

**The Pursuit of Multiple Identity Goals
Among Women in Science, Technology, Engineering
and Mathematics (STEM)**



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Wroclaw, Poland

2025

**The Pursuit of Multiple Identity Goals Among Women in Science,
Technology, Engineering and Mathematics (STEM)**

A DISSERTATION

Submitted to the Institute of Psychology, SWPS University
in partial fulfillment of the requirements for the Degree of

Doctor of Philosophy

in

Psychology

By

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2025

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Conceptual and empirical work on this dissertation was supported by the Beethoven Classic grant 2018/31/G/HS6/01382 from the National Science Centre awarded to Katarzyna Byrka at the SWPS University and FP: 404/20 from the Deutsche Forschungsgemeinschaft (DFG).

Dedication

To the fearless and determined individuals forging new paths...

Acknowledgments

First and foremost, I would like to express my deepest appreciation to my advisor, Dr. Katarzyna Byrka, for her invaluable guidance, expertise, and unwavering encouragement. From the moment you picked me up from the airport on that gloomy winter night and offered your care and support, and then till the last moment read each and every document word by word (it sure made others jealous) you have played a pivotal role in my journey. Your insights have profoundly shaped my research, and your steadfast belief in my abilities has inspired me to strive for excellence every step of the way.

I would also like to thank my committee members, for their thoughtful feedback and contributions that have enriched my work. Your perspectives have challenged me to think critically and expand my understanding of the subject matter.

I am grateful to my colleagues, Prof. Dr. Peter Gollwitzer and Dr. Johannes Doerflinger, for creating a collaborative and supportive environment. Your guidance and mentorship during the Beethoven research project were instrumental in shaping my understanding of the complexities of identity goals.

To my family-like friends, Hanna and Kamran, thank you for your unconditional love and unwavering belief in my potential. I deeply appreciate all the long calls and conversations, where I could vent my frustrations and seek the easiest ways to coffin my PhD. Your patience and tolerance have been nothing short of remarkable, and I'm glad you didn't kick me out of your lives—even when I gave you plenty of reasons to! A special thanks to Slawek for reminding me that it's time to break free from the "slavery" of this PhD journey, and to Asia for recognizing my strengths and reminding me that what I've faced in the past was nothing compared to this task. To Fateme, Neda, and Mahboubah, thank you for stepping in during those times when my head was buried in my laptop and for cooking for me—your kindness made a world of difference. To Maryam, you stood by my side despite my annoyance and your inner good and compassion got me through days.

I also want to acknowledge my unchosen family. Haadia, I'm glad you embarked on your PhD journey, and I cherish our shared moments of suffering together. Thanks to Abbu for saying All will be okay and may God be with you. Lastly, Ammi, thank you for always being by my side with prayers and offering your steadfast support in your traditional mother-like ways.

I would like to acknowledge the women in STEM as participants in my research studies. Their willingness to share their experiences has made this work possible, and I am honored to contribute to our understanding of this important topic.

This dissertation is a testament to the collective support and encouragement I have received, and I am truly thankful for each person who has played a role in this journey.

Abstract

Women in STEM often pursue both feminine and professional aspirations simultaneously. Building on the symbolic self completion theory (Gollwitzer, 2018) and the goal systems theory (Kruglanski et al., 2018), my doctoral dissertation examines how women in STEM manage dual identity goal pursuit through compensatory strategies and symbolizing. In Chapter 2, I tested whether positive affective outcomes from successfully pursuing one identity goal mitigate the impact of failure in the other identity goal. Study 1 ($N = 224$) found that failure in both identity goals increased guilt, while success in at least one reduced it. Study 2 ($N = 260$) revealed that engaging in compensatory tasks decreased the guilt. Study 3 ($N = 158$) examined a different form of compensation by choosing posters that symbolize both identity goals. In Chapter 3, I examined how overlap i.e. similarity between femininity and STEM identity goals influences the perception of symbolic means, such as outfits. Study 4 ($N = 232$) showed that a willingness to wear an outfit reflecting both identity goals was positively associated with identity goal overlap. In Study 5 ($N = 226$), higher identity goal overlap was linked to outfits being viewed as multifinal, serving both goals. Chapter 4 explored the imposter syndrome and gender (femininity/masculinity) differences among STEM professional men and women. Study 6 ($N = 400$) found that women experienced higher imposter syndrome and reported higher identity goal overlap in STEM than men. Identity goal overlap was negatively related to imposter syndrome for both genders, but gender did not significantly moderate this relationship.

Keywords: identity goals, self completion, goal systems, feminine women, women in STEM, identity goal overlap, multifinal symbols, compensation, emotions, imposter syndrome

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Chapter 1. Theoretical Introduction

Individuals pursue many goals. These goals represent the desired future states or achievements that they are committed to (Austin & Vancouver, 1996; Gollwitzer, 2018). Goals are crucial in guiding and energizing behavior, influencing the actions individuals take to achieve their objectives (Locke & Latham, 2013). The commitment to a goal pursuit differentiates it from mere wishes or fantasies, as it propels purposeful, goal-directed activity (Gollwitzer, 2018; Milyavskaya & Werner, 2018; Moskowitz & Grant, 2009). For example, a STEM scientist's goal of developing software to analyze data illustrates a structured, goal-driven approach toward achieving a clear objective. Some goals i.e. long-term are deeply intertwined with one's identity, shaping and affirming how individuals see themselves and their roles in the world (Wicklund & Gollwitzer, 1982). Identity is not only shaped by a cognitive aspect, such as the concept of oneself as a STEM scientist but also an action-oriented aspect, where individuals strive to fulfill identity-relevant indicators, such as developing new scientific formulas (Gollwitzer & Kirchoff, 1998)

Individuals pursue identity goals to define and reinforce their sense of self. These identity goals are significant because they are tied to how individuals want to be perceived and recognized by others, influencing the prioritization and pursuit of various life goals. The identity goals' perspective underscores the connection between identity and goal pursuit, showing that identity goals not only motivate temporary behavior but also play a crucial role in shaping an individual's broader life course in the long run (Gollwitzer, 2018).

1.1.The Symbolic Self Completion Theory (SCT)

The symbolic self completion theory (SCT Gollwitzer, 2018; Wicklund & Gollwitzer, 1982) posits that individuals pursue identity goals by acquiring symbols and

engaging in actions that affirm their desired identity goals. Identity goals are linked to one's ideal self, such as becoming a scientist after earning a Ph.D. or adopting the identity of a mother when having a child. For identity goal pursuit individuals must continuously symbolize i.e. accumulate relevant symbols, through commitment, effort, and continuous striving

These symbols can be physical objects (e.g., an award), behaviors (e.g., recycling), or self-descriptions (e.g., identifying as a lawyer) (Gollwitzer et al., 1982; Wicklund & Gollwitzer, 1982; Gollwitzer et al., 2009). For example, individuals striving to embody eco-friendliness engage in activities such as recycling and consuming vegan food to symbolize their commitment to environmental values (Longoni et al., 2014; Sorys et al., 2023). Those with a medical professional identity goal make presenting as competent physicians public (Brunstein & Gollwitzer, 1996; Sciara et al., 2022). Career-related identity goals are reflected through self-descriptions that align with ideal professional characteristics, emphasizing traits like leadership (Marquardt et al., 2016; Gollwitzer et al., 1982). Symbolic expressions also extend to clothing and attires. For instance, business executives use specific attire, such as tailored suits, to convey professionalism and authority (Solomon & Douglas, 1987), while athletes express their commitment through specialized sportswear (Dickson & Pollack, 2000).

Beyond single identity goals, research has also examined the simultaneous pursuit of multiple goals. Bicultural individuals affiliated with German and Turkish identity preferred webpages that considered both nationalities rather than only one of them to reflect dual identity goals (Doerflinger et al., 2022). In another example, religious and patriotic symbolizing was done through engaging in religious and national activities (Spychalska-Waszek et al., 2022, 2024). These studies highlight the diverse ways in which individuals use symbolic acts to pursue and affirm their identity goals,

whether focused on a single domain or multiple goals.

Once sufficient symbols are acquired, individuals experience a temporary state of completeness (Gollwitzer, 2018; Wicklund & Gollwitzer, 1982). When an individual fails to attain an identity-relevant symbol, a state of incompleteness arises (Gollwitzer et al., 1982). This can occur through negative feedback (Wicklund & Gollwitzer, 1982), recalling past failures related to a self-defining goal (Doerflinger et al., 2021, 2022), or failure to secure a lab placement. Incompleteness arises from a discrepancy between the current outcome and the ideal state of possessing the identity goal (Gollwitzer & Kirchoff, 1998). The discrepancy causes tension which energizes individuals to engage in necessary symbolizing to reduce discomfort and reach completeness (Brunstein & Gollwitzer, 1996; Gollwitzer, 2018; Gollwitzer & Wicklund, 1985). Reaching the state of completeness reduces the effort to seek additional symbols (Wicklund & Gollwitzer, 1982). The process is spontaneous, and once the relevant opportunity arises, the likelihood of symbolizing increases to minimize the feeling of incompleteness (Doerflinger et al., 2022). As identity goals are aspirational aspired-to goals, they are future-oriented and often encounter cycles of (in)completeness (Doerflinger et al., 2021; Gollwitzer, 2018; Gollwitzer & Wicklund, 1985).

1.2.The Goal Systems Theory

The goal systems theory posits that goals form associative networks in which superordinate and subordinate goals, as well as means, are interconnected (Kruglanski et al., 2018). Also identity goals form such networks i.e. being feminine and STEM professional, parental and professional, or patriotic and religious at the same time. These multiple identity goals form a system of goals.

Goals can be associated vertically, where a more general goal is linked to a specific subordinate goal (Kruglanski, 2018). For example, becoming a renowned STEM

scientist is a superordinate goal, which is linked to the subordinate goal of writing a scientific publication. Subordinate goals can also serve as means or symbols for superordinate goals. Goals can also be associated horizontally, meaning they exist at the same level of specificity, such as pursuing both a STEM professional identity and a feminine identity simultaneously.

In the goal systems, the reasons for pursuing certain identity goals are linked to superordinate goals, which occupy the top level of an associative network that includes subordinate goals and their associated means (Kruglanski, 2018). Reasons are factors that drive individuals to strive for more specific goals. They can automatically trigger and energize goal pursuit (Elliot & Church, 1997). Reasons may include values related to morality (Aquino & Reed II, 2002), motives tied to achievement, power, and affiliation (McClelland, 1988), or needs such as belonging to a certain group (Cameron, 2004; Diekman et al., 2011; Sychalska-Waszek et al., 2021, 2024; Zaman et al., 2025).

At the lowest level of the hierarchy are means. They are tools that assist in the realization of goals (see Figure 1.1). Means are concrete and tangible activities that individuals perceive as contributing directly to achieving their goals (Shah & Kruglanski, 2003). Symbols can be more abstract and figurative. Even a simple expression of intention can be sufficient to restore a sense of completeness (Gollwitzer et al., 2009). While means are viewed as practical tools in goal attainment (Kruglanski et al., 2002), symbols are symbolic actions.

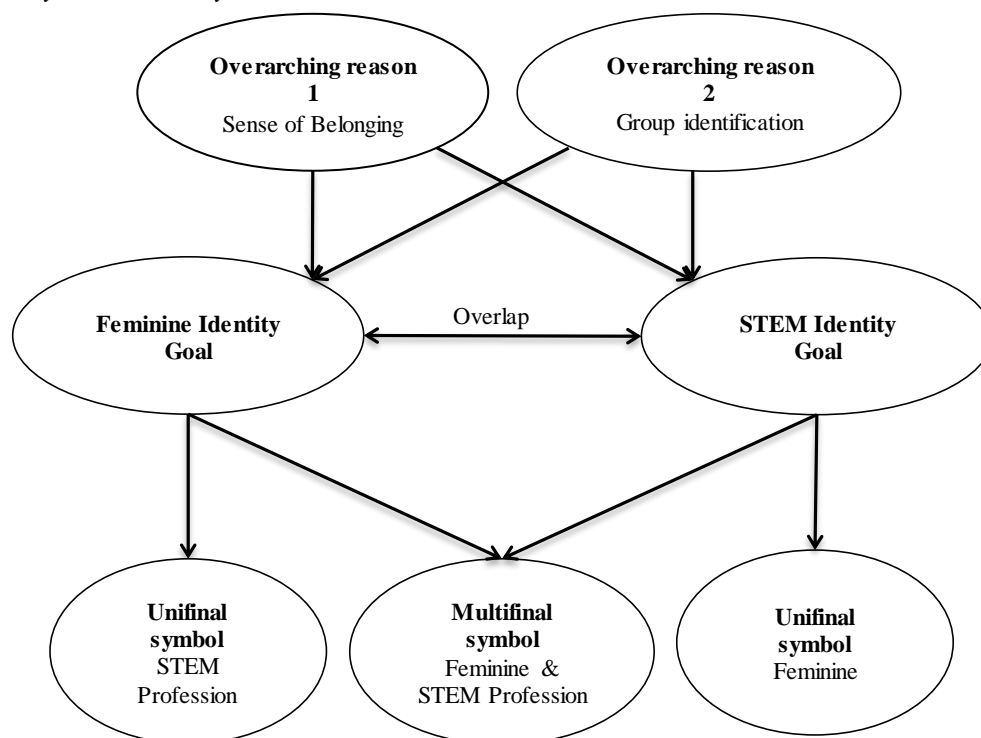
In the goal systems theory, means are categorized into distinct types (Kruglanski et al., 2015). Unifinal means refers to one mean that serves a single goal and is not associated with any alternative goal. For example, regular aerobic exercise for healthy bones (Zhang et al., 2007) or mouthwash for a sore throat (Schumpe et al., 2018) are unifinal means. Multifinal, on the other hand, refers to a single mean that is employed to

achieve multiple goals (Kruglanski et al., 2015; Zhang et al., 2007).

In the context of STEM and femininity, unifinal means are actions or symbols that serve a single identity goal, while multifinal means fulfill multiple identity goals simultaneously. For instance, wearing a lab coat may act as a unifinal means for a woman in STEM, symbolizing her professional identity as a scientist. Similarly, publishing research in a high-impact journal is a unifinal means of establishing expertise and credibility in her field. These means reinforce her STEM identity without necessarily addressing other identity goals, such as femininity. In contrast, multifinal means can serve both professional and personal goals (Chun et al., 2011; Kruglanski & Köpetz, 2009). For example, professional attire incorporating traditionally feminine elements—such as tailored blazers in softer colors or accessories—can signal competence in STEM while also expressing femininity.

Figure 1.1

Conceptual Model of the Association between Overlapping Reasons, Feminine and STEM Identity Goals, and Symbols



Note. Overarching reasons function as superordinate goals. Feminine and STEM identity goals are subordinate in the goal hierarchy. They overlap when they are pursued for the same reasons. Some symbols can serve as multifinal, while others serve as unifinal for the respective goals.

1.3. Identity Goal Overlap

Identity goals overlap when they are related to each other by serving the same reason—whether fulfilling the same psychological needs, driven by the same motives, or sharing underlying personal or moral values (Doerflinger et al., 2021; Spychalska-Waszek et al., 2021, 2024). More specifically, high overlap occurs when two identity goals are driven with similar strengths for the same reasons. For example, the goals of being a professional STEM employee and a feminine woman may both be pursued due to the need to belong to a group. Individuals vary in the extent to which reasons affect their goals, meaning that the degree of identity goal overlap is an individual difference.

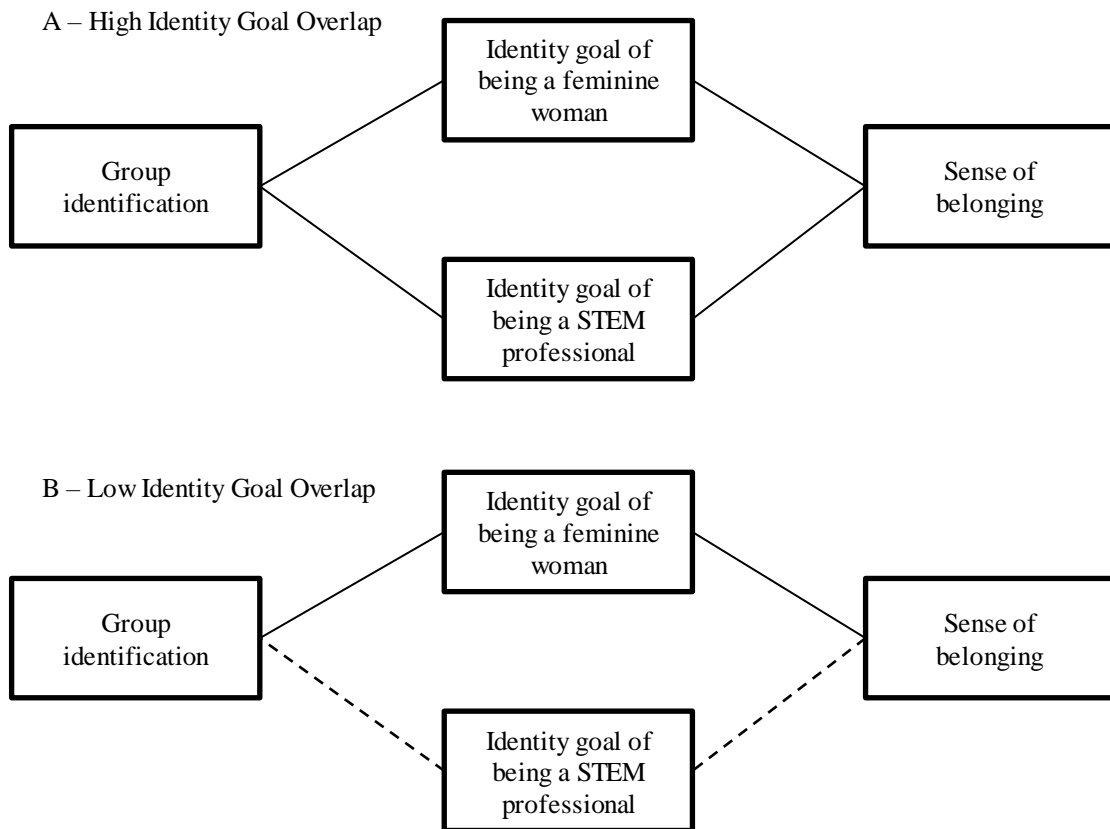
For instance, in Figure 1.2, I present examples of two hypothetical individuals, A and B. For person A, the identity goals of being a STEM professional and a feminine woman are strongly associated and influenced by two reasons: group identification and a sense of belonging, indicating a high degree of identity goal overlap. In contrast, for person B, the STEM professional identity goal is weakly connected to these reasons, while the feminine identity goal is strongly associated with them. Therefore, the identity goal overlap for person B is low, as only the feminine identity goal is driven by group identification and the sense of belonging.

The reasons for pursuing certain identity goals are often more relevant to specific goals, and this relevance can influence the overlap between different identity goals. For example, Doerflinger et al. (2021) found that morality and the need for achievement are key motivators for both parental and professional identity goals, meaning that the extent to which morality influences these goals directly correlates with their overlap. Similarly, Spychalska-Waszek et al. (2022, 2024) found that a sense of belonging and group identification is a critical factor in national and religious identity goal overlap. If values

and motives—such as the desire for belonging—are simultaneously associated with two identity goals, the goals are considered to overlap for these reasons.

Figure 1.2

Illustration of High (A) and Low (B) Identity Goal Overlap of Femininity and STEM Based on the Reasons of Group Identification and Sense Of Belonging.



Note. Solid lines represent relatively strong associations between reason(s) and identity goals, and dashed lines represent relatively weak associations.

A sense of belonging and group identification is often seen as integral to one's identity (Cameron, 2004; Ellemers & Haslam, 2012; Tajfel, 1978) and is central to understanding identity goal overlap. In the context of women in STEM, presumably belonging is a relevant reason for pursuing both feminine and STEM identity goals. Women in STEM may pursue these dual identity goals in part due to the need to belong to a group, which reflects a deep-seated human desire for connection and interpersonal attachment (Baumeister & Leary, 1995; Pickett et al., 2004). Belonging is vital for both mental and physical well-being (Umberson et al., 2010ab) and can help individuals avoid feelings of exclusion or rejection (Leary, 2005; Leary et al., 1995). Belonging is

considered a constituent of group identification (Wakefield et al., 2017), and women in STEM typically identify with both the STEM community and feminine groups. This dual identification supports their sense of self, both as STEM professionals and as women. The need to belong to the STEM community is associated with professional identity (Xu & Lastrapes, 2022) while belonging to a group of women reflects femininity (Fausto-Sterling, 2012; Tate et al., 2013; West & Zimmerman, 1987).

Research highlights that group identification is crucial for women in STEM, as it positively influences motivation, achievement, and retention in the field. For instance, Kissinger et al. (2009), Ladewig et al. (2020), and Walton and Cohen (2007) found that belonging to academic groups, such as those in physics or data science, fosters motivation and career success. Furthermore, Diekmann et al. (2017) showed that group identification can reduce the likelihood of women quitting STEM fields, highlighting the importance of networks and belonging in continuing and excelling in STEM majors.

