blossfeld et al., 2015) or consider women to be less competent, less capable, and less committed to their jobs than men (Ridgeway, 2011). These patriarchal cultural norms and cultural stereotypes regarding gender differences in abilities and preferences have become institutionalised in different wage structures and lower pay for female-dominated occupations or sectors (Lažetić, 2020). Also within the psychological literature, it has been argued that many workplace inequalities stem from the cultural stereotype associating women with communal roles that involve caretaking and nurturing, which are assumed incompatible with societal views of leadership and success that emphasize qualities such as dominance and competence (Ryan, 2023). Not only are these gender stereotypes entrenched in societal and organisational structures, including recruitment, promotion, and reward practices, evidence also suggests that these stereotypes are internalised. Across many cultures around the world, women see themselves as more fostering and nurturing, while men see themselves as more dominant and agentic than women (Bosson et al., 2021; Williams & Best, 1990).

Efforts to "fix" women

Efforts to address gender imbalances in career choices and pay tend to focus on the characteristics of women, not men. For example, initiatives to promote the participation of girls and women in STEM fields frequently concentrate on enhancing their engagement and ambition. Leadership training programs often aim to encourage them to take greater risks, to overcome impostor syndrome, and to negotiate the next promotion or pay rise. This approach embodies attitudes to gender equality which reflect the implicit assumption that women are in some way broken and need fixing, that their skill deficit has to be addressed and their mindset changed (Ryan, 2023). Focusing on women's "deficits", however, will not solve persistent gender inequalities in aspirations, attainment,

and pay. It is not women that need to be "fixed", but rather the deeply rooted systems of gender inequality and stereotypes that are inherent in organisations and the social structure of society at large. After all, gender stereotypes and beliefs, including the assumption of gender essentialism, have not been eliminated by the tremendous advances of women in education and employment or their increasing engagement in science-related fields. As long as females are undervalued in society, female work and female-dominated jobs will also continue to be undervalued and underrewarded (Mandel & Rotman, 2021).

Need for a more nuanced conceptualisation of gender inequality
Another issue to be considered here is that women are not a monolithic, homogeneous group. For a more comprehensive understanding of gender differences in aspirations and attainment, one has to take into account the intersection of sex, social and cultural background, ethnicity, and gender identity. Experiences of discrimination between and within different subgroups of women can even be more varied than experiences between men and women. For example, Whites and Asians are considered to have high STEM abilities, whereas Latino and African American boys are stereotyped as lacking intelligence and achievement motivation (Else-Quest et al., 2013). Asian women may be perceived as highly competent, yet are stereotyped as having low agency and hyper-femininity, while Black women are facing racialised gender stereotypes of being pushy or overly assertive (Ryan, 2023). Other factors such as family socio-economic status (SES) also play a significant role, illustrating the intersection of multiple disadvantages in one's life. Students from less privileged socio-economic family backgrounds are doing less well in mathematics than their more privileged peers (Bodovski et al., 2020; Duncan & Magnuson, 2012), are less likely to take mathematics and science classes during postsecondary education (Henderson et al., 2018), to enrol in science courses at university (Uludüz & Çalik, 2022), and to attain their goal of completing a degree in STEM fields (Harackiewicz et al., 2016).

In conceptualising the intersections between gender, social background, and ethnicity, one also has to consider variations in attainment by cultural context. For example, in the U.S. context, evidence suggests that female, Black, Latino, and low SES students are less likely to show, maintain, and develop an interest in STEM careers during high school (Saw et al., 2018). Evidence from England shows that White, Black African and Black Caribbean students have particularly low levels of relative uptake of STEM subjects, while Indian, Pakistani and "other ethnicity" students are more likely to choose STEM subjects – although female students of mixed ethnicity and Black Caribbean ethnicity are more likely to study STEM subjects than White female students, whereas Black Caribbean male students are less likely to study STEM than White male students (McMaster, 2017). For inequality initiatives to be effective, the wide variety of experiences of men and women have to be taken into account, including issues of social class, ethnicity, gender, and gender identity.