Identifying as a woman and belonging to a women's group is associated with well-being, resilience against negative academic climates, and academic success. Zitelny et al. (2022) found that belongingness positively affects well-being, while Settles et al. (2016) demonstrated that it shields women in STEM from perceived negative academic climates. Identification with one's gender fosters social support networks (Taylor, 2011), and the presence of female peers and role models is positively linked to academic success (Bailey et al., 2020). Additionally, belonging to women's groups is associated with activism and support for women's rights (Swank & Fahs, 2017).

1.4. Femininity and STEM Profession as Identity Goals

The number of women working in traditionally masculine fields like science, technology, engineering, and mathematics has increased over the years (Carli et al., 2016; Simon et al., 2017; Women in STEM Statistics, 2022). However, numerous studies

(Adikaram & Razik, 2022; Dasgupta & Stout, 2014; Steinke, 2017; Wegemer & Eccles, 2019) highlight the challenges women face in STEM, particularly in reconciling their gender identity with their professional roles. The simultaneous pursuit of femininity and a career in STEM can be framed through the identity goal paradigm (Gollwitzer, 2018), particularly the symbolic self completion theory (SCT; Wicklund & Gollwitzer, 1981). From this perspective, both gender identity and professional identity can be seen as identity goals. A woman who strives to be feminine may experience a state of completeness when she acquires symbols that signify femininity and may acquire the professional symbols for the identity goal of being a STEM professional (Wicklund & Gollwitzer, 1981). Goals in general can facilitate or conflict with each other (Shah et al., 2002). In this manner, pursuing femininity and STEM professional identity goals can be either conflicting or facilitating on a broader level.

Generally, conflict stemming from societal norms and gender expectations makes it difficult for women to simultaneously pursue these identity goals. Societal norms dictate that women should exhibit communal and nurturing behaviors, while success in STEM often demands more agentic traits, such as assertiveness and competitiveness (Carli et al., 2016; Dasgupta & Stout, 2014). This creates tension for women in STEM to maintain their feminine identity and meet the demands of professional roles often linked to masculine traits. Below, I provide an overview of theories explaining the challenges experienced by women in STEM regarding the dual identity goal pursuit.

Gender roles as culturally constructed expectations for behavior, associate STEM fields traditionally with masculine traits like assertiveness and decisiveness (Social Role Theory, Eagly, 1987). Therefore women in STEM often face conflict with their professional role and societal expectations of femininity. Gender role expectations lead to the belief that women are too feminine for STEM or that they prioritize family over

career (Miner et al., 2018). This contributes to the gender biases women face in STEM, resulting in fewer women pursuing STEM-related majors and lower STEM persistence compared to their male counterparts (Carli et al., 2016). Individuals who act outside societal gender norms often face negative evaluations and discrimination (Role Congruity Theory, Eagly & Karau, 2002). For women in STEM, showing stereotypically male traits can result in unfavorable evaluations (Diekmann et al., 2020; Skelly & Johnson, 2011).

Masculinity is linked to competition, achievement, and ego-oriented goals, while femininity is associated with collaboration and caring for others (Cultural dimension theory of masculinity/femininity, Hofstede, 2001). STEM fields, particularly those emphasizing competition and individual achievement, may inherently favor masculine traits, disadvantaging women raised in femininity-oriented cultures that prioritize communal goals. This cultural mismatch contributes to the systemic barriers women face in pursuing STEM careers.

Gender biases arise from the perceived incongruity between the characteristics typically associated with women and the traits necessary for success in traditionally male-dominated roles (Lack of fit theory, Heilman, 2001). In STEM, the expectation that women will be less successful creates an environment of prejudice, hindering their career progression. Stereotyping of women results from their perceived incongruity with traditional gender roles, which assumes that women working outside of the home can no longer fulfill their traditional gender expectations. Women in STEM are often perceived as having less occupational congruence with their gender identity than their male counterparts (Su et al., 2009) and face disadvantages due to a lack of fit and role incongruity (Carli et al., 2016). Research by Smyth and Nosek (2015) on gender-science stereotypes found that women's social identity is less associated with STEM than men's.

O'Brien et al. (2015) revealed that stereotypical gender bias is particularly pronounced in STEM, as more masculine traits are associated with STEM. These stereotypes contribute to a lower STEM persistence rate among women (Williams et al., 2016), leading many to either abandon their studies or leave their profession (Sassler et al., 2017).

Individuals perceived as more competent and of higher status are more influential within groups, however, gender status beliefs, which associate greater competence and status with men, systematically disadvantage women (Expectation states theory, Wagner & Berger, 1993; Ridgeway, 2001). These beliefs contribute to a cycle of underrepresentation, where women are less likely to be seen as capable of higher occupational positions further limiting their chances for career advancement. Cundiff and Vescio (2016) noted that women entering predominantly male-dominated occupations often face challenges associated with negative gender stereotypes, which label them as underperforming or less talented.

There exists a paradoxical expectation placed on women in higher managerial positions. Women who adopt masculine, assertive styles to succeed in male-dominated environments like STEM are often criticized for being too aggressive and unlikeable. Conversely, if they conform to feminine stereotypes, they may be seen as weak or ineffective (The double bind, Eagly & Carli, 2007). This double bind creates a no-win situation, contributing to the persistent gender gap in STEM leadership. When women display masculine traits (e.g., strength, self-promotion, assertiveness) necessary for success, their femininity is questioned (Debebe, 2017). As a result, women pursuing STEM careers often face a challenging process to prove their effectiveness while maintaining their gender-related identity (Faulkner, 2007; Nosek et al., 2002).

Considering various theoretical perspectives highlighting the challenges women in STEM face, my dissertation seeks to explore an alternative perspective. In this

dissertation, I focus on the simultaneous pursuit of femininity and STEM as identity goals because these two goals represent key aspects of women's personal and professional lives that are often in conflict. Despite that, identity goal overlap can offer a possibility to pursue the goals simultaneously. For women in STEM, the degree of overlap between their STEM professional identity and their feminine identity can vary widely. Some women might see their STEM and femininity goals as complementary, finding means to symbolize both. Others, however, might experience these goals as conflicting. This variation in identity goal overlap reflects an individual difference that shapes how women strive for these dual goals. To better understand simultaneous goal pursuit among women in STEM, the symbolic self completion theory and the goal systems theory provide a valuable lens for examining the hierarchical structure including reasons, means, and identity goals.

1.5. Research Objectives

The primary aim of my dissertation is to empirically examine how women manage the simultaneous pursuit of femininity and professional STEM aspirations. It draws on the symbolic self completion theory (Gollwitzer, 2018) and the goal systems theory (Kruglanski et al., 2018). My research focuses on three key objectives:

The first objective is to examine how women in STEM react to (in)completeness in their gender and professional identity goals. Particularly, I investigate how identity goal (in)completeness effects changes in emotional experiences.

The second objective is to verify how women in STEM evaluate symbolic means such as outfits for both identity goals. More specifically I explore whether the overlap between feminine and STEM identity goals influences the perception of symbols such as outfits as serving one (unifinal) or both identity goals (multifinal).

The third objective is to compare the identity goal overlap and imposter syndrome among women and men in the STEM profession. More precisely, I will examine how identity goal overlap qualifies the relationship between gender and imposter syndrome in STEM professions.

Chapter 2. Affective Compensation in the Pursuit of Aspired-to STEM and Feminine Identity Goals¹

The experience of (in)completeness evokes motivational processes and prompts individuals to take up or refrain from acting. In general, pursuing goals is also accompanied by emotional experience (Frijda & Mesquita, 1998). According to the functional account, emotions are considered as the response to an individual's concerns, motives, and values. Emotions are often instrumental to desirable goals (Frijda & Mesquita, 1998). Emotions will be experienced when individuals compare between the current and the ideal state in the goal pursuit. Individuals establish certain standards, rules, and goals relevant to themselves and compare their actions to them, resulting in the interpretation of the situation as a success or a failure (Lewis, 2008; Tracy, & Robins, 2007). When there is a discrepancy between the current and ideal state, individuals may experience guilt, whereas, meeting the requirements of the ideal state may lead to pride (Carver & Scheier, 1998; Duval & Wicklund, 1972; Tracy, 2012; Tracy, & Robins, 2007).

2.1. Affective Consequences of Identity Goals' (In)Completeness

Specific emotions such as guilt and pride can be considered relevant to (in)completeness processes due to their established relevance to the constructs of self, identity, and goal attainment (Bynum & Artino, 2018; Frijda, 1988; Krettenauer & Casey, 2015; Tracy & Robins, 2004). Once individuals are committed to identity goals and symbolize them over the long term, it results in a stronger and more concrete association with emotions like guilt and pride. These emotions are triggered when events are evaluated

¹ **Zaman, S.**, Spsychalska-Waszek, H., Doerflinger, J. T., Gollwitzer, P. M., & Byrrka, K. (2024). Affective consequences of pursuing STEM professional and feminine Identity Goals (Manuscript in Preparation)

as relevant to one's goals and attributed internally (Tracy & Robins, 2004, 2007).

Guilt is experienced as a result of a negative outcome due to a certain behavior. It is a kind of regretful, painful, and aversive feeling aroused by one's actions or inactions (Baumeister et al., 1995). This introspective emotional state is due to negative attributions which are very specific situation-based (failure in the exam due to lack of preparation) (carelessness), and are controllable and alterable (working hard next time) (Lewis, 2008; Tracy & Robins, 2006). The discrepancy between the desired identity goal and the actual behavior becomes a powerful motivator for change and rectification in the future, rooted in the negative emotional experience of guilt (Baumeister et al., 1995; Miceli & Castelfranchi, 2018; Tangney et al., 1996). Furthermore, guilt has a forward-looking, motivational component, encouraging corrective actions and improvement (Castonguay et al., 2012; Lickel et al., 2014; Liss et al., 2013).

Guilt along with regret frequently co-occur and are experienced together leading to similar outcomes. Both involve thinking, where individuals reflect on how they could have acted differently, as well as self-discrepancies between their current self-perception and the person they aspire to be (Higgins, 1987). Moreover, due to their substantial overlap and high correlation (Mandel, 2003), these emotions are often measured interchangeably (Liss et al., 2013; Sheikh & Janoff-Bulman, 2010; Smith et al., 2002). Regret can occur when there is a gap between an individual's actual self and their ideal self, such as not pursuing a dream job. Guilt is more complex, as it can arise from failure to meet obligations or responsibilities (ought to self-discrepancies), like not helping a friend in need (cultural differences; Zhang et al., 2021), but may also involve ideal self-discrepancies depending on the situation i.e. not being a perfect mother (Castonguay et al., 2012; Liss et al., 2013). Individuals experience

them differently when it comes to interpersonal (guilt) and intrapersonal (regret) harm (Zeelenberg & Breugelmans, 2008), or desire to self-change (guilt) and mental undoing/repairing of the past (regret) (Lickel et al., 2014). In the context of the present research on affective outcomes among women in STEM, both emotions are conceptualized as part of the broader guilt experience. The feeling of guilt in a state of incompleteness emphasizes the significance of the identity goal, thereby reinforcing future commitment and effort toward achieving it.

Pride is felt when there are goal-congruent successful outcomes due to certain behavior(s) (e.g. I am proud of the award for my hard work in the lab). This emotional state is due to positive internal attributions (hard work), which are controllable and alterable (doing more hard work) and are very specific situation-based (work in the lab to get an award) (Carver et al., 2010; Lewis, 2008; Sznycer, 2019). Pride encompasses a range of positive emotional experiences, such as feelings of pleasure, satisfaction, and joy (Frijda et al., 1989). It also includes a sense of accomplishment, confidence, and enhanced self-worth (De Hooze & Van Osch, 2021; Tracy & Robins, 2007). These emotions reflect a genuine sense of achievement and personal growth. In general, the emotions of pride bear the element of inherent satisfaction, and Van Osch et al. (2018) examined pride together with satisfaction. They found that an overall sense of pride and satisfaction confirmed an elevated self-perception. While pride may be triggered by social comparisons, it is primarily self-focused rather than reliant on negative evaluations of others.

In pride, the self is separated from the task and the individual focuses more on the behavior leading to success and giving a sense of achievement (Tracy et al., 2009). As a woman committed to an engineering career, succeeding in an engineering exam directly

matches with identity goal pursuit, and elicits pride. This specific match does not necessarily trigger general happiness or satisfaction which can be influenced by various factors beyond identity goals. Moreover, pride can temporarily halt future efforts by creating a sense of accomplishment that reduces immediate motivation. This occurs because the experience of successful symbolizing leads to a state of perceived completeness.

2.2. Aim of the Studies

When it comes to women in STEM, they are significantly underrepresented (National Academies of Sciences et al., 2020; Ortiz-Martínez et al., 2023) and experience more barriers to career entry and progression (Jebsen et al., 2022) and this leads to heightening self-scrutiny in a male-dominated field. Choosing STEM as a non-traditional path has remained a strong factor for women undermining their performance and motivation (experiencing stereotype threat, Kahalon et al., 2020 and imposter syndrome, Paterson & Vincent-Akpu, 2022). Therefore, failure to symbolize and experience incompleteness represents a setback in the pursuit of personal and professional aspirations within a challenging domain and may induce a stronger emotion of guilt. Whereas, the pursuit of identity goals with successful symbolizing might be perceived as a significant achievement and will heighten the emotional response of pride.

In the present research, it was assumed that incompleteness i.e. the lack of symbolizing the desired identity goals of femininity and/or STEM profession would lead to experiencing unpleasant emotions such as guilt. In contrast, completeness i.e. symbolizing aspired-to identity goals would lead to pleasant emotions such as pride. Importantly, the research examined the effect of the absence or presence of possible compensatory symbolizing in case of identity goals incompleteness and its consequences on different

emotions.

2.3. Study 1 – Identity Goal (In)completeness and Guilt and Pride

Study 1 examined the states of (in)completeness and their effect on emotions such as guilt and pride. It was hypothesized that participants in the double incompleteness condition (incompleteness both as feminine and STEM professionals) would feel more guilt than those who experienced completeness in one and two of these identity goals (H_1). Whereas, participants in the double completeness condition would feel more pride than those experiencing incompleteness in one or two identity goals (H_2).

2.3.1. Method

2.3.1.1 Study Design. The experimental design was $2 \times 2 \times 2$; STEM identity goal (incompleteness vs. completeness) x feminine identity goal (incompleteness vs. completeness) as between-subject variables x time of measurement (t_0 vs t_1) as a within subject-variable. Emotions were measured at baseline (t_0) and a week after the manipulation (t_1). Participants were randomly assigned into one of four experimental conditions; (i) double incompleteness (STEM and feminine incompleteness) vs. (ii) double completeness (STEM and feminine completeness) vs. (iii) STEM completeness and feminine incompleteness vs. (iv) STEM incompleteness and feminine completeness.

2.3.1.2. Participants. Before the study, power analysis using G*Power software (Faul et al., 2007) for the model with two-time repeated measures and within-between interactions for 4 groups ($f^2 \geq .10$, $\alpha = .05$, power = .95, correlation = .40) was conducted. A sample of approximately 236 participants was required for the mentioned model. A total of 243 participants with self-declaration to be a woman and being employed in STEM entered Prolific.Co (Palan & Schitter, 2018) to complete the baseline measurement

(t_0). In the main experiment (t_1) 224 women entered the study and were randomly assigned to four experimental conditions. These participants followed the experimental manipulation conditions (ensuring the instructions of an open-ended task without entering random filler letters or without giving irrelevant responses) and this final sample's age was $M = 27.90$ ($SD = 7.39$) ranging from 19 to 68 years; 62.9% ($n = 141$) were from science, 14.7% ($n = 33$) from technology, 17.4% ($n = 39$) from engineering, 1.8% ($n = 4$) from mathematics and remaining 3.1% ($n = 7$) were from other category and missing responses.

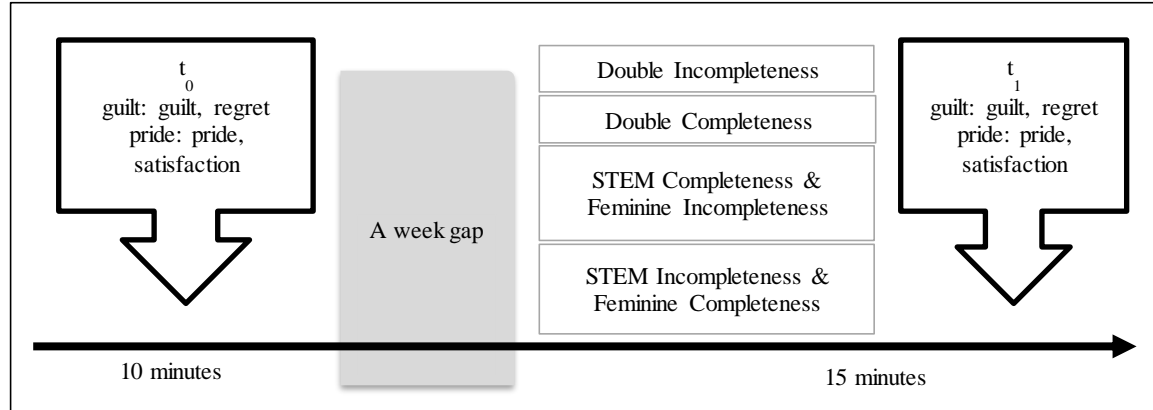
2.3.1.3. Procedure. Study 1 was conducted online from July 6th to July 22nd, 2023.

After entering the Prolific.co webpage participants read instructions and gave informed consent. Age, STEM subfields, and emotions i.e. guilt and pride were measured at t_0 , a week before the experimental manipulation. At t_1 participants first received experimental manipulation of (in)completeness and then their emotions were measured again (see Figure 2.1). Participants received £1 for the completion of the baseline measurement (ca. 10 minutes) and £1.50 for the main experiment (ca. 15 minutes). The Internal Faculty Board of the first author's institution approved the experimental procedure (Decision 02/E/01/2023). Data sets and analysis files for the study are available at:

https://osf.io/snqd8/?view_only=28c75e4236934f96a0ff35f93e8b7b20

Figure 2.1

Flow Chart of the Experimental Manipulation and Measurement of Emotions



Note. Participants took part in Study 1 and were randomly assigned to only one of the four manipulation conditions (i.e. incompleteness in both, completeness in both or completeness in one and incompleteness in the other identity goals) and scored their emotions subsequently.

2.3.1.4. Measures.

(In)Completeness Manipulation. Incompleteness was manipulated by asking participants to describe behaviors that were not aligned with their identity goals of being feminine and/or STEM professionals. This method was previously empirically verified (Doerflinger et al., 2021, Spsychalska-Wazsek et al., 2024). The instructions read as follows:

“Please write a short text about a personal experience in which you did not feel that you acted well enough as a feminine woman [STEM professional/scientist], as detailed in the description as possible and describe the location and events of the experience as well as your feelings and thoughts in the situation.”

Completeness was manipulated by asking participants to recall and describe behaviors that aligned with their identity goals of being feminine and/or STEM professionals. The instructions read as follows:

“Please write a short text about a personal experience in which you felt particularly

great and fulfilled of yourself as a feminine woman [STEM professional/Scientist], as detailed in the description as possible and describe the location and events of the experience as well as your feelings and thoughts in the situation.”

Manipulation check. Incompleteness states are known to have immediate effects and are sensitive to verbal affirmations (e.g., Sciara et al., 2022; Sorys, 2023). Therefore, linguistic analysis using LIWC-22 was employed to verify the occurrence of manipulation instead of a direct self-report question to avoid potential symbolizing. The incompleteness condition was hypothesized to show increased verb usage, reflecting heightened agency and goal activation (Formanowicz et al., 2017; Pietraszkiewicz & Formanowicz, 2023). An independent samples *t*-test was conducted to compare verb usage between the combined data of incompleteness and completeness conditions. Results indicated a statistically significant difference in verb usage, $t(404) = 2.86, p = .004$. Participants in the incompleteness condition ($M = 18.81, SD = 6.26$) used significantly more verbs than those in the completeness condition ($M = 17.03, SD = 6.25$). The effect size, measured by Cohen’s *d*, was 0.28, 95% CI [0.09, 0.48], indicating a small to moderate effect.

Emotions. Emotions (guilt and pride) were measured with a question: “*To what extent do you agree that you are feeling the following emotions at the moment?*” Responses were given on a 7-point Likert scale (1 = *strongly disagree* to 7 = *strongly agree*). Guilt was measured with two items guilt and regret (Cavalera, 2017; Liss et al., 2013; Marschall et al., 1994; Ozgul et al., 2003). The Pearson correlation between the two items was .52** (t_0) and .70** (t_1). The mean of guilt was $M = 2.93, (SD = 1.57)$ at t_0 and $M = 3.00 (SD = 1.68)$ at t_1 . Pride was measured with two items proud and satisfied (De Hooze & Van Osch, 2021; van Osch et al., 2018). The Pearson correlation between the two items was .52** (t_0) and .66**

(t_1). The mean value of pride (pride and satisfaction) was $M = 4.31$, ($SD = 1.44$) at t_0 and $M = 4.60$ ($SD = 1.41$) at t_1 . Additionally, as part of a bigger research project, shame, and hubris were also examined in study 1 but the differences across the experimental conditions were not statistically significant.

2.3.2. Results

In the following section, first, hypothesized contrast analysis for H_1 and H_2 are reported to examine the differences across four manipulation conditions at t_1 on both guilt and pride respectively.

For the robustness and the overall model testing, linear mixed-effect modeling (LMM, Meteyard & Davies, 2020) was performed. This analysis allowed to account for the individual differences in experienced emotions by participants when they entered the study and to distinguish between the fixed and random effects in the models. The models examined the emotions i.e. guilt and pride (outcome) and identity goals' (in)completeness, and time (predictors). General fixed and random model parameters, omnibus fixed effect parameters, and results on the postdoc level for both guilt and pride (with plots) are reported.

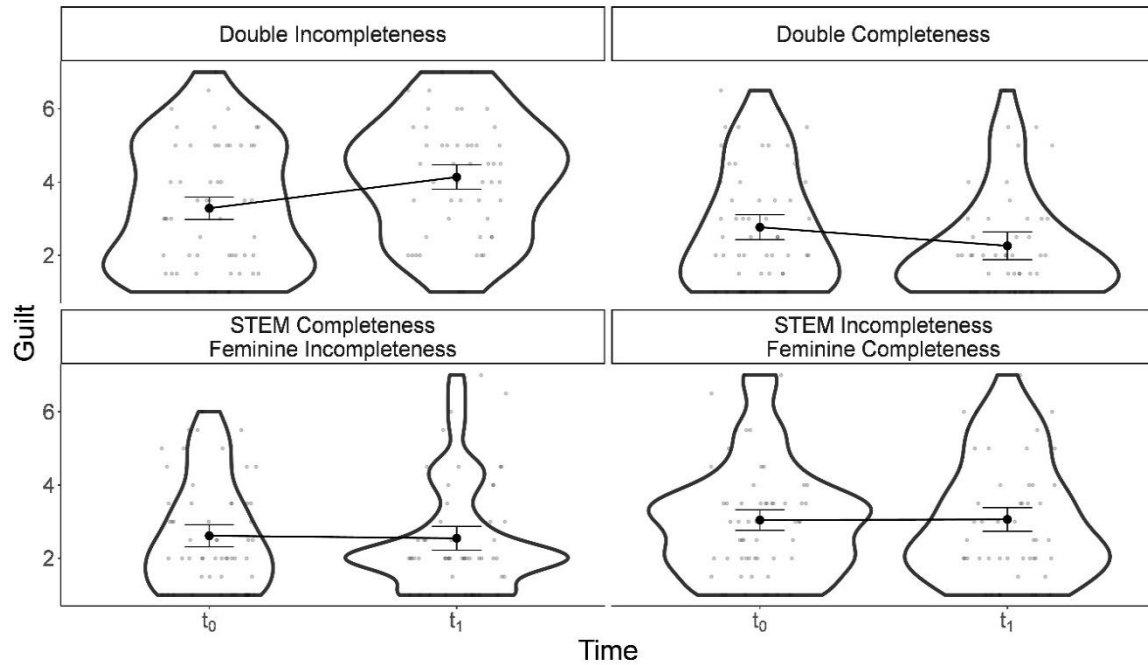
The Effect of Identity Goals' (In)Completeness on Guilt. To test the hypothesis (H_1) that participants in the double incompleteness condition will feel more guilt than those who are experiencing completeness in one and two of these identity goals, a planned contrast analysis was performed comparing the double incompleteness (3) with the remaining three conditions (-1, -1, -1). The whole model was significant $t(198) = 6.12$, $p < .001$. Participants in the double incompleteness condition ($M = 4.14$, $SE = 0.214$, 95% CI [3.72, 4.56]) reported more guilt when compared with the remaining three conditions i.e. double completeness ($M = 2.26$, $SE = 0.22$, 95% CI [1.83, 2.69]), STEM completeness &

feminine incompleteness ($M = 2.55$, $SE = 0.21$, 95% CI [2.13, 2.97]), and STEM incompleteness & feminine completeness ($M = 3.06$, $SE = 0.22$, 95% CI [2.63, 3.49]). These findings confirmed the hypothesis that participants in the double incompleteness condition would feel more guilt than those who are experiencing completeness in one and two of these identity goals.

For mixed models, the simple model with fixed effects explained 11% of the variance (marginal R^2) in guilt. Adding random intercepts increased the model's explanatory power by an additional 35% ($R^2 = 46\%$ in total). Intra Class Correlation equaled .39, which indicates that random effects are present in the data (Kreft & DeLeeuw, 1998). The main effect of the manipulation conditions on guilt was statistically significant, $F(3, 218.50) = 10.03$, $p < .001$. The two-way interaction between the time of measurement (t_0 vs. t_1) and four manipulation conditions was also significant $F(3, 209.05) = 5.94$, $p < .001$. However, the effect of the time itself was not statistically significant, $F(1, 209.08) = 0.28$, $p = .597$.

On the post-hoc analysis, a significant change in guilt was observed on double incompleteness condition across t_0 and t_1 i.e. $t(208.01) = -3.60$, $p < .05$, from t_0 ($M = 3.29$ ($SE = .21$) 95% CI [2.88, 3.69]) to t_1 ($M = 4.13$, $SE = .22$, 95% CI [3.71, 4.56]). Moreover, consistent with contrast analysis, there was significantly ($p < .001$) more guilt reported after manipulation (t_1) in the double incompleteness condition compared to the other three conditions (see Figure 2.2).

Figure 2.2
The Effect of Identity Goals (In)Completeness on Guilt



Note. Figure 2.2. t_0 : baseline, t_1 : post-manipulation. The violin plots represent the spread of the scores. The lines from t_0 to t_1 reflect the change in mean emotion scores after manipulation and confidence interval. The differences in guilt after being exposed to four manipulation conditions. The guilt was reported significantly more in the double incompleteness condition as compared to the rest of the three conditions.

The Effect of Identity Goals (In)Completeness on Pride. To test the hypothesis (H_2) that participants in the double completeness condition will feel more pride than those who are experiencing incompleteness in one and two of these identity goals, a planned contrast analysis was performed comparing the double completeness (3) with the remaining three conditions (-1, -1, -1). The whole model was significant $t(198) = 2.68, p < .01$. Participants in the double completeness condition ($M = 5.04, SE = 0.19, 95\% \text{ CI } [4.67, 5.41]$) reported more pride when compared with the remaining three conditions i.e. double incompleteness ($M = 3.78, SE = 0.19, 95\% \text{ CI } [3.41, 4.14]$), STEM completeness & feminine incompleteness ($M = 4.91, SE = 0.18, 95\% \text{ CI } [4.55, 5.28]$), and STEM incompleteness & feminine completeness ($M = 4.69, SE = 0.19, 95\% \text{ CI } [4.32, 5.07]$). These

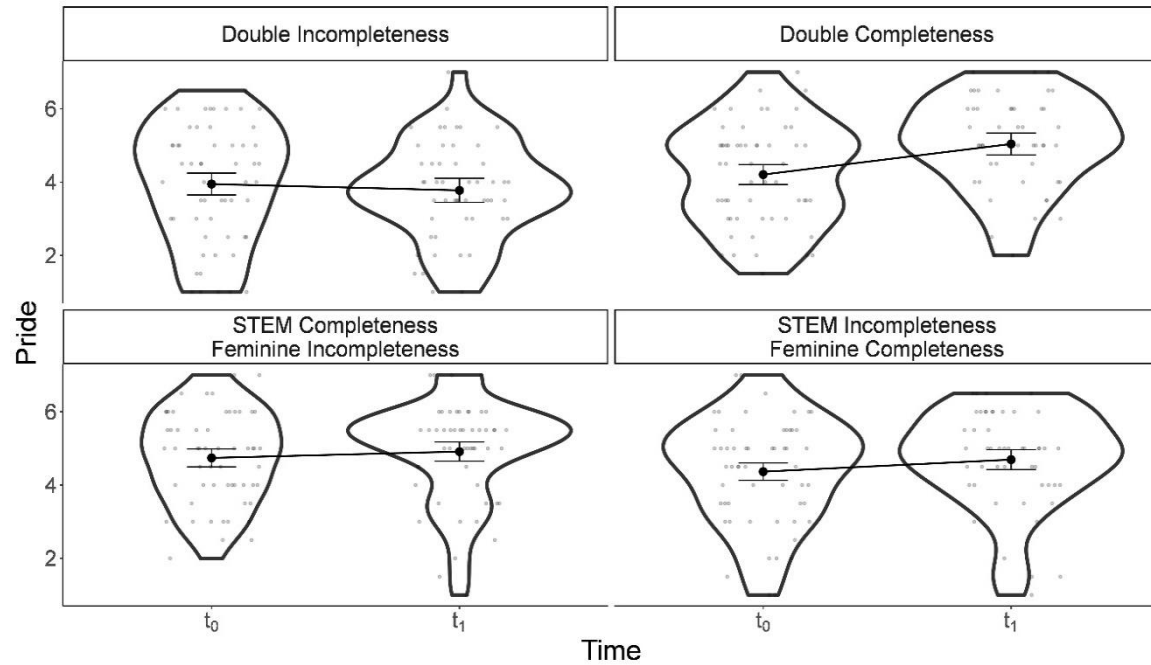
findings confirmed the hypothesis that participants in the double completeness condition would feel more pride than those who are experiencing incompleteness in one and two of these identity goals.

On the linear mixed-effect modeling (LMM), the simple model with fixed effects explained 9% of the variance (marginal R^2) in guilt. Adding random intercepts increased the model's explanatory power by an additional 40% ($R^2 = 49\%$ in total). Intra Class Correlation equaled .44 indicating the random effects. The main effect of the manipulation conditions on pride was statistically significant, $F(3, 219.44) = 7.12, p < .001$. The two-way interaction between the time of measurement (t_0 vs. t_1) and four manipulation conditions was also significant $F(3, 208.98) = 4.72, p < .01$, and the effect of the time itself was significant on pride as well, $F(1, 209.01) = 8.19, p < .05$.

On the post-hoc analysis, a significant change in pride was observed on double completeness condition across t_0 and t_1 i.e. $t(208.98) = -4.27, p < .001$, from $t_0 (M = 4.21 (SE = .18) 95\% CI [3.84, 4.57])$ to $t_1 (M = 5.07, SE = .19, 95\% CI [4.69, 5.45])$. Upon further exploration, there was significantly lower pride reported after manipulation (t_1) in the double incompleteness condition as compared to the double completeness condition, $t(372.21) = -4.84, p < .001$, as compared to STEM completeness & feminine incompleteness, $t(368.07) = -4.21, p < .001$, and as compared to STEM incompleteness & feminine completeness $t(373.81) = -3.43, p < .05$. There were no significant differences in pride between double completeness and STEM completeness & feminine incompleteness condition ($p = 1.0$) and STEM incompleteness feminine completeness ($p = 1.0$). Participants in the double completeness condition felt more pride than those experiencing incompleteness in two identity goals. However, participants with one identity goal

completeness did not differ in pride from participants with two identity goals completeness (see Figure 2.3).

Figure 2.3
The Effect of Identity Goals (In)completeness on Pride



Note. Figure 2.3. t₀: baseline, t₁: post-manipulation. The violin plots represent the spread of the scores. The lines from t₀ to t₁ reflect the change in mean emotion scores after manipulation and confidence interval. The differences in pride after being exposed to four manipulation conditions. Pride was reported significantly less in the double incompleteness and significantly more in the double completeness condition after manipulation.

2.3.3. Discussion

The states of (in)completeness in dual identity goal pursuit yielded stronger affective consequences as compared to single identity goals. The findings of Study 1 verified the hypotheses that completeness or incompleteness of identity goals impact emotions such as pride and guilt. Identity goal completeness is equivalent to attaining the symbols for example accomplishing tasks in the STEM profession or feminine domain hence relevant to feeling pride. Oppositely, incompleteness increased the negative emotion of guilt. Overall, the effect of (in)completeness was found equally influential regardless of the identity goal type i.e. STEM or femininity.

When women in STEM experience incompleteness in both STEM as well as feminine identity goals they experience more guilt in comparison with women who are in a state of completeness in both or at least one of the identity goals (H_1). Moreover, when it comes to experiencing pride due to identity goal completeness, even feeling the state of completeness in one of the identity goals did not differ from having the state of completeness in both identity goals (H_2). Only double incompleteness condition participants reported less pride. It is possible that having a state of completeness even in one of two crucial identity goals may be a sufficient substitute for maintaining the emotion of pride. This result directed that perhaps feeling completeness in one identity goal may serve as a compensatory effect for the other identity goal's incompleteness.

Study 2 was designed and executed to cover the two possible confines of Study 1. Firstly, a clearer understanding was needed of whether identity goal completeness may serve as an effective compensation for incompleteness, enhancing pride and reducing guilt. Secondly, instead of two measurements of emotions; baseline and post-manipulation, a more dynamic interplay of emotions was to be examined by adding a third measurement (during the manipulation) of emotional states.

2.4. Study 2 – Identity Goal Compensation and Emotions

Study 2 was conducted to test the affective consequences when there is a possibility of compensation as compared to no possibility in the situation of identity goals' incompleteness. It was expected that women in an incompleteness state, who will not get a chance to experience completeness (no compensation) would report more guilt as compared to the ones with the possibility to compensate (H_3). Moreover, women in an incompleteness state, who will get a chance to experience completeness (compensation) would report more

pride as compared to the ones without compensation (H_4). Study 1 did not show differences depending on the identity goal i.e. feminine or STEM, thus no ground to expect differences between the two goals were found.

In this study, three measurements (t_0, t_1, t_2) of emotions; baseline, post-first manipulation, and post-second manipulation were introduced. This allowed to capture dynamic changes in experienced emotions after each manipulation. Positive and negative affect (PANAS) were introduced to explore the difference between more general affect in comparison to more specific emotions such as pride and guilt.

2.4.1. Method

2.4.1.1. Study Design. The experimental design was 2 (compensation: no vs. yes) x 2 (identity goal: STEM vs. feminine) x 3 (time of measurement: t_0 vs. t_1 vs. t_2). Participants were randomly assigned into four conditions in a between-subject design; (i) STEM completeness → Feminine *incompleteness* (NO compensation) vs. (ii) Feminine completeness → STEM *incompleteness* (NO compensation) vs. (iii) STEM *incompleteness* → Feminine *completeness* (YES compensation) vs. (iv) Feminine *incompleteness* → STEM *completeness* (YES compensation). Within-subject emotions (guilt, pride, positive and negative affect) were measured at baseline (t_0) during (t_1), and post (t_2) manipulation.

2.4.1.2. Participants. To calculate a required sample size, a partial eta of 0.02, along with an effect size of 0.142, an error probability of 0.05, and a power of .95 as per the previous Study 1 was assumed. Based on effect sizes found before, in four groups and three times measurement, a sample of $n = 260$ was sufficient to attain the effect size $f = 0.142$ with a statistical power greater than $1 - \beta = .95$ (Faul et al., 2007). A total of 260 women in STEM entered Prolific.Co (Palan & Schitter, 2018). Out of which 240 participants followed the

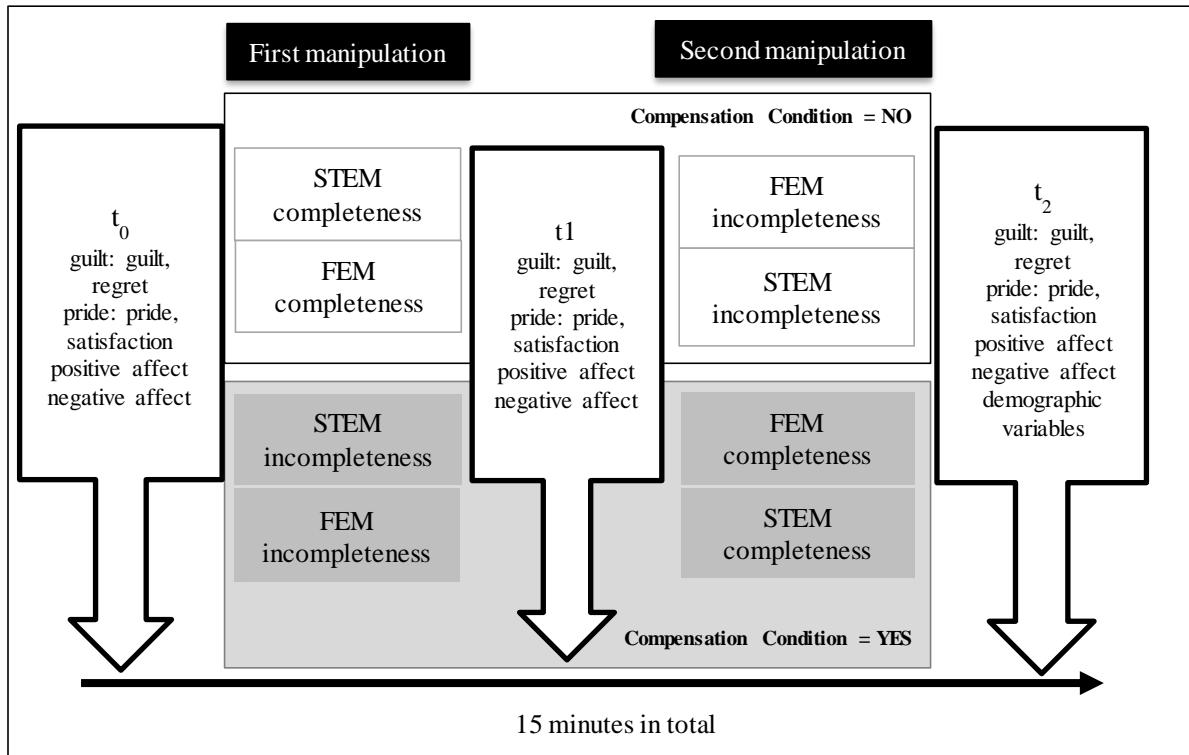
experimental manipulation conditions (responding to an open-ended task without entering random filler letters or without giving irrelevant responses) and this final sample's age was $M = 28.40$ ($SD = 7.60$) ranging from 19 to 71 years; 55% ($n = 132$) were from science, 19.3% ($n = 46$) from technology, 18.8% ($n = 45$) from engineering, 2.9% ($n = 7$) from mathematics and remaining 10% ($n = 4.6$) were from other category and missing responses.

2.4.1.3. Procedure. The study was conducted on January 8th, 2024. After entering the Prolific.co webpage participants read instructions and expressed gave informed consent. At baseline (t_0), all the participants evaluated their emotions (guilt, pride, positive emotions, and negative emotions). Next, participants were assigned to four experimental conditions to receive the manipulation tasks. Emotions (t_1) were measured after the first manipulation i.e. identity goal (in)completeness. The final measurement of emotions (t_2) was taken after the second manipulation i.e. presence and absence of compensation opportunity (See flowchart in Figure 2.4). The Internal Faculty Board of the first author's institution approved the experimental procedure (Decision 02/E/01/2024) and the hypotheses of Study 2 were pre-registered on a public database AsPredicted (no. 156958, see appendix 1). Data sets and analysis files for the study are available at:

https://osf.io/snqd8/?view_only=28c75e4236934f96a0ff35f93e8b7b20

Figure 2.4

Flow Chart of the Experimental Manipulation and Measurement of Emotions



Note. Figure 2.4. Participants took part in study 2 and experienced STEM or Feminine (FEM) (in)completeness in the First manipulation and later on took part in NO compensation condition (i.e. experiencing incompleteness as STEM or feminine) or in YES compensation condition (i.e. experiencing completeness as STEM or feminine) in the second manipulation.

2.4.1.4. Measures

(In)Completeness Compensation Manipulation. The method and task to induce (in)completeness were the same as in Study 1. In the compensation condition (yes), at first, participants were asked to describe behaviors that were not aligned with either of their identity goals of femininity or STEM (t_1); followed by the description of the behaviors that aligned with their identity goals of femininity or STEM (t_2). In the no compensation condition, at first, participants were asked to describe behaviors that were aligned with either of their identity goals of femininity or STEM (t_1); followed by the description of the behaviors that were not aligned with their identity goals of femininity or STEM (t_2).

Manipulation check. Similar to study 1, an independent samples t -test was

conducted to compare verb usage between the data of incompleteness and completeness conditions. Results indicated a statistically significant difference, $t(478) = 4.79, p < .001$. Participants in the self-incompleteness condition ($M = 18.70, SD = 6.33$) used significantly more verbs than those in the self-completeness condition ($M = 15.99, SD = 6.03$). The effect size, measured by Cohen's d , was 0.44, 95% CI [0.26, 0.62], indicating a small to moderate effect.