One group that has yet received little attention in the study of how to promote equality in aspirations and attainment, particularly in STEM-related fields, are sexual minorities, the LGBTQ (i.e., lesbian, gay, bisexual, transgender, and queer) communities. Based on data from the U.S. Higher Education Research Institute, there is evidence to suggest that LGBTQ students were less likely to persist after being enrolled on a 4-year study STEM major, although they had

participated in undergraduate research at higher rates (Hughes, 2018), pointing to potential bias among faculty. Moreover, there is evidence of widespread inequalities for LGBTQ employees in the workplace, with LGBTQ professionals being more likely to experience harassment, career limitations, and devaluation of their professional expertise than their non-LGBTQ peers (Cech & Waidzunas, 2021).

Addressing gender inequalities by challenging gender stereotypes

What does it take to change perceptions, preferences, values, and cultural stereotypes – and for individuals to engage in political action to promote gender equality? Beliefs in gender equality have shown to increase with economic development and modernization (Inglehart et al., 2002), yet as we have seen, there is continued gender discrimination across highly developed countries, including those with strong laws to prohibit gender discrimination. As long as gender inequalities are primarily seen as the result of individual differences in ability, effort, and determination, the influence of structural processes and discrimination remains underestimated.

Differentiating between young people's beliefs in and perceptions of gender equality, Hoskins and Janmaat (2014) argue that a conviction that women should be treated equally is not necessarily associated with a perception that they are treated unequally, even in situations of overt gender discrimination. In a study across 28 countries, they found that while the levels of young people's beliefs in gender equality follow patterns of economic development (gross domestic product) and are associated with actual measures of gender equality (Gender Empowerment Measure), young people's perceptions of gender equality are independent of their beliefs in gender equality, actual levels of gender equality, and economic development (Hoskins & Janmaat, 2014). Moreover, the study reported evidence to suggest that believing in gender equality is not sufficient to create social change, unless it is accompanied by the perception that gender inequality and discrimination do actually occur. However, motivation to act was not necessarily highest in those countries where awareness of inequality is highest (except for Sweden). There might thus be other factors that influence the motivation for change.

Arguing that men tend to withdraw support for gender equality movements when their higher gender status is threatened, Kosakowska-Berezecka and colleagues (2020) tested if men's zero-sum beliefs (i.e., one group's gain can only be achieved at the other group's loss) predict reduced support for collective action to promote gender equality. Across 42 countries, they found that zero-sum beliefs as well as country-level gender parity (measured by the Global Gender Gap Index) independently predicted lower willingness to engage in collective action (Kosakowska-Berezecka et al., 2020). That is, the more gender equal the countries were, the less likely men are to support gender equality. The authors explain the finding by suggesting that women's advances in gender egalitarian countries might be perceived as a threat to men's dominance – or that men in egalitarian countries consider it as unnecessary to engage in further action. In any case, men's zero-sum beliefs are a universal hinderance to collective action, regardless of country-level differences in gender equality. Efforts to change men's competitive zero-sum beliefs are thus a crucial step to address persisting gender inequalities.

Another leverage to consider are precarious manhood beliefs (Bosson et al., 2021), i.e., the assumption that manhood is something that could be lost by not behaving in the ways that are expected of a "real man". Compared with womanhood, which is typically viewed as resulting from a natural, permanent, and biological developmental transition, manhood is perceived as something that must be earned and maintained through publicly verifiable actions (Vandello et al., 2008). Because of this, men experience more anxiety over their gender status than women do, particularly when gender status is uncertain or challenged (Vandello & Bosson, 2013). Findings from a study comprising over 33,400 participants in 62 countries suggest that especially in countries with lower gender equality and human development levels, precarious manhood beliefs are higher, not only among men but also among women, suggesting that in more patriarchal and less developed countries, women tend to endorse precarious manhood beliefs (Bosson et al., 2021). In addition, there is an increased risk that LGBTQ groups may be targets of derogation as symbolic threats to masculinity and men's distinctiveness (Vandello et al., 2023).