Emotions. Emotions (guilt and pride) were measured with a straightforward question: “*To what extent do you agree that you are feeling the following emotions at the moment?*” Responses were given on a 7-point Likert scale (1 = *strongly disagree* to 7 = *strongly agree*). Guilt was measured with two items guilt and regret (Cavalera, 2017; Marschall et al., 1994). The Pearson correlation between the two items was .60** (t_0), .71** (t_1), and .76** (t_2). Overall the mean of guilt was $M = 2.50, (SD = 1.50)$ at t_0 , $M = 2.84 (SD = 1.69)$ at t_1 , and $M = 2.91 (SD = 1.74)$ at t_2 . Pride was measured with two items proud and satisfied (De Hooze & Van Osch, 2021). The Pearson correlation between the two items was .55** (t_0), .72** (t_1), and .81** (t_2). Overall the mean of pride was $M = 4.35, (SD = 1.31)$ at t_0 , $M = 4.50 (SD = 1.51)$ at t_1 , and $M = 4.40 (SD = 1.70)$ at t_2 .

Positive and Negative Affect Schedule (PANAS). Additionally, positive and negative affect with responses on a 7-point Likert scale (1 = *strongly disagree* to 7 = *strongly agree*) to ten affective states was assessed. Participants were instructed to rate to which degree, at that very moment, they were experiencing specific positive affective states i.e. inspired, alert, excited, enthusiastic, determined, and negative affective states i.e. afraid, upset, nervous, scared, distressed (Thompson, 2007). The indices of positive affect and negative affect were created for further analyses. Cronbach alpha for positive affect was .78

(t_0), .80 (t_1), and .86 (t_2), whereas for negative affect was .88 (t_0), .88 (t_1), and .90 (t_2).

Overall positive affect was $M = 4.51$, ($SD = 1.10$) at t_0 , $M = 4.54$ ($SD = 1.21$) at t_1 , and $M = 4.39$ ($SD = 1.37$) at t_2 . Whereas, the overall negative affect was $M = 2.91$, ($SD = 1.48$) at t_0 , $M = 2.82$ ($SD = 1.41$) at t_1 , and $M = 2.88$ ($SD = 1.48$) at t_2 .

2.4.2. Results

To test hypotheses (H_3 & H_4), Similar to study 1, linear mixed-effect modeling (LMM, Meteyard & Davies, 2020) was performed. Moreover, aside from the hypothesized model i.e. guilt and pride (outcome) and identity goals, compensation conditions, and time (predictors and their interactions), another model considering positive and negative affect as covariates to distinguish the role of general vs. specific emotions was also examined (See Tables 2.1 & 2.2). Additionally, it is imperative to mention earlier that (with and without covariate models) there were no significant differences in emotions due to the type of identity goals i.e. whether it was STEM or feminine. In the following sections, the general fixed and random model parameters, omnibus fixed effect parameters, and hypothesized results on the posthoc level for both guilt and pride (with plots) with additional covariates PANAS analyses are reported.

The Effect of Identity Goal Compensation on Guilt. The simple model with fixed effects explained 15% of the variance (marginal R^2) in guilt. Adding random intercepts increased the model's explanatory power by an additional 41% ($R^2 = 56\%$ in total). Intra Class Correlation equaled .48. The main effect of the time of measurement on guilt was statistically significant, $F(2, 472) = 9.39$, $p < .001$ as was the two-way interaction between time of measurement and compensation (no vs. yes), $F(2, 472) = 108.23$, $p < .001$. The interaction effects revealed significant results for the time (t_0, t_1, t_2) x compensation (no,

yes). The effect of time between t_1 vs. t_0 along with compensation condition was significant, $t(472) = 5.97, p < .001$. Also, the effect of time between t_2 vs. t_0 along with compensation condition was significant $t(472) = -8.66, p < .001$ (see Table 2.1).

In the no compensation condition (see Figure 2.5, dashed line and circle data points), participants first underwent completeness manipulation, there was no change in the guilt, $t(472) = 1.74, p = .410$, from t_0 ($M = 2.37$ ($SE = .14$) 95% CI [2.10, 2.64]) to t_1 ($M = 2.12, SE = .14$, 95% CI [1.85, 2.39]). Then they underwent incompleteness manipulation and as predicted (H_3), a significant increase in guilt was noted, $t(472) = -10.73, p < .001$, from t_1 to t_2 ($M = 3.65, SE = .14$, 95% CI [3.38, 2.92]) in the absence of compensation.

In the yes compensation condition (see Figure 2.5, solid line and triangle data points), participants first underwent incompleteness manipulation and as predicted, the significant increase in the guilt was observed, $t(472) = -6.66, p < .001$, from t_0 ($M = 2.65$ ($SE = .14$) 95% CI [2.37, 2.93]) to t_1 ($M = 3.61, SE = .14$, 95% CI [3.33, 3.89]). Then they underwent completeness manipulation and a drop in guilt was observed, $t(472) = 9.97, p < .001$, from t_1 to t_2 ($M = 2.17, SE = .14$, 95% CI [1.89, 2.45]). Participants at the baseline t_0 did not differ in guilt whether they were in the no, or yes, compensation condition, $t(486) = -1.41, p = .641$. Whereas, there were statistically significant differences among participants who underwent no vs. yes compensation at t_2 , $t(486) = 7.46, p < .001$. These results confirmed that women in an incompleteness state, who did not get a chance to experience (no) compensation would report more guilt as compared to the ones with the (yes) compensation.

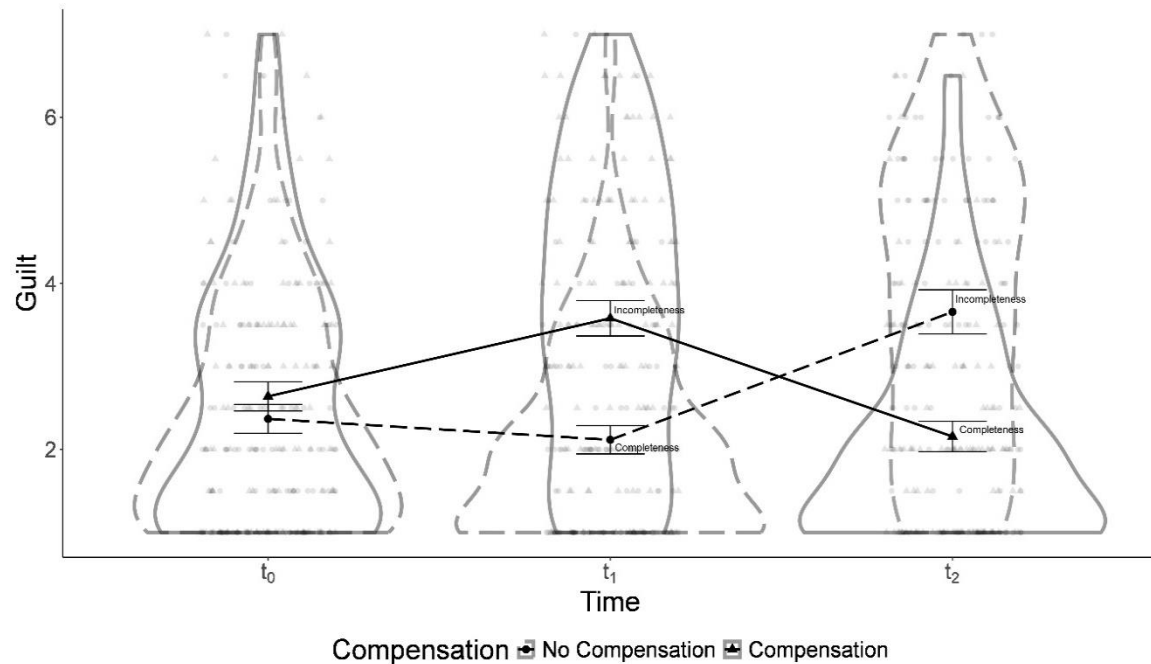
Table 2.1*Linear Mixed Model Results for Guilt as a Function of Time, Compensation, and Identity Goals*

Model Parameters Guilt (Outcome) R-squared marginal = 0.15 R-squared conditional = 0.56 Inter Class Correlation (ICC) = 0.48								Model Parameters Guilt (Outcome) Covariates – PANAS, Positive and Negative Affect R-squared marginal = 0.55 R-squared conditional = 0.71 Inter Class Correlation (ICC) = 0.36							
Fixed Omni bus Effect				<i>F</i>	<i>df</i>	<i>p</i>			<i>F</i>	<i>df</i>	<i>p</i>				
								Positive Affect	30.31	1, 517.42	<.001				
								Negative Affect	373.03	1, 470.55	<.001				
Time (t_0, t_1, t_2)				9.39	2, 472	<.001			15.97	2, 469.55	<.001				
Time (t_0, t_1, t_2) * Compensation Conditions (Novs. Yes)				108.23	2, 472	<.001			41.11	2, 510.03	<.001				
Time (t_1 , vs. t_0) * Compensation Conditions (Novs. Yes)				5.97	472	<.001			4.35	479.06	<.001				
Time (t_2 , vs. t_0) * Compensation Conditions (Novs. Yes)				-8.66	472	<.001			5.30	510.65	<.001				
Compensation				0.36	1, 236	.547			1.81	1, 233.96	.180				
Identity Goals (STEM vs. Feminine)				0.92	1, 236	.338			0.53	1, 232.71	.466				
Time * Identity Goals				0.42	2, 472	.657			0.96	2, 468.38	.504				
Compensation * Identity Goals				0.67	1, 236	.412			0.69	1, 232	.405				
Time * Compensation * Identity Goals				1.54	2, 472	.216			0.23	2, 471.50	.796				
Post-hoc Comparisons of Guilt Across Compensation Conditions and Time															
Compensation Condition	Manip. Time	Mean	SE	95% CI [Lower, Upper]	<i>t</i>	<i>df</i>	<i>p</i>	Mean	SE	95% CI [Lower, Upper]	<i>t</i>	<i>df</i>	<i>p</i>		
No	t_0	2.37	0.14	[2.10, 2.64]				2.37	.01	[2.17, 2.57]					
No	t_1 – completeness manip.	2.12	0.14	[1.85, 2.39]	1.74	472	.410	2.42	.01	[2.21, 2.62]	-0.42	478.79	1.0		
No	t_2 –	3.65	0.14	[3.38, 3.92]	-10.73	472	<	3.23	.11	[3.02, 3.44]	-6.51	533.04	<		

	incompleteness manip.						.001						.001
Yes	t_0	2.65	0.14	[2.37, 2.93]				2.58	.10	[2.38, 2.79]			
Yes	t_1 – incompleteness manip.	3.61	0.14	[3.33, 3.89]	-6.66	472	< .001	3.36	.11	[3.16, 3.57]	-6.57	475.09	<.001
Yes	t_2 – completeness manip.	2.17	0.14	[1.89, 2.45]	9.97	472	< .001	2.52	.11	[2.31, 2.73]	6.85	506.43	<.001
No vs. Yes	t_0	2.37 vs. 2.65			-1.41	486	.641	2.37 vs. 2.52			-1.45	559.73	1.0
No vs. Yes	t_2	3.65 vs. 2.17			7.46	486	< .001	3.23 vs. 2.52			4.52	561.94	< .001

Note. Participants in the NO compensation condition experienced a significant increase in guilt at t_2 following incompleteness manipulation. Participants in the YES compensation condition reported a significant decrease in guilt at t_2 after completeness manipulation. The shaded model shows results after adding covariates to the original model.

Figure 2.5
The Effect of Identity Goal Compensation on Guilt



Note. Figure 2.5. t_0 : baseline, t_1 : First-manipulation, t_2 : Second-manipulation/Post compensation. Circle & dashed line: data point for no compensation, Triangle & solid line: data point for Yes compensation. The violin plots represent the spread of the scores. The line from t_0 to t_1 to t_2 reflects the change in mean guilt scores after manipulations and confidence interval. Guilt was reported significantly more in the incompleteness task as compared to the completeness task. Participants in No Compensation condition t_2 reported more guilt compared to participants in Yes Compensation t_2 .

Aside from the hypothesized (H_3) results, there were no differences in guilt due to the main effect of compensation only, $F(1, 236) = 0.36, p = .547$, and identity goals (STEM vs. feminine), $F(1, 236) = 0.92, p = .338$. Moreover, the two-way interactions between time and identity goals, $F(2, 472) = 0.42, p = .657$, compensation and identity goals, $F(1, 236) = 0.67, p = .412$, and the three-way interaction between time, compensation and identity goal $F(2, 472) = 1.54, p = .216$, were not statistically significant.

The effect of positive and negative affect as covariates were also examined in this above-reported model (see Table 2.1, Shaded area). Positive affect, $F(1, 517.42) = 30.31, p < .001$, and negative affect, $F(1, 470.55) = 373.03, p < .001$ were found to be significant covariates. However, it did not effect the main results i.e. effect of time and compensation

on guilt. For model specification, marginal $R^2 = .55$ and conditional $R^2 = 71\%$ in total for fixed effects with ICC = 36 accounting for random component. It was found that the effect of the presence or absence of compensation on guilt as a specific and relevant emotion superseded the general positive and negative affect.

The main effect of the time of measurement on guilt was statistically significant, $F(2, 469.55) = 15.97, p < .001$ as was the two-way interaction between time of measurement and compensation (no vs. yes), $F(2, 510.03) = 41.11, p < .001$. The interaction effects revealed significant results for the time (t_0, t_1, t_2) x compensation (no, yes). The effect of time between t_1 vs. t_0 along with compensation condition was significant, $t(479.06) = 4.35, p < .001$. Also, the effect of time between t_2 vs. t_0 along with compensation condition was significant $t(510.65) = -5.30, p < .001$.

Similar to the original model (without covariates), in this new model (Positive Negative affect as covariates) in the no compensation condition participants first underwent completeness manipulation, no change in the guilt was found, $t(478.79) = -0.42, p = 1.0$, from $t_0 (M = 2.37 (SE = .10) 95\% CI [2.17, 2.57])$ to $t_1 (M = 2.42, SE = .10, 95\% CI [2.21, 2.62])$. Then they underwent incompleteness manipulation and as predicted (H_3), a significant increase in guilt was observed, $t(533.04) = -6.51, p < .001$, from t_1 to $t_2 (M = 3.23, SE = .11, 95\% CI [3.02, 3.44])$ in the absence of compensation.

In the yes compensation condition, participants first underwent incompleteness manipulation and as predicted, a significant increase in the guilt was observed, $t(475.09) = -6.57, p < .001$, from $t_0 (M = 2.58 (SE = .10) 95\% CI [2.38, 2.79])$ to $t_1 (M = 3.36, SE = .11, 95\% CI [3.16, 3.57])$. Then they underwent completeness manipulation and a drop in guilt was observed, $t(506.43) = 6.85, p < .001$, from t_1 to $t_2 (M = 2.52, SE = .11, 95\% CI [2.31,$

2.73]). Participants at the baseline t_0 did not differ in guilt, $t(559.73) = -1.45, p = 1.0$.

Whereas, there were statistically significant differences among participants who underwent no vs. yes compensation at t_2 , $t(561.94) = 4.52, p < .001$. These results confirmed that women in an incompleteness state, who did not get a chance to experience (no) compensation would report more guilt as compared to the ones with the (yes) compensation.

There were no differences in guilt due to the main effect of compensation only, $F(1, 233.96) = 1.81, p = .180$, and identity goals (STEM vs. feminine), $F(1, 232.71) = 0.53, p = .466$. Moreover, the two-way interactions between time and identity goals, $F(2, 468.38) = 0.96, p = .504$, compensation and identity goals, $F(1, 232) = 0.69, p = .405$, and the three-way interaction between time, compensation and identity goal $F(2, 471.50) = 0.23, p = .796$, were not statistically significant.

The Effect of Identity Goal Compensation on Pride. The simple model with fixed effects explained 18% of the variance (marginal R^2) in pride. Adding random intercepts increased the model's explanatory power by an additional 44% ($R^2 = 62\%$ in total). Intra Class Correlation equaled .53. The main effect of the compensation (no vs. yes) was, $F(1, 236) = 3.93, p = .05$. The two-way interaction between time of measurement and compensation (no vs. yes) was statistically significant, $F(2, 472) = 149.92, p < .001$. The interaction effects revealed significant results for the time (t_0, t_1, t_2) x compensation (no, yes). The effect of time between t_1 vs. t_0 along with compensation condition was significant, $t(472) = -8.13, p < .001$. Also, the effect of time between t_2 vs. t_0 along with compensation condition was significant $t(472) = 9.17, p < .001$ (see Table 2.2).

Table 2.2*Linear Mixed Model Results for Pride as a Function of Time, Compensation, and Identity Goals*

Model Parameters Pride (Outcome) R-squared marginal = 0.18 R-squared conditional = 0.62 Inter Class Correlation (ICC) = 0.53								Model Parameters Pride (Outcome) Covariates – PANAS, Positive and Negative Affect R-squared marginal = 0.68 R-squared conditional = 0.82 Inter Class Correlation (ICC) = 0.43					
Fixed Omni bus Effect				<i>F</i>	<i>df</i>	<i>p</i>		<i>F</i>	<i>df</i>	<i>p</i>			
								Positive Affect	711.12	1,562.99	<	.001	
								Negative Affect	53.24	1,514.47	<	.001	
Time (t_0, t_1, t_2)				1.37	2, 473	.256			3.70	2, 471.56	<	.05	
Time (t_0, t_1, t_2) * Compensation Conditions (Novs. Yes)				149.92	2, 472	<			49.26	2,511.40	<	.001	
Time (t_1 , vs. t_0) * Compensation Conditions (Novs. Yes)				8.13	472	<			6.93	481.00	<	.001	
Time (t_2 , vs. t_0) * Compensation Conditions (Novs. Yes)				9.17	472	<			3.49	512.39	<	.001	
Compensation				3.93	1, 236	.05			0.01	1, 236.17		.915	
Identity Goals (STEM vs. Feminine)				3.11	1, 236	.079			0.82	1, 234.84		.366	
Time * Identity Goals				1.20	2, 472	.303			1.12	2, 470.37		.326	
Compensation * Identity Goals				0.50	1, 236	.480			0.00	1, 234.65		.997	
Time * Compensation * Identity Goals				0.06	2, 472	.941			0.07	2, 473.68		.932	
Post-hoc Comparisons of Pride Across Compensation Conditions and Time													
Compensation Condition	Manip. Time	Mean	SE	95% CI [Lower, Upper]	<i>t</i>	<i>df</i>	<i>p</i>	Mean	SE	95% CI [Lower, Upper]	<i>t</i>	<i>df</i>	<i>p</i>
No	t_0	4.22	0.13	[3.98, 4.47]				4.25	.08	[4.10, 4.41]			
No	t_1 – completeness manip.	5.07	0.13	[4.82, 5.32]	-6.96	472	<	4.79	.08	[4.63, 4.94]	-6.27	478.75	<.001
No	t_2 –	3.49	0.13	[3.24, 3.74]	6.06	472	<	4.19	.08	[4.03, 4.35]	6.57	5.32.73	<.001

	incompleteness manip.						.001						
Yes	t_0	4.46	0.13	[4.21, 4.71]				4.40	.03	[4.24, 4.55]			
Yes	$t_1 -$ incompleteness manip.	3.90	0.13	[3.65, 4.15]	4.55	472	< .001	4.09	.08	[3.93, 4.24]	3.60	475.02	<.05
Yes	$t_2 -$ completeness manip.	5.31	0.13	[5.06, 5.56]	-11.46	472	< .001	4.78	.08	[4.61, 4.94]	-7.74	506.35	<.001
No vs. Yes	t_0	4.22			-1.31	451.21	.363	4.25					
	vs.	4.46						4.40			-1.28	514.70	.804
No vs. Yes	t_2	3.49			10.17	451	< .001	4.19					
	vs.	5.31						4.78			-4.88	527.15	<.001

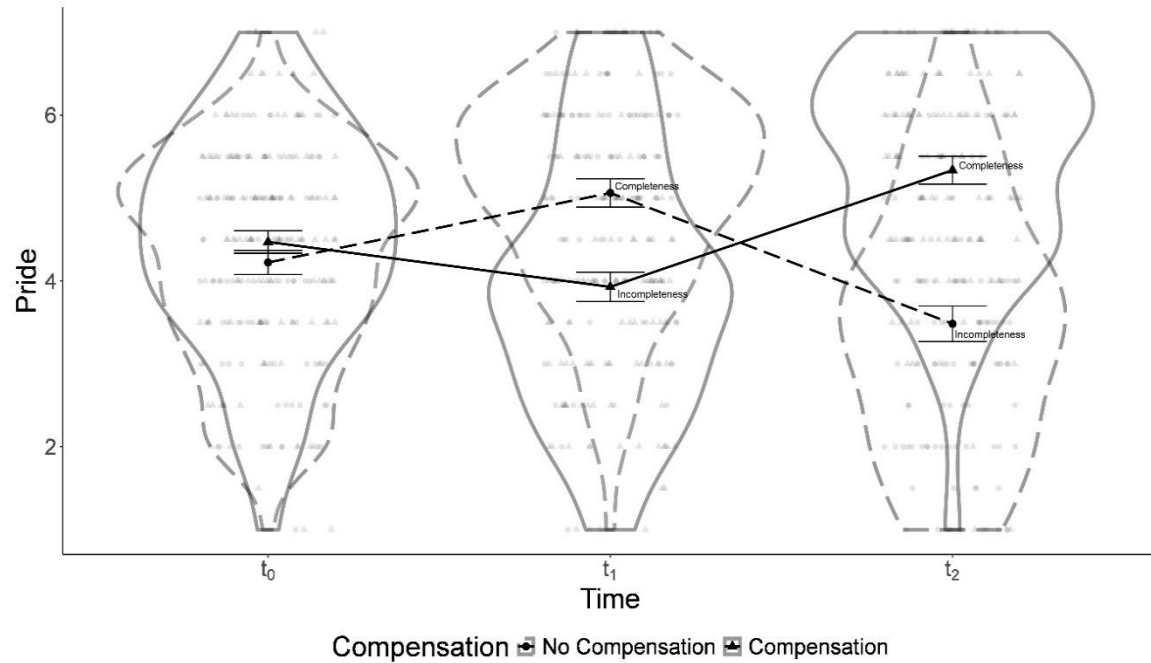
Note. Participants in the YES compensation condition experienced a significant increase in pride at t_2 following completeness manipulation. Participants in the NO compensation condition reported a significant decrease in pride at t_2 after incompleteness manipulation. The shaded model shows results after adding covariates to the original model.

In the yes compensation condition (see Figure 2.6, solid line & triangle data points), participants first underwent incompleteness manipulation and as predicted, a significant drop in the pride was noted, $t(472) = 4.55, p < .001$, from $t_0 (M = 4.46 (SE = .13) 95\% CI [4.21, 4.71])$ to $t_1 (M = 3.90, SE = .13, 95\% CI [3.65, 4.15])$. Then they underwent completeness manipulation as predicted (H_4), and a significant increase in pride was noted, $t(472) = 11.46, p < .001$, from t_1 to $t_2 (M = 5.31, SE = .13, 95\% CI [5.06, 5.56])$ due to compensation.

In the no compensation condition (see Figure 2.6, dashed line & circle data points), participants first underwent completeness manipulation, a significant increase in the pride was observed, $t(472) = -6.96, p < .001$, from $t_0 (M = 4.22 (SE = .13) 95\% CI [3.98, 4.47])$ to $t_1 (M = 5.07, SE = .13, 95\% CI [4.82, 5.32])$. Then they underwent incompleteness manipulation and a significant drop in pride was observed, $t(472) = 6.06, p < .001$, from t_1 to $t_2 (M = 3.49, SE = .13, 95\% CI [3.24, 3.74])$ in the absence of compensation. Participants at the baseline t_0 did not differ in pride regardless of compensation conditions, $t(451.21) = -1.31, p = .363$. There were statistically significant differences among participants who underwent no vs. yes compensation at $t_2, t(451) = 10.17, p < .001$. These results confirmed that women in an incompleteness state, who did get a chance to experience compensation reported more pride as compared to the ones with no compensation.

There were no differences in pride due to the main effects of time $F(2, 473) = 1.37, p = .256$, and identity goals (STEM vs. feminine), $F(1, 236) = 3.11, p = .079$. Moreover, the two-way interactions between time and identity goals, $F(2, 472) = 1.20, p = .303$, compensation and identity goals, $F(1, 236) = 0.50, p = .480$, and the three-way interaction between time, compensation and identity goal, $F(2, 472) = 0.06, p = .941$, were not statistically significant.

Figure 2.6
The Effect of Identity Goal Compensation on Pride



Note. Figure 2.6. t_0 : baseline, t_1 : First-manipulation, t_2 : Second manipulation / post-compensation. Circle & dashed line: data point for no compensation, Triangle & solid line: data point for Yes compensation. The violin plots represent the spread of the scores. The line from t_0 to t_1 to t_2 reflects the change in mean emotion scores after manipulations and confidence interval. Pride was reported significantly more in the completeness task as compared to the incompleteness task. Participants in Yes Compensation condition t_2 reported more pride compared to participants in No Compensation t_2 .

Again for this model, positive affect, $F(1, 562.99) = 711.12, p < .001$, and negative affect, $F(1, 514.47) = 53.24, p < .001$ were found to be significant covariates (see Table 2.2, shaded area). However, it did not effect the main results i.e. effect of time and compensation on pride. For model specification, marginal $R^2 = .68$ and conditional $R^2 = 82\%$ in total for fixed effects with $ICC = .43$ accounting for random component. The effect of the presence or absence of compensation on pride as a specific and relevant emotion superseded the general positive and negative affect.

The main effect of the time of measurement on pride was statistically significant, $F(2, 471.56) = 3.70, p < .05$ as was the two-way interaction between time of measurement and compensation (no vs. yes), $F(2, 511.40) = 49.26, p < .001$. The interaction effects

revealed significant results for the time (t_0, t_1, t_2) x compensation (no, yes). The effect of time between t_1 vs. t_0 along with compensation condition was significant, $t(481.00) = -6.93$, $p < .001$. Also, the effect of time between t_2 vs. t_0 along with compensation condition was significant $t(512.39) = 3.49$, $p < .001$.

In the yes compensation condition, participants first underwent incompleteness manipulation, and as predicted, a significant drop in the pride was reported, $t(475.02) = 3.60$, $p < .05$, from t_0 ($M = 4.40$ ($SE = .03$) 95% CI [4.24, 4.55]) to t_1 ($M = 4.09$, $SE = .08$, 95% CI [3.93, 4.24]). Then they underwent completeness manipulation as predicted (H_4), significant increase in pride was observed, $t(506.35) = -7.74$, $p < .001$, from t_1 to t_2 ($M = 4.78$, $SE = .08$, 95% CI [4.61, 4.94]) due to compensation.

In the no compensation condition, participants first underwent completeness manipulation, a significant increase in the pride was found, $t(478.75) = -6.27$, $p < .001$, from t_0 ($M = 4.25$ ($SE = .08$) 95% CI [4.10, 4.41]) to t_1 ($M = 4.79$, $SE = .08$, 95% CI [4.63, 4.94]). Then they underwent incompleteness manipulation and a significant drop in pride was reported, $t(532.73) = 6.57$, $p < .001$, from t_1 to t_2 ($M = 4.19$, $SE = .08$, 95% CI [4.03, 4.35]) in the absence of compensation. Participants at the baseline t_0 did not differ in pride, $t(514.70) = -1.28$, $p = .804$. Whereas, there were statistically significant differences among participants who underwent no vs. yes compensation at t_2 , $t(527.15) = -4.88$, $p < .001$. These results confirmed that women in a completeness state, who did get a chance to experience compensation reported more pride as compared to the ones with no compensation.

There were no differences in pride due to the main effect of compensation only, $F(1, 236.17) = 0.01$, $p = .915$, and identity goals (STEM vs. feminine), $F(1, 234.84) = 0.82$, $p = .366$. Moreover, the two-way interactions between time and identity goals, $F(2, 470.37) =$

1.12, $p = .326$, compensation and identity goals, $F(1, 234.65) = 0.00$, $p = .997$, and the three-way interaction between time, compensation and identity goal $F(2, 473.68) = 0.07$, $p = .932$, were not statistically significant.

2.4.3. Discussion

The findings of Study 2 confirmed the prediction that the possibility of compensating for incompleteness (t_2) made women experience more pride. Whereas, the absence of such compensation led to experiencing guilt. Overall, there were no differences in the identity goal type i.e. whether participants felt (in)completeness in STEM or femininity. The impact of both the time points (from t_1 to t_2) and the manipulation (presence or absence of compensation) was stronger for pride, suggesting that it may be a more desired and maintained emotion. While both pride and guilt were affected by the manipulation, the increase in guilt was specifically tied to the absence of the compensatory mechanism. This suggests that the lack of opportunity to symbolize after incompleteness contributes to feeling guilt.

Another important observation was that the statistical analysis using a linear mixed model revealed varying levels of inter-class correlation (degree of individual variation) for different emotions as random effects. Specifically, the analysis indicated a greater degree of individual variation in general positive and negative affect (PANAS) compared to the more specific emotions of guilt and pride. While guilt and pride may be categorized under the broader umbrellas of negative and positive emotions respectively, participants demonstrated more consistency in the reporting expressions of guilt and pride across feminine and STEM or time points (as captured by the random effect variation) than they did for overall positive and negative affect. This implies that while individuals may vary considerably in their

overall positive or negative emotional states, their experiences of guilt and pride are relatively more stable and predictable within individuals. This observation highlights the importance of considering specific emotions, rather than just broad categories when examining the underlying mechanism behind the identity goal-specific emotion led by (in)completeness states, especially for the pursuit of femininity and STEM identity goals.

2.5. Study 3: Identity Goals' (In)Completeness and Symbolizing

The third study aimed to explore the connection between states of (in)completeness in both identity goals and behavioral symbolizing. Specifically, it examined whether women who experience incompleteness both as feminine women and as STEM professionals are more likely to engage in a multifinal symbol based activity—decorating a wall with posters—that fulfills the symbolizing need for both identity goals. In contrast, women who feel completeness in both identity goals were hypothesized to show less engagement in symbolizing via the same activity.

The posters used in this study served as a multifinal symbol, addressing both femininity and STEM identity aspects simultaneously. This dual relevance was assumed to make the posters particularly suitable for testing symbolizing behaviors when participants experienced incompleteness in both identity domains. The wall-decorating task was selected for two main reasons: first, the activity was assumed to be intrinsically interesting, and engaging, and second, the posters featured information about renowned women in STEM, serving as a meaningful symbol for both identity goals. The content for the posters was sourced from an online store (see details in the method section), where merchandise affiliated with STEM fields is purchased as a representation of the STEM field (Megan Lee Shop Etsy, n.d.; Megan Lee Instagram Photos and Videos, n.d., see appendices for

permission of material usage).

The primary hypothesis (H_5) posited that women in double incompleteness in their identity goals would engage more in the virtual wall-decorating task compared to women in double completeness, i.e., those who feel completeness as both a feminine woman and a STEM professional. This study sought to examine how behavioral activity can serve as a symbolizing means for addressing identity goal incompleteness.

2.5.1. Method

2.5.1.1. Study Design. The experimental study was conducted in three parts via an online platform. Experimental manipulation (part one), symbolizing variables (part two), and demographic variables i.e. age and STEM subfields were measured (part three). The experiment used a between-participants (double incompleteness vs. double completeness) design. Directly after the manipulation, the participants were given the opportunity to enter an online platform to decorate a virtual wall with posters. The dependent variables were the decision to decorate (yes/no), the number of posters used on the wall, and the email sent to the researcher with the designed poster (yes and no).

2.5.1.2. Participants. Before the study, a power analysis using G*Power was conducted (Faul et al., 2007). This was based on a t-test for a difference between two independent means (double incompleteness vs. double completeness). For a power of 0.95, 216 participants would be required to detect small to medium effects ($f^2 \geq 0.2$). Initially, 228 participants entered the Prolific platform for the study. Seventy participants were excluded because they did not follow the experimental instruction i.e. experienced completeness or incompleteness in both identity goals (femininity and STEM). The final sample size was thus $N = 158$. The participants' mean age was $M = 25.28$ ($SD = 4.15$), ranging from 19 to 42

years; in this sample of STEM women, 58% ($n = 93$) were from science, 18.4% ($n = 29$) from technology, 12.7% ($n = 20$) from engineering, 3.2% ($n = 5$) from mathematics and remaining 6.9% ($n = 11$) were from other category and missing responses. Based on the means differences and chi-square results there were no statistically significant differences between the excluded $n = 70$ and the included $n = 158$ participants regarding age and STEM disciplines.

2.5.1.3. Procedure. The study was conducted online in three parts. In part 1, women were invited to participate in the experimental manipulations. At this point, they were randomly assigned to one of two conditions (double incompleteness vs. double completeness). In part 2, the participants were given the opportunity to symbolize their identity goals of femininity and STEM by decorating a virtual wall with a poster reflecting artistic visualization of renowned women in STEM, executed with the help of external experimental design software PsychoPy (Peirce et al., 2019) and hosted on Pavlovia. At the end, participants were re-linked for part 3 to the Qualtrics survey to answer demographic information, receive the debriefing regarding experimental manipulation, and be redirected to Prolific for their reward (2 pounds for ca. 15). Participants at the end of Part Two, after symbolizing, were also asked to take a picture of their decoration and send it via email to the researcher as a voluntary task. The Internal Ethics Faculty Board of the Psychology Department at SWPS University approved the procedure (Decision 01.2/E/06/2022). Data sets and analysis files for the study are available at:

https://osf.io/wjx2k/?view_only=fe84460d82f342d2935497374cf65db3

2.5.1.4. Measures and Materials

(In)Completeness Manipulation. (In)completeness was manipulated by similar

methods as study 1 by asking participants to describe behaviors that were aligned or not with their identity goals of being feminine and/or STEM professional. After the experimental manipulation from the sample of $N = 158$, $n = 59$ (37.3%) were in double incompleteness, and $n = 99$ (62.7%) were in double completeness condition.

Manipulation Check. An independent samples t -test was conducted to compare verb usage between the self-incompleteness and self-completeness conditions in Study 3. Results indicated a statistically significant difference, $t(316) = 5.06$, $p < .001$. Participants in the incompleteness condition ($M = 19.51$, $SD = 6.60$) used significantly more verbs than those in the completeness condition ($M = 15.55$, $SD = 5.34$). The effect size, measured by Cohen's d , was 0.66, 95% CI [0.40, 0.92], indicating a moderate to large effect.

Additionally, I ran the following exploratory analysis based on the literature suggesting that goal activation is often linked to arousal and tension (Gollwitzer, 2018; Gollwitzer & Wicklund, 1985). I expected emotionally expressive language to be more frequent in the (in)completeness conditions. Specifically, positive emotions should be higher in the completeness state, while negative emotions should be higher in the incompleteness state. Results showed a significant difference in negative emotion scores, $t(316) = 5.39$, $p < .001$. Participants in the incompleteness condition ($M = 1.25$, $SD = 1.63$) received significantly higher negative emotion scores than those in the completeness condition ($M = 0.32$, $SD = 0.92$). The effect size, measured by Cohen's d , was 0.70, 95% CI [0.44, 0.96], indicating a moderate to large effect. Results also indicated a significant difference for positive emotions, $t(234) = -7.01$, $p < .001$. Participants in the completeness condition ($M = 2.48$, $SD = 2.19$) reported significantly higher positive emotion scores than those in the incompleteness condition ($M = 0.63$, $SD = 1.86$). The effect size, measured by Cohen's d ,

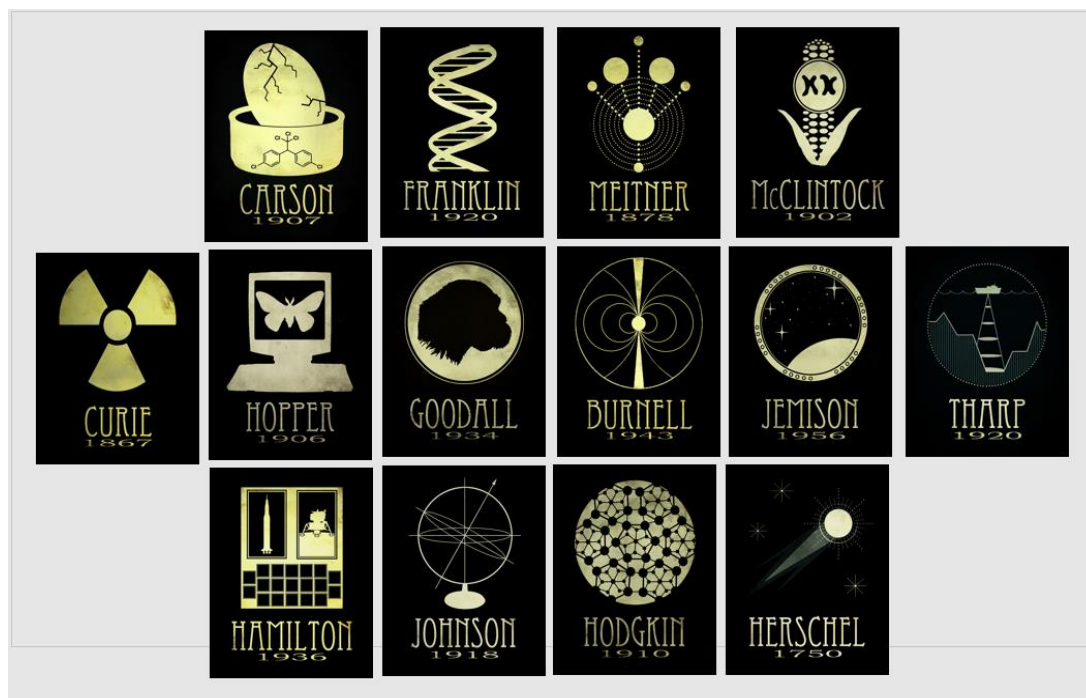
was -0.91, 95% CI [-1.18, -0.64], indicating a large effect size.

Symbolizing Behavior. Three dependent variables i.e. decoration decision, number of posters, and email sending were examined based on the participants' online behavior of symbolizing via decoration. The details are as follows;

- i. **Decoration decision.** After experimental manipulation, participants were given instructions for whether they would like or not to proceed with symbolizing behavior by decorating the wall. The description said: *"In the next section, you have a voluntary task to perform. In this voluntary task, you will be decorating the wall of a living room with posters. Click Yes if you wish to proceed"*. Only one participant resigned from doing the task and then was directed to part 3 for demographic questions.
- ii. **Number of posters.** Poster images were taken from the online platform <https://www.etsy.com/shop/meganlee> with the permission of the digital art to be used for scientific purposes only. Fourteen posters (See Figure 2.7 for a sample) contained artwork related to renowned female STEM scientists including *Curie, Herschel, Jemison, Burnell, Hamilton, Goodall, Franklin, Johnson, Hodgkin, Carson, Hopper, McClintock, Meitner, and Tharp*. These posters showed the STEM subfields, surnames, and years of birth of these scientists. These posters were considered relevant symbols for symbolizing due to them reflecting the women and STEM aspects simultaneously. The overall mean for the number of posters used on the wall decoration was $M = 4.07$, $SD = 2.42$, $Mdn = 3$, observed range = 0–14, actual range = 0–14, $n = 154$, missing $n = 4$, skewness = 2.27, kurtosis = 6.07).

Figure 2.7

Posters Presented to Decorate the Wall, as a Symbolizing Activity



Participants were given the following description of the voluntary symbolizing task:

“Dear participant, you made a choice for the voluntary task. We acknowledge your decision. You will be performing this task on a different screen, please be patient while it displays on your screen. Then carefully read the instructions. After finishing the task, you will be directed to the next part of the survey.”

Afterward, participants were taken to the Pavlovia platform for part 2 of the study i.e. decorating the wall. they were given the description

“Imagine this the picture of your living room. Please decorate the wall behind the sofa with the artwork (posters of female scientists) you have on your screen. Please drag the poster on the wall to your desired place. You can choose as many as you want. Click Finish in the end.” (see figure 2.8 A & B)

Figure 2.8

Posters Presented (left side) and the Space to Decorate the Wall, as a Symbolizing Activity (right side).



Note. Posters of women scientists were, column-wise, ordered from top to bottom (randomly presented every time) in image A the screen participants see for the first time. In image B, the sample of dragged posters (e.g. blue dashed line for trailing) on the wall for decoration.

- iii. **Email sending.** The emails sent back to the researcher (me) with the decoration images (yes/no – dichotomous) were considered as another dependent variable. The text of the description for the email request was “*Before clicking the finish, you can take a picture of the screen with your phone and send it to the researcher [email id]. Note: This is an entirely voluntary task and your information will be kept confidential. You can send the*

image without the fear of any unwanted/spam emails in the future.” Overall, 16 participants sent the email with images to the researcher.

Task relevance. Due to the nature of the symbolizing activity, questions were asked to inquire whether this activity was relevant to the identity goals. The responses were on a Likert scale from 1 = *strongly disagree* to 7 = *strongly agree*. Questions were as follows; “*Did you find the posters relevant to WOMEN IN STEM?*” ($M = 5.57, SD = 1.24, n = 150$), “*To what extent, do you agree that your task of decorating the wall with posters reflects 'you being a feminine woman and STEM professional', simultaneously?*” ($M = 4.76, SD = 1.57, n = 150$),

Task Aesthetics. One question was asked to examine the elements of beauty and aesthetics of the task by inquiring “*To what extent do you agree that the posters presented to decorate the wall were aesthetically pleasing?*” on a Likert scale from 1 = *strongly disagree* to 7 = *strongly agree*. The mean score was $M = 5.21 (SD = 1.71, n = 150)$.