In conclusion, efforts to break down gender stereotypes have to recognise that these stereotypes go beyond the individual and permeate across countries. We have to change attitudes towards men as much as attitudes towards women to break down persisting stereotypes. While women are encouraged to move into gender-non-traditional activities and positions, the same does not apply to men. For example, in the UK it would have taken just over 15,000 more female students to balance the male dominance in all types of engineering, while in subjects allied to medicine (including nursing), the number of extra men needed was close to 30,000 (Matthews, 2014). Encouraging more men to female-dominated domains would open up new perspectives regarding the value of predominantly female activities.

Supporting men in taking up subjects where they are underrepresented may be as an important strategy for addressing gender imbalance in STEM as encouraging women into STEM directly. Notably, although wage growth is generally lowest for those who move to primarily female-dominated occupations, the highest wages for both men and women are earned in gender-balanced occupations (Bartnik et al., 2022). However, there is also evidence to suggest that the gender wage gap for those in leadership positions is greater in female- than in male-dominated establishments, suggesting that career-oriented males benefit from entering female-dominated fields (Pfeifer, 2014). Thus, much needs to be done to overcome existing inequalities in pay and the devaluation of female work on all levels.

CONCLUSION

To initiate change in perceptions and behaviour, it is crucial to raise awareness of persisting inequalities and actively foster policies and institutional reforms that promote equality. Without major external forces, such as the feminist movement in the 1960s, gender and pay equality legislation cultural climates tend to change slowly. Differences in the status of women, especially regarding career choices, the division of household responsibilities, and differences in paid and unpaid labour, are still engrained in our society and continue to play a powerful role in shaping the career development of men and women. Gender differences in aspirations and attainment are always inextricably bound with other societal systems of difference such as class and ethnicity. The life course is to a

considerable degree a personal construction, but also entails selective processes and a sifting and sorting of people into different contexts, where individual lives are continually produced, sustained, and changed by the social context they encounter.

The aim of this paper is to raise awareness of the complex interplay of individual and structural forces that shape occupational choices and behaviour. A person's position in society continues to be assigned to a considerable extent by his or her family's social position, gender, as well as ethnic and cultural background, and is reinforced through interactions in the family, at school, at work, and in the wider socio-historical context. Understanding the persisting gender differences in aspirations, attainment, and pay requires a broad view of the options available to both men and women and how these are perceived and evaluated at different life stages and in different socio-cultural and historical contexts.

The combination of socio-ecological life course approaches and the situated expectancy-value model of motivated behaviour provide a conceptual framework that enables us to gain a better understanding of the reciprocal interactions between structural and individual-level processes, the dynamic interactions between a changing individual and a changing socio-historical context in shaping aspirations and attainment of men and women. Individual decision making and choice have to be understood against the backdrop of socio-cultural constraints and opportunities, as well as openings and challenges arising at particular phases in life and their integration in one's own life and identity. It is crucial to address discriminatory practices at young ages when children develop their preferences, ability self-concepts, and their academic and career interests, starting even before preschool. Early experiences in the family and school contexts cumulate to shape self-concepts, values, choices, and behaviours, which in turn become part of the gendered social world.

To address persisting gender inequalities, it is necessary to understand the multiple and interlinked processes involved. It is not sufficient to focus on or target any single factor or process such as individual preferences or self-concepts. Lives are lived in context and over time. A systemic developmental approach that accounts for multiple influences, ranging from the micro- to the macro-level context and including attention to cultural norms and expectations, allows us to adopt a holistic view and to move towards a better understanding of how different factors are connected and how they influence each other over time.

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