2.5.2. Results

The Decision to Decorate. Statistically, there was no significant difference between yes vs. no for decision, due to the lack of variance i.e. $n = 1$ saying no to decorate (Fischer’s exact test $p = .627$).

Number of Posters and Task Relevance. The main hypothesis (H_5) for this study was that participants in the double incompleteness condition would engage more in symbolizing, that is they would hang more posters on the virtual wall. Due to the differences in the total number of participants in the experimental manipulation groups' ($n = 59$ double incompleteness and $n = 98$ double completeness), the nonparametric Mann-Whitney test (Mann & Whitney, 1947), was used as a test of distributions of ranks in both groups.

Assuming both populations have distributions with the same shape, it can be viewed as a comparison of two medians. Table 2.3 shows the details of the analyses;

Table 2.3

Non-Parametric Analysis of Posters and Task Relevance Variables

Dependent Variables	Double incompleteness (<i>n</i> = 59)		Double completeness (<i>n</i> = 98)		<i>U</i> - test	(2-sided test) <i>p</i>
	Median	Mean Rank	Median	Mean Rank		
Number of posters (0-14)	3.00	74.30	3.00	79.38	2582.00	.469
Task Relevance to Women in STEM	5.00	71.68	6.00	77.78	2418.00	.389
Task Relevance to myself both as a STEM professional & feminine woman	5.00	68.30	5.00	79.79	2229.00	.109
Task Aesthetically pleasing	6.00	75.48	6.00	75.51	2631.00	.997

The initial hypothesis was that double incompleteness condition participants would engage more in the task, by using more posters and subsequently will find the task more relevant for symbolizing and identity goals. Non-parametric analysis of the symbolizing behavior and its relevance did not significantly differ among participants in both experimental groups.

Sending Email. Lastly, it was examined whether a participant sent an email to the researcher or not. Overall, *n* = 16, participants send the email with images (see samples of decoration in Figure 2.9). Among double incompleteness condition participants (*n* = 59), only 3, participants sent emails, and among double completeness participants (*n* = 98) 13, participants sent emails. A Chi-Square test was conducted to assess differences in the proportion of emails sent by participants in two experimental groups. The difference was not statistically significant, $\chi^2(1, N = 158) = 2.63, p = .105$, indicating no significant association between the group and sending an e-mail.

Figure 2.9*Symbolizing Images sent by Participants via Email (n = 16)*

Association between Symbolizing and Task Relevance. For the sake of exploration, Spearman's correlational analyses were conducted to examine the relationships between the number of posters and variables relevance of task for the sample between double incompleteness and double completeness group.

For participants in the double incompleteness condition ($n = 59$), the correlation between the number of posters and how these famous STEM Women posters are relevant generally for the women in STEM is as, $\rho = -0.47, p = .728$. The correlation with relevance to participants' own femininity and STEM professional identity goals was $\rho = -.137, p = .316$. On the task being aesthetically pleasing the correlation was $\rho = -.142, p = .297$. There was no significant correlation found between the task of decoration and its relevance for the double incompleteness group.

For double completeness participants ($n = 98$), the correlation between the number of posters and its relevance to women in STEM was, $r = .224, p = .030$. The correlation with relevance to participants' own femininity and STEM professional identity goals was r

$= .079, p = .451$. On the task being aesthetically pleasing the correlation was $r = .12, p = .248$. It was found that women in double completeness perceived this task relevant for women in STEM in general with a significant positive small effect size.

2.5.3. Discussion

The findings of Study 3 showed that all the participants decided to engage in the activity regardless of the state of (in)completeness. Usage of the number of posters remained the same for both experimental groups and there were no differences found in the number of participants sending an email.

Participants who felt double completeness exhibited outcomes similar to those who felt double incompleteness, which can be attributed to the positive mood induced by their sense of completeness, as evidenced in Studies 1 & 2. This positive mood likely influenced their approach to the decoration task, allowing participants to engage with it more enthusiastically and creatively. According to Damian and Robins (2012), positive emotional states and pride can significantly enhance an individual's motivation leading to increased levels of creativity and engagement in tasks (He, 2023).

Participants in a positive mood are often motivated to maintain that state (Waugh et al., 2018). For those who felt completeness, the decoration task could have been seen as an opportunity to express their positive mood, leading them to put forth effort and creativity similar to that of the incompleteness condition participants. The task may have played a role in maintaining their positive emotions. In other words, engaging in the task could have helped them feel good by providing a sense of creativity and self-expression.

However, it is possible that the task of symbolizing via decoration may not be well suited when it comes to compensating for identity goals such as femininity and the STEM

profession-related incompleteness. It is possible that the task of decorating with posters of female STEM scientists might not sufficiently differentiate between the feelings of completeness and incompleteness in identity goals. Focusing on decoration as a primary method of symbolizing may lead to superficiality. The chosen task may not have been perceived as a meaningful way to pursue their identity goals. If the task does not resonate deeply with their experiences of femininity or professional identity in STEM that have been narrated during the experimental manipulation, it may not motivate the double incompleteness condition participants to engage optimally enough for compensation.

A detailed discussion of the affective consequences of identity goal incompleteness, including its implications for emotions such as guilt and pride, is further elaborated in Chapter 5 under the General Discussion section. This chapter integrates the findings from all studies, providing a comprehensive analysis of how identity goals influence emotional experiences and their broader implications for women in STEM.

Chapter 3. Outfits Serve as Symbols for Overlapping Feminine and STEM

Identity Goals²

Individuals pursuing two identity goals should prefer multifinal symbols because by serving both goals at the same time, these symbols can provide greater utility. When two goals are highly overlapping, they should be strongly linked in the individual's goal systems, and the activation of one goal should make the activation of the other more likely. Therefore, high overlap should further increase preferences for multifinal symbols. Applied to the context of women working in STEM, this implies that STEM women with high (compared to low) levels of overlap should prefer multifinal over unifinal symbols.

3.1. Outfits as Symbols

Acquiring and displaying symbols of an identity goal (e.g., being a competent professional, or a feminine woman) makes a person feel completeness regarding the pursued identity goal (Sorys et al., 2023; Wicklund & Gollwitzer, 1981). Past research has shown that even the mere expression of an intention to pursue an aspired-to identity goal works as an effective symbolizing, that is, creates a sense of completeness regarding this goal (Gollwitzer et al., 2009).

Therefore, in line with the symbolic self completion theory (Wicklund & Gollwitzer, 1982) outfits should effectively serve as symbols for identity goals. The outfits are not merely an artifact but they are embedded in social existence and communicate symbolically (Kaiser, 1997) that a certain woman is aspiring to be very feminine or a

² This chapter is based on the following published work, where I have been the lead author.

Zaman, S., Spychalska-Waszek, H., Doerflinger, J. T., Gollwitzer, P. M., & Byrka, K. (2025), Outfits serve as symbols for overlapping feminine and STEM identity goals. *Scandinavian Journal of Psychology*. doi: 10.1111/SJOP.13093

diligent scientist in a lab, or both. Symbols such as outfits help individuals reach their wanted versions of themselves (Wicklund & Gollwitzer, 1981). To be a symbol for identity goals such as STEM professional and feminine identity goals, a symbol should be relevant to the aspired-to identity goals and socially recognized as such.

Clothing choice reflects subjective preferences, but clothing also communicates symbolically who an individual wants to be in a figurative manner. Outfits signal information about various relevant features of an individual such as gender, profession, age, social class, culture, political affiliation, or environmental attitudes (Akdemir, 2018; Delgado et al., 2023). Outfits have been found to be identification markers in early as well as contemporary psychology of self and identity (Allport, 1932; Akdemir, 2018), as they effectively express gender identification (Koch & Dickey, 1988), beliefs (Maxey, 2022), emotions (Elliot & Niesta, 2008), personalities (Moody et al., 2010), events (e.g., dances or formal evenings; Grammer et al., 2004; Lowe & Lowe, 1990), hobbies (Dickson & Pollack, 2000), and professions (Forsythe et al., 1985; Furnham et al., 2013; Fasoli et al., 2018; Lafferty & Dickey, 1980; Solomon & Douglas, 1987). Gruber et al. (2023) investigated the utilization of outfit attire as symbolic indicators in the navigation of diverse situations. For example, participants demonstrated a proclivity for gender-confirming outfits when confronted with fear-inducing situations, such as those arising during pandemics or periods of political discord.

Outfits express values, relationships, and meanings. People opt for outfits that reflect who they are in the eye of the public. They enable people to showcase and confirm their desired identities (Hamilton & Hamilton, 1989). Past research has shown that women use bright colors (Elliot & Niesta, 2008) and figure-enhancing attire (Grammer et al., 2004) to

express their femininity with their clothes. A uniform signals professional belonging, for instance, of being a nurse (Lafferty & Dickey, 1980). As an example of multifinality in outfit choices, women were also found to signal their belonging to more than one group, for example in professional sports. Female golfers (Wheat & Dickson, 1999), bicyclists (Casselman-Dickson & Damhorst, 1993), and in-line skaters (Dickson & Pollack, 2000) all combine symbols for being an athlete and symbols for their female gender via custom-designed outfits with bright colors and feminine shapes that are at the same time functional for acting successfully as an athlete.

3.2. Aim of the Studies

I aimed to test the relation between the overlap of the two aspired-to identity goals of being feminine and being a STEM professional, and the extent to which preferred outfits serve both femininity and STEM professionalism at the same time. I also tested the relation between identity goal overlap and the subsequent choice of multifinal vs. unifinal outfits. Grounding this study in both the symbolic self completion and goal systems theory, I hypothesized that overlap between both feminine and STEM identity goals should correlate with a preference for multifinal symbols rather than unifinal symbols (H_6). The perception of outfits as professional and feminine in modern times is highly subjective. Therefore, different individuals can evaluate the multifinality of the same outfit differently. When individuals select an outfit from a given set of options, the higher the overlap between both identity goals, the more the chosen symbol should be evaluated as multifinal (H_7). The lower overlap will be related to evaluating the chosen outfit as unifinal feminine or unifinal STEM.

3.3. Study 4: Outfits as Symbols and Identity Goal Overlap

Study 4 was conducted to examine the evaluation of certain outfits as unifinal

symbols (i.e., outfits are evaluated as either feminine or STEM professional) or multifinal symbols (i.e., outfits are seen as both feminine and STEM). The main objective of Study 4 was to test whether the preference for multifinal symbols is related to the identity goal overlap measured in terms of the sense of belonging as a reason for goal pursuit.

3.3.1. Method

3.3.1.1. Design and Participants. Study 4 was based on a cross-sectional design. Power analysis using G*Power software (Faul et al., 2007), bivariate normal model suggested a sample of 202 participants to detect a correlation of $< .2$ between identity goal overlap and the preference of outfits as symbols with a power of .95. A total of 232 women working in STEM disciplines in the UK took part voluntarily in the study through the online platform Prolific.Co (Palan & Schitter, 2018). The inclusion criteria were taken from the selection criteria proposed by Prolific for gender and STEM (subfields of STEM, e.g. information technology, science, physics, etc.) and only those participants were invited to take part in the study. The mean age was 32.16 ($SD = 8.05$), and the range was 19 to 63 years of age, 61.6% ($n = 143$) were from science, 15.5% ($n = 36$) from technology, 9.5% ($n = 22$) from engineering, 0.9% ($n = 2$) from Mathematics and remaining 3% ($n = 7$) were from other category and missing responses.

3.3.1.2. Procedure. Participants were invited and presented with an online survey. They completed an informed consent statement and rated fifteen outfits based on femininity and professionalism, preference. Next, identity goal overlap was measured based on the sense of belonging. Further, participants responded to the demographic characteristics. As compensation for taking part in the study, the participants received 2.5£. The Internal Faculty Ethics Board of the institution approved the study procedures (Decision

01.1/E/06/2022). Data sets and analysis files for the study are available at:

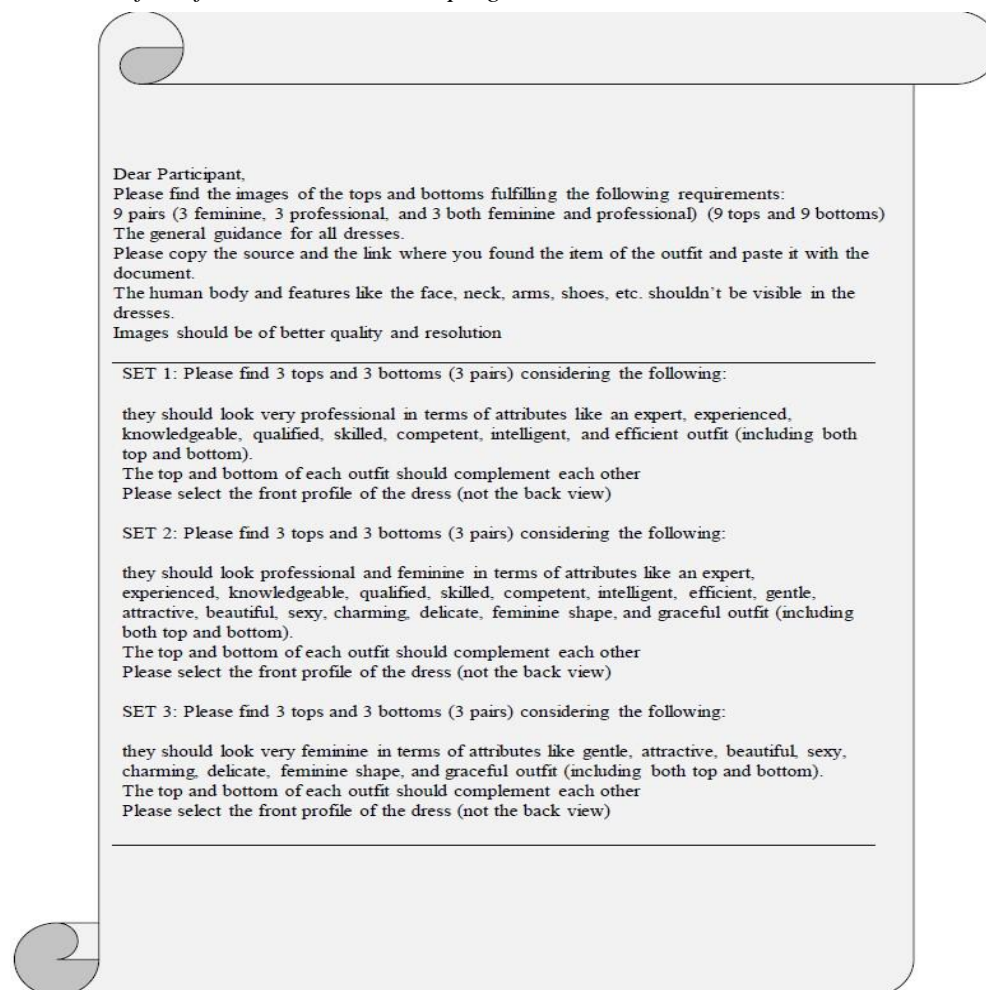
https://osf.io/zjs57/?view_only=29aa875416cf41baa712cdae479b74c3

3.3.1.3. Measures

Outfits as Symbols of Professionalism and Femininity. Five research assistants blind to the hypotheses collected outfits on the markers of femininity and/or professionalism (see Figure 3.1 for outfit collection task). As a result, a big collection was examined from the larger pool of female garments showcased. Caution was taken to make the outfit unidentifiable regarding brands. Only upper and lower body wear i.e. top and bottom (in a unified pair) of an outfit were considered as the complete outfit set. Fifteen outfit sets (top and bottom) were prepared for the study (see Figure 3.2 below). The outfits were finalized based on certain markers from the product aesthetics (van Tilburg et al., 2015) and evolutionary aspects (Buss, 2016). Firstly, outfits reflected different shapes, colors, and textures as their central features. Secondly, to keep consistency and minimize the confounds, it was made sure to assemble similar designs and features based on sleeves, necklines, length of the tops and bottoms, and sizes.

Figure 3.1

The Task of Outfit Selection – Developing the Pool.



Dear Participant,

Please find the images of the tops and bottoms fulfilling the following requirements:
 9 pairs (3 feminine, 3 professional, and 3 both feminine and professional) (9 tops and 9 bottoms)
 The general guidance for all dresses.
 Please copy the source and the link where you found the item of the outfit and paste it with the document.
 The human body and features like the face, neck, arms, shoes, etc. shouldn't be visible in the dresses.
 Images should be of better quality and resolution

SET 1: Please find 3 tops and 3 bottoms (3 pairs) considering the following:

they should look very professional in terms of attributes like an expert, experienced, knowledgeable, qualified, skilled, competent, intelligent, and efficient outfit (including both top and bottom).
 The top and bottom of each outfit should complement each other
 Please select the front profile of the dress (not the back view)

SET 2: Please find 3 tops and 3 bottoms (3 pairs) considering the following:

they should look professional and feminine in terms of attributes like an expert, experienced, knowledgeable, qualified, skilled, competent, intelligent, efficient, gentle, attractive, beautiful, sexy, charming, delicate, feminine shape, and graceful outfit (including both top and bottom).
 The top and bottom of each outfit should complement each other
 Please select the front profile of the dress (not the back view)

SET 3: Please find 3 tops and 3 bottoms (3 pairs) considering the following:

they should look very feminine in terms of attributes like gentle, attractive, beautiful, sexy, charming, delicate, feminine shape, and graceful outfit (including both top and bottom).
 The top and bottom of each outfit should complement each other
 Please select the front profile of the dress (not the back view)

Note. This flyer was sent to the research assistants to select the outfits as per guidance.

Eventually, the following fifteen outfit sets (top and bottom) were prepared for the study (see Figure 3.2).

Figure 3.2

Fifteen Outfits finalized from the Universal Garment Pool



Note. The Alphabetical labeling was random and later on used as an outfit label for further analyses.

Participants evaluated each of the fifteen outfit sets. They responded to the direct questions: “*Does the outfit reflect femininity?*” and “*Does the outfit reflect professionalism?*” on a scale from 1 = *strongly disagree* to 7 = *strongly agree*. They also evaluated on the same response scale whether each outfit seemed *gentle, attractive, beautiful, sexy, charming, pleasing, feminine shape, and graceful* (adjectives describing the femininity aspects in an outfit) and *expert, experienced, knowledgeable, qualified, skilled, competent, intelligent, and efficient* (adjectives describing professionalism aspect in an outfit). The responses combined for femininity vs. professionalism by creating two separate indices. The attributes of femininity and masculinity features in the outfits were adapted from the study by Lower (2018), in which outfits were evaluated. The *Cronbach’s alpha* for outfit femininity ranged from .92 to .94, and for outfit professionalism from .96 to .98 for all 15 outfits (for details per outfit in Table 3.1).

Table 3.1*Outfits' rated based on Femininity, Professionalism, Preference, and Occasion to Wear*

Outfit Label	Cronbach alpha Index 8 items	FPDQ Corr. (p)	FPI Corr. (p)	FPDQ		FPI		Outfit preference <i>M</i> (<i>SD</i>)	Outfit occasion (%)		
				<i>M</i> & <i>SD</i>	<i>t</i> -test (<i>p</i>)	<i>M</i> & <i>SD</i>	<i>t</i> -test (<i>p</i>)		Professional Meeting	Work lunch	Free time
A	FI = .94 PI = .98	.17 (.014)	.18 (.008)	<i>M_F</i> = 2.53 <i>SD_F</i> = 1.36 <i>M_P</i> = 5.43 <i>SD_P</i> = 1.05	-27.06 ($<.001$)	<i>M_F</i> = 2.93 <i>SD_F</i> = 1.20 <i>M_P</i> = 4.95 <i>SD_P</i> = 1.02	-20.79 ($<.001$)	2.34(1.32)	89.16	9.64	1.20
B	FI = .93 PI = .96	.16 (.022)	.25 ($<.001$)	<i>M_F</i> = 2.48 <i>SD_F</i> = 1.30 <i>M_P</i> = 5.31 <i>SD_P</i> = 1.61	-21.21 ($<.001$)	<i>M_F</i> = 3.14 <i>SD_F</i> = 1.19 <i>M_P</i> = 4.94 <i>SD_P</i> = 0.95	-19.88 ($<.001$)	2.21(1.23)	75.68	21.62	2.70
C	FI = .93 PI = .96	.15 (.024)	.23 ($<.001$)	<i>M_F</i> = 2.84 <i>SD_F</i> = 1.45 <i>M_P</i> = 5.27 <i>SD_P</i> = 1.10	-25.74 ($<.001$)	<i>M_F</i> = 3.30 <i>SD_F</i> = 1.17 <i>M_P</i> = 4.92 <i>SD_P</i> = 0.91	-18.04 ($<.001$)	2.36(1.28)	61.90	28.57	9.52
D	FI = .93 PI = .97	.26 ($<.001$)	.43 ($<.001$)	<i>M_F</i> = 4.88 <i>SD_F</i> = 1.35 <i>M_P</i> = 5.90 <i>SD_P</i> = 0.92	-10.49 ($<.001$)	<i>M_F</i> = 4.31 <i>SD_F</i> = 1.15 <i>M_P</i> = 5.35 <i>SD_P</i> = 1.01	-13.19 ($<.001$)	3.63(1.09)	92.18	6.70	1.12
E	FI = .92 PI = .97	.36 ($<.001$)	.51 ($<.001$)	<i>M_F</i> = 4.75 <i>SD_F</i> = 1.23 <i>M_P</i> = 4.52 <i>SD_P</i> = 1.38	2.26 (.025)	<i>M_F</i> = 3.95 <i>SD_F</i> = 1.07 <i>M_P</i> = 4.45 <i>SD_P</i> = 1.07	-6.90 ($<.001$)	2.13(1.05)	43.33	46.67	10.00
F	FI = .93 PI = .97	.56 ($<.001$)	.35 ($<.001$)	<i>M_F</i> = 5.38 <i>SD_F</i> = 1.08 <i>M_P</i> = 5.37 <i>SD_P</i> = 1.11	0.20 (.841)	<i>M_F</i> = 4.19 <i>SD_F</i> = 1.19 <i>M_P</i> = 4.92 <i>SD_P</i> = 1.04	-8.30 ($<.001$)	3.20(1.28)	63.27	32.65	4.08
G	FI = .93 PI = .97	.41 ($<.001$)	.46 ($<.001$)	<i>M_F</i> = 5.01 <i>SD_F</i> = 1.11 <i>M_P</i> = 5.50 <i>SD_P</i> = 1.01	-6.28 ($<.001$)	<i>M_F</i> = 4.27 <i>SD_F</i> = 1.04 <i>M_P</i> = 5.14 <i>SD_P</i> = 0.95	-11.75 ($<.001$)	2.81(1.24)	80.87	17.39	1.74
H	FI = .93 PI = .97	.48 ($<.001$)	.64 ($<.001$)	<i>M_F</i> = 5.31 <i>SD_F</i> = 1.06 <i>M_P</i> = 4.16 <i>SD_P</i> = 1.47	12.61 ($<.001$)	<i>M_F</i> = 4.35 <i>SD_F</i> = 1.55 <i>M_P</i> = 4.16 <i>SD_P</i> = 1.14	2.85 (.005)	2.46(1.27)	25.00	56.25	18.75

I	FI = .92 PI = .97	.11 (.102)	.53 (<.001)	$M_F = 5.54$ $SD_F = 1.13$ $M_P = 2.92$ $SD_P = 1.48$	21.76 (<.001)	$M_F = 4.19$ $SD_F = 1.18$ $M_P = 3.52$ $SD_P = 1.22$	8.38 (<.001)	1.75(1.15)	10.53	28.95	60.53
J	FI = .94 PI = .97	.37 (<.001)	.62 (<.001)	$M_F = 5.53$ $SD_F = 1.03$ $M_P = 4.28$ $SD_P = 1.50$	12.45 (<.001)	$M_F = 4.56$ $SD_F = 1.21$ $M_P = 4.29$ $SD_P = 1.20$	3.68 (<.001)	2.34(1.28)	31.82	46.59	21.59
K	FI = .93 PI = .97	.52 (<.001)	.64 (<.001)	$M_F = 5.20$ $SD_F = 1.12$ $M_P = 4.38$ $SD_P = 1.43$	9.38 (<.001)	$M_F = 4.40$ $SD_F = 1.13$ $M_P = 4.41$ $SD_P = 1.05$	-0.11 (.916)	2.59(1.28)	28.57	56.19	15.24
L	FI = .93 PI = .97	.34 (<.001)	.59 (<.001)	$M_F = 5.35$ $SD_F = 1.00$ $M_P = 4.28$ $SD_P = 1.35$	11.38 (<.001)	$M_F = 4.48$ $SD_F = 1.10$ $M_P = 4.43$ $SD_P = 1.02$	0.79 (.433)	2.93(1.29)	24.81	41.09	34.11
M	FI = .92 PI = .97	.26 (<.001)	.58 (<.001)	$M_F = 5.09$ $SD_F = 1.26$ $M_P = 3.14$ $SD_P = 1.43$	17.20 (<.001)	$M_F = 3.83$ $SD_F = 1.18$ $M_P = 3.62$ $SD_P = 1.13$	2.83 (.005)	1.74(1.02)	7.50	32.50	60.00
N	FI = .93 PI = .96	.23 (<.001)	.53 (<.001)	$M_F = 5.01$ $SD_F = 1.21$ $M_P = 2.98$ $SD_P = 1.39$	18.55 (<.001)	$M_F = 3.74$ $SD_F = 1.21$ $M_P = 3.52$ $SD_P = 1.12$	2.77 (.006)	1.64(0.97)	13.33	40.00	46.67
O	FI = .93 PI = .98	.31(<.001)	.60 (<.001)	$M_F = 5.13$ $SD_F = 1.26$ $M_P = 3.71$ $SD_P = 1.64$	11.95 (<.001)	$M_F = 4.16$ $SD_F = 1.25$ $M_P = 4.03$ $SD_P = 1.28$	1.66 (.099)	2.44(1.31)	27.08	31.25	41.67

Note. Corr = Pearson Correlation Coefficient, FPDQ = Femininity & Professionalism Direct Questions, FPI = Femininity & Professionalism Indices, F = Femininity, P = Professionalism, FI = Femininity Index, PI = Professional Index Outfit. The shaded area reflects the 6 outfits selected for further analysis in main studies 4 and 5.

Criteria for Outfit as Unifinal and Multifinal Symbols. Evaluations of femininity and professionalism (both on single questions and indices) were used as criteria for three different categories of outfits: unifinal STEM, unifinal feminine, and multifinal.

- i. **Unifinal STEM outfit:** An outfit to be categorized as a unifinal STEM outfit had to fulfill the criteria of a significantly ($p < .05$) higher mean of professionalism than femininity, and a low ($r \leq .3$, Cohen, 1992) correlation between femininity and professionalism.
- ii. **Unifinal feminine outfit:** An outfit to be categorized as a unifinal feminine outfit had to fulfill the criteria of a significantly ($p < .05$) higher mean of femininity than professionalism and a low ($r \leq .3$) correlation between femininity and professionalism.
- iii. **Multifinal outfit:** An outfit to be categorized as multifinal had to fulfill the criteria of having similarly high means regarding femininity and professionalism, and a high correlation ($r \geq .5$) between femininity and professionalism.

Preference to Wear an Outfit. Participants responded whether they would like to wear each of the 15 outfits on a scale from 1 = *definitely not* to 5 = *definitely yes*.

Identity Goal Overlap. To measure the identity goal overlap of being a feminine woman and a STEM professional, the participants completed the Sense of Belonging Questionnaire (Roccas, 1997; as cited in Tartakovsky, 2002, 2009, Rocca et al., 2010, 4 items) and were presented with modified versions of the scale; one version referred to feminine identity and the other to STEM identity. Participants indicated their agreement with statements such as '*Being a feminine woman [STEM professional] is an important part of my self-definition*' by responding on a scale from 0 = *strongly disagree* to 6 = *strongly agree*. For the sense of belonging, in Study 4 ($N = 232$), the feminine identity goal had a

mean of 3.50 ($SD = 1.39$, $\alpha = .85$), and the STEM identity goal had a mean of 4.04 ($SD = 1.25$, $\alpha = .86$).

Modified Items of the Sense of Belonging and Group Identification Scales

Being a feminine woman	Being a STEM professional
Sense of Belonging items (used in Study 4 & 5)	
Being a feminine woman is an important part of my self-definition.	Being a STEM professional is an important part of my self-definition.
When I talk about feminine women, I say "we" and not "they"	When I talk about STEM professionals, I say "we" and not "they".
When feminine women are criticized, I take it personally.	When STEM professionals are criticized, I take it personally.
It is important for me to think about myself as a feminine woman.	It is important for me to think about myself as a STEM professional.

Identity goal overlap was calculated the same way as in previous studies (Doerflinger et al., 2021; Spychalska-Waszek et al., 2022, 2024) using the formula that is an extension of the formula proposed by Linville (1985; see also Luo et al., 2008). The original formula was designed for dichotomous responses. For measuring identity goal overlap through reasons, this formula was extended to accommodate continuous responses on a scale since reasons like sense of belonging are captured with Likert-type scales.

In the formula below, x_i is the response to an item describing the first identity goal and y_i is the response to an item describing the second identity goal; n is the number of items for each identity goal. Identity goal overlap is then calculated as follows:

$$GOL_{ang} = \frac{\sum_{i=1}^n (x_i * y_i)}{\sqrt{\sum_{i=1}^n x_i^2} * \sqrt{\sum_{i=1}^n y_i^2}} = \frac{x * y}{||x|| * ||y||} = \cos(\angle xy)$$

In line with the formula above, responses to the items measuring sense of belonging are formalized as two vectors in a 4-dimensional space (corresponding to the $n = 4$ items used for each identity goal): one vector for the items describing the identity goal of being a

feminine woman and one for the items describing the identity goal of being a STEM professional. Responses to individual items are the coordinates of the vectors. The similarity of vectors can be expressed as the angle between them, which in mathematical senses according to the formula is the cosine of this angle. If 0 is the minimum value of the items, the cosine of the angle can take values from 0 to 1, where 0 indicates maximum misalignment of the two vectors (i.e., they are orthogonal), whereas 1 indicates perfect alignment (i.e., they are parallel).

3.3.2. Results

In the first part of the results section, the sorting of outfits into three categories is reported: unifinal STEM, unifinal feminine, and multifinal outfits. In the second part of the results section, the correlations between outfit preference and identity goal overlap are reported.

Outfits' Categorization as Unifinal and Multifinal Symbols. A set of six outfits from the 15 evaluated ones (see Figure 3.3) were categorized according to the criteria outlined above as unifinal STEM (pro.1 & pro.2), unifinal FEM (fem.1 & fem.2), and multifinal (pro-fem.1 & pro-fem.2). These outfits form the basis of further analyses in Study 4. Table 3.2 shows the information on the paired *t*-tests regarding the mean values of femininity and professionalism based on two direct questions and two indices. It also shows the correlation between femininity and professionalism on direct questions and indices.

Table 3.2*Unifinal and Multifinal Outfits on the Bases of Femininity and Professionalism*

Label	FPDQ <i>r. (p)</i>	FPI <i>r. (p)</i>	FPDQ		FPI	
			<i>M (SD)</i> (F & P)	<i>t-test,</i> (<i>df, p</i>)	<i>M (SD)</i> (F & P)	<i>t-test</i> (<i>df, p</i>)
pro.1 (A) Unifinal STEM	.17 (.014)	.18 (.008)	$M_{DF} = 2.53$ (1.36) $M_{DP} = 5.43$ (1.05)	-27.06 (214, <.001)	$M_{IF} = 2.93$ (1.20) $M_{IP} = 4.95$ (1.02)	-20.79 (214, <.001)
pro.2 (C) Unifinal STEM	.15 (.024)	.23 (<.001)	$M_{DF} = 2.84$ (1.45) $M_{DP} = 5.27$ (1.10)	-25.74 (212, <.001)	$M_{IF} = 3.30$ (1.17) $M_{IP} = 4.92$ (0.91)	-18.04 (212, <.001)
fem.1 (I) Unifinal FEM	.11 (.102)	.53 (<.001)	$M_{DF} = 5.54$ (1.13) $M_{DP} = 2.92$ (1.48)	21.76 (212, <.001)	$M_{IF} = 4.19$ (1.18) $M_{IP} = 3.52$ (1.22)	8.38 (212, <.001)
fem.2 (O) Unifinal FEM	.31 (<.001)	.59 (<.001)	$M_{DF} = 5.13$ (1.26) $M_{DP} = 3.71$ (1.64)	11.95 (214, <.001)	$M_{IF} = 4.16$ (1.25) $M_{IP} = 4.03$ (1.28)	1.66 (214, .099)
pro-fem.1 (H) Multifinal	.48 (<.001)	.64 (<.001)	$M_{DF} = 5.31$ (1.06) $M_{DP} = 4.16$ (1.47)	12.61 (213, <.001)	$M_{IF} = 4.35$ (1.55) $M_{IP} = 4.16$ (1.14)	2.85 (213, .005)
pro-fem.2 (K) Multifinal	.52 (<.001)	.64 (<.001)	$M_{DF} = 5.20$ (1.12) $M_{DP} = 4.38$ (1.43)	9.38 (215, <.001)	$M_{IF} = 4.40$ (1.13) $M_{IP} = 4.41$ (1.05)	-0.11 (215, .916)

Note. *r* = Pearson Correlation Coefficient, FPDQ = Femininity & Professionalism Direct Questions, FPI = Femininity & Professionalism Indices, F = Femininity, P = Professionalism, DP = Direct question Professionalism, DF = Direct question Femininity, IP = Index Professionalism, IF = Index Femininity. Labels pro.1, pro. , fem.1, fem2, pro.fem1 and prof.fem2 represent the outfits as professional 1 & 2, feminine 1 & 2, and professional-feminine 1 & 2. Letters A, C, I, O, H, and K are assigned to the outfits from the set of the original 15 outfits

Unifinal STEM outfits. Based on the criteria of evaluating outfits as unifinal or multifinal symbols, outfits pro.1 and pro.2 (A & C, see Figure 3.3) were selected as unifinal STEM outfits. Also, both of them were evaluated as significantly more professional than feminine, based on the direct questions (pro.1, $M_{DP} = 5.43$, $SD = 1.05$ vs. $M_{DF} = 2.53$, $SD = 1.36$; pro.2, $M_{DP} = 5.27$, $SD = 1.10$ vs. $M_{DF} = 2.84$, $SD = 1.45$). Similarly, both unifinal STEM outfits were evaluated as significantly more professional than feminine, based on

indices of femininity and professionalism (pro.1, $M_{IP} = 4.95$, $SD = 1.02$ vs. $M_{IF} = 2.93$, $SD = 1.20$; pro.2, $M_{IP} = 4.92$, $SD = 0.91$ vs. $M_{IF} = 3.30$, $SD = 1.17$ (see Table 5). For both unifinal STEM professional outfits, the correlation between evaluated femininity and professionalism was low (Cohen, 1992) based on the direct questions, pro.1, $r = .17$ and pro.2, $r = .15$, and the indices pro.1, $r = .18$ and pro.2, $r = .23$.

Unifinal feminine outfits. Based on the criteria outfits, fem.1 and fem.2 (I & O, see Figure 3.3) were selected as unifinal feminine outfits. Also, both of them were evaluated as significantly more feminine than professional, based on the direct questions (fem.1, $M_{DF} = 5.54$, $SD = 1.13$ vs. $M_{DP} = 2.92$, $SD = 1.48$) and (fem.2, $M_{DF} = 5.13$, $SD = 1.26$ vs. $M_{DP} = 3.71$, $SD = 1.64$). Similarly, a unifinal feminine outfit fem1 was evaluated as more feminine than professional based on the indices of femininity and professionalism (fem.1, $M_{IF} = 4.19$, $SD = 1.18$ vs. $M_{IP} = 3.52$, $SD = 1.22$). The difference in the evaluation of the second item fell short of being significant (fem.2, $M_{IF} = 4.16$, $SD = 1.25$ vs. $M_{ID} = 4.03$, $SD = 1.28$, $p = .09$). The correlation between evaluated femininity and professionalism was low (fem1. $r = .11$) and moderate (fem.2 $r = .31$) based on the direct questions. Nonetheless, the correlation was high based on the indices fem.1, $r = .53$, and fem.2, $r = .59$. Although, the outfits fem.1 and fem.2 did not meet the criteria related to low correlation on one of the measures (indices), they were taken to further analyses as overall they represented the feminine outfits the best from the initial set of 15.

Multifinal outfits. The two outfits, pro-fem.1 and pro-fem.2 (H & K, see Figure 3.3), were categorized as multi-final ones. Of the 15 initial outfits, there were only these two outfits where the evaluation of femininity and professionalism would not differ. Therefore, following the same logic as above, the one in which the difference was the smallest was

chosen. An outfit pro-fem.1 was evaluated as comparatively more feminine ($M_{DF} = 5.31$, $SD = 1.06$) than professional ($M_{DP} = 4.16$, $SD = 1.47$) based on the direct questions ($p < .001$). Similarly, outfit pro-fem.2 was evaluated as more feminine ($M_{DF} = 5.20$, $SD = 1.12$) than professional ($M_{DP} = 4.38$, $SD = 1.43$, $p < .01$).

Based on the indices, pro-fem.1 was evaluated as more feminine ($M_{IF} = 4.35$, $SD = 1.55$) than professional ($M_{IP} = 4.16$, $SD = 1.14$). Outfit pro-fem.2 was, however, evaluated similarly on femininity and professionalism based on the indices ($p = .92$). For the outfit pro-fem.1, the correlation between femininity and professionalism was moderate ($r = .48$) and a little higher ($r = .52$) for the outfit pro-fem.2. Based on the indices, evaluations of the pro-fem.1 ($r = .64$) and pro-fem.2 ($r = .64$) outfits correlated highly (Cohen, 1992).

Figure 3.3

Outfits as Unifinal STEM, Multifinal, and Unifinal Feminine Symbols



Note. These 6 outfits were finalized from the pool of 15 outfits to be considered as three distinct symbols for symbolizing concerning identity goal overlap and to be further used in Study 5.

Outfits as Symbols and Identity Goal Overlap. The preference for six outfits reflecting unifinal STEM, unifinal feminine, and multifinal symbols was examined in relation to identity goal overlap.

Table 3.3

Relation of Unifinal and Multifinal Outfits' Preference to Identity Goal Overlap

Identity Goal Overlap: Sense of Belonging	Outfit as Symbols – Spearman rho Correlation					
	Unifinal STEM		Unifinal feminine		Multifinal	
	pro.1 (A)	pro.2 (C)	fem.1 (I)	fem.2 (O)	pro-fem.1 (H)	pro-fem.2 (K)
	.08	.07	.19**	.13	.28**	.19**

Note. The table reports RCorr = Spearman Correlation Coefficient due to the left skewed ($Sk. = -2.48$) distribution of the identity goal overlap variable.

* $p < .05$, ** $p < .01$

In line with the predictions, there was no significant correlation between the preference for unifinal STEM outfits and identity goal overlap (pro.1, $r_s = .08$ & pro.2 $r_s = .07$, $p > .05$). Similarly, for one of the unifinal feminine outfits (fem.2, $r_s = .13$, $p > .05$) there was no significant correlation. Contrary to the predictions, there was a significant correlation between the preference to wear one of the unifinal feminine outfits (fem.1) and identity goal overlap ($r_s = .19$, $p < .01$).

It is possible that some confounding variables affected the examined relations. It was expected that more experienced STEM professionals might feel more confident in their STEM identity and thus might choose more feminine attributes when seeing two goals as similar and overlapping. Indeed, when controlled for age and professional experience of participants, the correlation between the unifinal feminine outfits and overlap was significantly reduced and no longer significant (fem.1, $r_s = .13$, $p = .06$ & fem.2 $r_s = .05$, $p = .50$).

The preference for multifinal outfits was positively ($p < .01$) correlated with the overlap (pro-fem1, $r_s = .28$, pro-fem2, $r_s = .19$). The results of the correlation between multifinal outfits and identity goal overlap stayed the same and were positively correlated after controlling for age and professional experience (pro-fem.1, $r_s = .24$, & pro-fem.2 $r_s = .20$, $p < .01$). Apparently, these two variables did not account for variance in the preferences for multifinal outfits.

3.3.3. Discussion

The results of Study 4 suggested that STEM female professionals can differentiate outfits in terms of femininity and professionalism. Especially the outfits that were clearly professional with simple colors and a masculine cut were found to be associated with more professional (i.e., competency, intelligence, efficiency, etc.) than feminine (i.e., gentle, attractive, beautiful, etc.) attributes, and in general were evaluated as more professional.

Finding the feminine and multifinal outfits in line with the adopted criteria was found to be difficult. When participants evaluated feminine outfits by answering two general questions regarding femininity and professionalism, the expected low correlation between the two responses was found. However, moderate to high correlations between femininity and professionalism on the indices were observable. It could be that directly asking about professionalism activates the schema of masculinity (Koenig et al., 2011). When asked with a single direct question, professionalism may be understood in terms of masculinity as opposed to femininity, and this may have resulted in low correlations for unifinal feminine outfits. However, upon looking at the attributes of the professionalism index (i.e., *expert, experienced, knowledgeable, qualified, skilled, competent, intelligent, and efficient*), participants may have understood professionalism in broader and more unisex terms. From

this perspective, a very feminine outfit can be considered as professional, in terms of being efficient and competent. Therefore, it may be the case that attributes such as competence, intelligence, skillfulness, etc., do not possess any clear association with one or the other gender (Bye et al., 2022); and in effect, femininity and professionalism might no longer be seen as opposing when evaluating feminine outfits.

Multifinal outfits, as expected, had high scores both on femininity and professionalism dimensions. However, multifinal outfits were evaluated as significantly more feminine than professional based on direct questions and indices. Firstly, the fact that the difference is significant may partially be because they were highly positively correlated, which was necessary to qualify them as multifinal, when using paired *t*-tests, correlations between responses are accounted for. Secondly, these multifinal outfits were designed for and used by women and not men in the professional domain, so they may be seen by women as essentially more feminine and for women than professional. Finally, the distinction between what is an attribute of femininity and what serves two goals might be strongly affected by interpersonal differences.

Importantly, the preference for multifinal symbols varied with identity goal overlap. Multifinal outfits were positively associated with an identity goal overlap via a sense of belonging. As predicted, the relation between the preference for unifinal STEM outfits and identity goal overlap was close to zero. Also, the preference for unifinal feminine outfits and identity goal overlap was close to zero as well, except for one outfit (fem.1). In the case of this outfit, when controlled for age and professional experience of the participants, the association between the preference for this outfit and overlap got weaker and became non-significant. Specific features of this outfit could have made it more or less preferred

depending on professional experience.

A noteworthy limitation of Study 4, however, is that the evaluation of the outfits and the identity goal overlap were measured at the same time. So it seems possible that the ratings and preferences for the outfits themselves impacted the subsequent identity goal overlap. Also, participants evaluated all outfits without choosing a preferred one. Study 5 was conducted to address the limitations and to find out whether identity goal overlap indeed impacts the choice of outfits that qualify as multifinal symbols.

3.4. Study 5: Identity Goal Overlap Predicting Multifinality over Unifinality

Study 5 investigated the relationship between identity goal overlap and the selection of either a multifinal or unifinal outfit, building on Study 4's exploratory approach by focusing on the pre-defined objective of examining symbolic choices tied to identity goal overlap. the first and main objective was to examine whether identity goal overlap is related to the choice of a multifinal or a unifinal outfit out of the six pre-selected outfits in Study 4. I also tested whether the subjective evaluation of multifinality and unifinality of chosen outfits depends on the identity goal overlap measured a week before this evaluation. In Study 5, I opted for a more sophisticated, person-centered methodological approach to categorize individuals into those who evaluate a given outfit as feminine unifinal, STEM unifinal, or multifinal. Finally, identity goal overlap via a sense of belonging (Roccas, 1997, Tartakovsky, 2002, 2009) as in Study 4 was measured again, but additionally introduced group identification (Cameron, 2004) as a relevant reason. It was assumed that both reasons encapsulate the broader idea of identifying and belonging with one's group (Baumeister & Leary, 1995), either related to the feminine gender and/or a STEM profession.

3.4.1. Method

3.4.1.1. Design and Participants. Study 5 employed a research design using measurements at two-time points to examine the predictability of multifinal symbols' preference by identity goal overlap. Similar to Study 4, power analysis helped to determine the minimal required sample size. A bivariate normal model suggested a sample of 202 participants to detect a correlation of $< .2$ for a power of .95. Participants were recruited on Prolific using the same inclusion criteria as in Study 4. Out of the initial 254 women from STEM disciplines who expressed consent to participate in the study and completed the questionnaires at t_1 , a sample of 226 (age $M = 26.48$, $SD = 5.90$, range 18-56 years) completed the questionnaires at t_2 and constituted the final sample. Out of which 54% ($n = 122$) were from science, 17.7% ($n = 40$) from technology, 21.2% ($n = 48$) from engineering, 2.7% ($n = 6$) from Mathematics and the remaining 4% ($n = 9$) were from other category and missing responses.

3.4.1.2. Procedure. Participants completed online surveys at two measurement points. In Part 1 of the study, on January 03, 2023, they completed the questionnaires including identity goal overlap based on the sense of belonging, group identification, and demographic characteristics. After a week, in Part 2, 226 participants selected the outfit that they liked the most from the six categorized in Study 4 as either unifinal STEM, unifinal feminine, or multifinal (see Figure 3.3). Then, they rated all the outfits based on professionalism and femininity. As compensation for taking part in the study, participants received 3£. The Internal Faculty Ethics Board of the institution approved the study procedure (Decision 01.1/E/06/2022). Data sets and analysis files for the study are available at: https://osf.io/zjs57/?view_only=29aa875416cf41baa712cdae479b74c3

3.4.1.3. Measures.

Identity Goal Overlap. Identity goal overlap was measured via a sense of belonging as in Study 4 and via group identification. Participants responded on the Group Identification Scale (Cameron, 2004, 12 items, 4 reverse coded) to statements such as '*In general, I am glad to be a feminine woman/STEM professional*', or '*I find it difficult to form a bond with other feminine women/STEM professionals*' by responding on a scale from 0 = strongly disagree to 6 = strongly agree. Overlap was calculated for each measure using the same formula as in Study 4. For sense of belonging, in Study 5 ($N = 226$), the feminine identity goal had a mean of 3.84 ($SD = 1.30$, $\alpha = .84$), and the STEM identity goal had a mean of 4.05 ($SD = 1.15$, $\alpha = .84$). For group identification, ($N = 226$), the mean for group identification with the feminine identity goal was 3.80 ($SD = 0.91$, $\alpha = .87$). For STEM group identification, the mean in Study 5 was 3.99 ($SD = 0.81$, $\alpha = .85$).

Group identification items (used in Study 5 only)	
I often think about being a feminine woman.	I often think about being a STEM professional.
Being a feminine woman is an important part of my self-image.	Being a STEM professional is an important part of my self-image.
Being a feminine woman has little to do with how I feel about myself in general. (R)	Being a STEM professional has little to do with how I feel about myself in general. (R)
The fact I am a feminine woman rarely enters my mind. (R)	The fact I am a STEM professional rarely enters my mind. (R)
In general, I'm glad to be a feminine woman.	In general, I'm glad to be a STEM professional.
Generally, I feel good about myself when I think about being a feminine woman.	Generally, I feel good about myself when I think about being a STEM professional.
I often regret being a feminine woman. (R)	I often regret being a STEM professional. (R)
I don't feel good about being a feminine woman. (R)	I don't feel good about being a STEM professional. (R)
I have a lot in common with other feminine women.	I have a lot in common with other STEM professional
I feel strong ties to other feminine women.	I feel strong ties to other STEM professionals.
I find it difficult to form a bond with other feminine women. (R)	I find it difficult to form a bond with other STEM professionals. (R)
I don't feel a strong sense of being connected to feminine women. (R)	I don't feel a strong sense of being connected to STEM professionals. (R)

Note. (R) is for reverse items

One Chosen Outfit. Participants were presented with six outfits selected in Study 4 (see Figure 3.3). To sustain the interest of participants, engage them in the study, and maintain ecological validity of the task, they were provided with the following instructions to select only one outfit of their choice;

“Dear Participant, we are creating an online platform to share lifestyle trends of WOMEN IN STEM. Please choose one outfit that you find most relevant for this website. We will make an online post about trends in fashion tagging your name/nick to your choice. We would greatly appreciate your helping us in choosing one outfit of your choice and answering some follow-up questions. Please choose one outfit from the following and sign it with your nick/name”.

It was mentioned that the participants’ selection would be made public and linked to their nick/name to increase the social reality of the decision because according to symbolic self completion theory effective symbols require social reality i.e. exhibition of symbolizing in the presence of others as viewers (Gollwitzer, 1986; Gollwitzer et al., 2009). Outfits categorized as multifinal in Study 4 were the most often selected outfits with 39.82% in total (pro-fem.1: $n = 46$, 20.35%, pro-fem.2: $n = 44$, 19.47%). Outfits categorized as unifinal professional were selected by 36.28% in total (pro.1: $n = 32$, 14.16% & pro.2: $n = 50$, 22.12%), and those categorized as unifinal feminine were selected by 23.89% in total (fem.1: $n = 45$, 19.91%, fem.2: $n = 9$, 3.98%).

Outfit selection reason (Open-ended). To gain an insight into participants’ choices among the six outfits (See Figure 3.3) an open-ended question was included as well stating *“Why did you select this particular outfit?”*. Key adjectives were identified from the text: *“I chose the dress because it was “professional, classic, fashionable, minimalist, etc.”*. For

analysis of this explorative question, the frequencies of the responses were calculated as follows in Table 3.4;

Table 3.4*Frequencies and Percentages of the Descriptive for the Choice of Particular Outfit*

Sr. no.	The adjective from the qualitative text description	Frequency of using descriptions N = 225	Outfit Chosen					
			Unifinal STEM		Multifinal		Unifinal FEM	
			A	C	H	K	I	O
			pro.1 n = 32	pro.2 n = 50	pro-fem.1 n = 46	pro-fem.2 n = 44	fem.1 n = 9	fem.2 n = 45
			<i>f</i> (%)	<i>f</i> (%)	<i>f</i> (%)	<i>f</i> (%)	<i>f</i> (%)	<i>f</i> (%)
1	Professional	41	6 (18.75)	6 (12)	6 (13.04)	11 (25)	1 (11.11)	11 (24.44)
2	Comfortable/Comfy/ Cozy	35	1 (3.13)	7 (14)	7 (15.22)	14 (31.82)	0	6 (13.33)
3	Simple	26	4 (1.25)	14 (28)	3 (6.52)	2 (4.55)	0	3 (6.67)
4	Classy/Classic/ Timeless	25	9 (28.13)	6 (12)	2 (4.35)	5 (11.36)	0	3 (6.67)
5	Feminine	24	1 (3.13)	1 (2)	8 (17.39)	8 (18.18)	3 (33.33)	3 (6.67)
6	Stylish/fashionable/ trendy	24	1 (3.13)	1 (2)	4 (8.70)	6 (13.64)	0	12 (26.67)
7	Similar to myself/ routine/style	22	2 (6.25)	6 (12)	7 (15.22)	4 (9.09)	0	3 (6.67)
8	Elements appeal (texture/design/shape/flowers)	20	2 (6.25)	1 (2)	8 (17.39)	2 (4.55)	1 (11.11)	6 (13.33)
9	Elegant	15	2 (6.25)	2 (4)	7 (15.22)	1 (2.27)	1 (11.11)	2 (4.44)
10	Neutral/androgynous/ not too girly	14	3 (9.38)	5 (10)	2 (4.35)	2 (4.55)	0	2 (4.44)
11	Suitable for all occasions	13	4 (1.25)	3 (6)	3 (6.52)	2 (4.55)	0	1 (2.22)
12	Lovely/nice	11	1 (3.13)	2 (4)	1 (2.17)	5 (11.36)	0	2 (4.44)
13	Casual	10	0	3 (6)	2 (4.35)	3 (6.82)	0	2 (4.44)
14	Vibrant/colorful/pop	10	1 (3.13)	0	5 (10.87)	1 (2.27)	2 (22.22)	1 (2.22)
15	Trouser cut	10	1	0	3	2	0	4

			(3.13)		(6.52)	(4.55)	(8.89)
16	Just right/only option/ least outdated	9	4 (1.25)	1 (2)	3 (6.52)	1 (2.27)	0 0
17	Formal	9	3 (9.38)	2 (4)	0	2 (4.55)	0 (4.44)
18	Workwear / STEM wear	8	0 (4)	2 (4)	2 (4.35)	4 (9.09)	0 0
19	Liked	8	1 (3.13)	2 (4)	2 (4.35)	0 (11.11)	1 (4.44)
20	Practical/ helps concentration/ busy morning	6	1 (3.13)	2 (4)	2 (4.35)	0	1 (2.22)
21	Neutral colors	6	3 (9.38)	1 (2)	0	2 (4.55)	0 0
22	Manly/powerful/ strong	6	1 (3.13)	1 (2)	0	1 (2.27)	0 (6.67)
23	Pretty/ Beautiful	5	0 (2)	1 (2)	1 (2.17)	2 (4.55)	0 (2.22)
24	Not stereotypically as Women in STEM wear	4	0	0	1 (2.17)	1 (2.27)	1 (11.11)
25	Reflects a personality	4	0	0	1 (2.17)	1 (2.27)	0 (4.44)
26	Presentable/ approachable	3	1 (3.13)	0	0	1 (2.27)	0 (2.22)
27	Appealing/ attractive	3	0	2 (4)	0	0	0 (2.22)
28	Dark color	3	0	0	0	0	0 (6.67)
29	least horrible/ ugly/ hideous	3	2 (6.25)	0	1 (2.17)	0	0 0
30	Sober/respectable	2	0	0	1 (2.17)	0	0 (2.22)
31	Interesting	2	0	0	0	0	0 (4.44)
32	Bold/Sexy	2	0	0	0	1 (2.27)	0 (2.22)
33	Turtle neck	2	0	0	0	0	0 (4.44)
34	Don't want to stand out/ not	2	0	2	0	0	0 0

	outlandish			(4)				
35	Fastly done	1	0	1 (2)	0	0	0	0
36	Great match	1	0	0	0	0	0	1 (2.22)

Note. A, C, H, K, I, and O are the labels assigned to the outfits (Study 4) from the set of all 15 outfits in Study 4. Table 3.4 shows the details of how many times a particular description was used for the outfit that participants have chosen. For example, participants used the word “*Professional*” the most, and based on percentages, 18.75 % of participants chose outfit A (unifinal STEM) considering it professional. 25% of participants chose outfit K (multifinal) considering it professional. More interestingly, nearly 24.44 % of participants choose outfit O (unifinal FEM) considering it professional. This reflects that the evaluation of an outfit as a professional was behind the three unique choices. Similarly, the consideration of an outfit as “*Feminine*” was the cause behind the choice of outfit I (Unifinal FEM) the most up to 33.33 %, and then for outfits K and H (Multifinal) up to 18.18% and 17.39% respectively. Unifinal STEM outfits (A & C) were evaluated least feminine among all.

Femininity and Professionalism of Chosen Outfit. Similar to Study 4, participants rated the femininity and professionalism of the outfits on two direct questions and they evaluated outfits using adjectives from which the two indices of femininity and professionalism were calculated (see measures of Study 4). Presently, two sets of new variables evaluating femininity and professionalism were created as a result of i) direct question measurement and ii) indices measurement of the one chosen outfit. Similar to Study 4, these questions were used to determine the evaluations of participants regarding the one outfit they had selected.

Classification of Individuals Based on the Evaluation of an Outfit. Participants were classified into clusters based on how they evaluated their chosen outfits (see Table 3.5). Clustering based on the K-mean person-centered analysis (Everitt et al., 2011) for its distinct advantages was opted. This approach afforded us a precise understanding of group observations by assessing outfits. Clustering participants' evaluations, heightened the ability to accurately discern membership affiliations and laid the foundation for more advanced analyses at the next stage. Additionally, it allowed us to distinctly identify three meaningful clusters, each aligned with the characteristics of unifinal STEM, unifinal feminine, and multifinal in outfit evaluations.

Table 3.5*Clusters Emerged Due to the Femininity and Professionalism Evaluations of the Chosen Outfits*

Variables		Clusters			Model Test
		1	2	3	Chi-Square
Rating values (1 = low – 7 = high)					
Direct Questions	Femininity	3	6	5	112.83***
	Professionalism	6	6	4	
		<i>n</i> = 41	<i>n</i> = 150	<i>n</i> = 34	
Mean values (1 = low – 7 = high)					
Indices	Femininity	3.96	5.91	5.63	15.71**
	Professionalism	4.58	5.94	4.14	
		<i>n</i> = 55	<i>n</i> = 102	<i>n</i> = 68	
		Unifinal-STEM	Multifinal	Unifinal-FEM	

Note. Direct questions were based on a 1-7 Likert point, and indices were the cumulative means of the subsequent questions.

p* < .01, *p* < .001

For direct questions, there were significant differences in cluster membership in terms of outfits' evaluation, $\chi^2 = 112.83$, $p < .001$. Cluster 1 ($n = 41$) had low ($M = 3$) feminine and high ($M = 6$) professional scores (unifinal STEM). Cluster 2 ($n = 150$) had high ($M = 6$) feminine and high ($M = 6$) professional scores (multifinal). Cluster 3 ($n = 34$) had high ($M = 5$) feminine and low ($M = 4$) professional scores (unifinal FEM).

For indices-based measures, there were significant differences in the clusters, $\chi^2 = 15.71$, $p < .01$. Cluster 1 ($n = 55$) had a low ($M = 3.96$) feminine and high ($M = 4.58$) professional scores (unifinal STEM). Cluster 2 ($n = 102$) had a high ($M = 5.91$) feminine and a high ($M = 5.94$) professional score (multifinal). Cluster 3 ($n = 68$) had high ($M = 5.63$) feminine and low ($M = 4.14$) professional scores (unifinal FEM).

This clustering is based on the evaluation of individual participants, rather than an external categorization as STEM, feminine, or multifinal. Because the perception of clothes, fashion, and gender-related symbols can be a highly subjective matter (Puiu, 2020), this approach better accounts for individual differences and the subjective perception of the

women in the sample. A large proportion of participants belonging to a multifinal Cluster 2 and considered their chosen outfit to be high on femininity and professionalism at the same time, regardless of whether it was originally considered professional, feminine, or both.

3.4.2. Results

The results are reported in two parts corresponding to the two objectives of Study 5. First, it was tested whether participants who choose multifinal outfits from six items categorized in Study 4 do have higher overlap as compared to participants choosing unifinal outfits. Second, it was tested whether the identity goal overlap predicts participants' cluster membership based on the evaluation of a selected item.

Identity Goal Overlap and Outfit Selection. A one-way ANOVA was conducted to examine the differences in identity goal overlap depending on the outfits selected by the participants. Identity goal overlap measured with a sense of belonging did not differ depending on the chosen items, $F(5, 217) = 0.84, p = .53$. Similar results were found for overlap based on group identification, $F(5, 219) = 0.15, p = .98$. Considering the different percentages of the outfit choice, non-parametric analyses of variance were conducted with the Kruskal-Wallis test (Kruskal & Wallis, 1952). Again, there were no differences for identity goal overlap measured for sense of belonging, $\chi^2(5, 217) = 5.83, p = .32, \xi^2 = 0.03$, nor group identification, $\chi^2(5, 219) = 1.37, p = .93, \xi^2 = 0.01$.

Identity Goal Overlap and Classification of Individuals Based on the Evaluation of an Outfit. The second objective of Study 5 was to verify whether identity goal overlap relates to the evaluation of perceived multifinality over unifinality of the chosen outfit. It was hypothesized that participants having higher identity goal overlap would evaluate their chosen outfit as more multifinal. After estimating the cluster membership, multinomial

logistic regression (Peng & Nichols, 2003; Menard, 2000) was used to test whether identity goal overlap predicted participants' cluster membership: unifinal STEM, unifinal feminine, or multifinal (see Table 3.6). The reference category was the multifinal cluster.

Table 3.6

Identity Goal Overlap and Multifinal vs. Unifinal Cluster Membership of the Chosen Outfits

DV		IV	Model Coefficients				95% Confidence Interval		Overall Model Wald $\chi^2(df)$, p
Cluster label	Categories (Reference = Multifinal)		Estimate CI[LL,UL]	SE	p	OR	LL	UL	
Femininity and Professionalism Direct Questions	US – M	Intercept	1.03 [-1.91, 3.96]	1.50	0.49	2.79	0.15	52.29	I- 2.98(2) $p = .23$
		OLSOB	-2.54 [-5.68, 0.59]	1.60	0.11	0.08	0.02	1.81	
	UF – M	Intercept	-2.37 [-7.09, 2.35]	2.41	0.32	0.09	0.00	10.43	
		OLSOB	0.90 [-4.04, 5.85]	2.52	0.72	2.46	0.01	346.96	
	US – M	Intercept	3.97 [-1.11, 9.06]	2.59	0.13	53.20	0.33	8558.83	II- 4.85(2) $p = .08$
		OLGI	-5.67 [-11.11, -0.22]	2.78	0.04	0.0034	0.00	0.80	
	UF – M	Intercept	2.64 [-2.97, 8.26]	2.86	0.35	14.02	0.05	3846.22	
		OLGI	-4.40 [-10.40, 1.60]	3.06	0.15	0.01	0.00	4.96	
Femininity and Professionalism Indices	US – M	Intercept	3.40 [-0.23, 7.04]	1.86	0.08	30.09	0.79	1142.43	III- 5.60(2) $p = .06$
		OLSOB	-4.29 [-8.14, -0.45]	1.96	0.03	0.14	0.00	0.64	
	UF – M	Intercept	2.08 [-1.66, 5.81]	1.91	0.28	7.99	0.19	334.51	
		OLSOB	-2.65 [-6.58, 1.27]	2.00	0.16	0.07	0.01	3.57	
	US – M	Intercept	6.63 [1.35, 12.00]	2.74	0.02	757.13	3.51	163509.86	IV- 7.67(2) $p = .02$
		OLGI	-7.75 [-13.48, -2.01]	2.93	0.01	0.000	1.40	0.13	
	UF – M	Intercept	2.54 [-3.13, 8.22]	2.89	0.38	12.72	0.04	3697.24	
		OLGI	-3.14 [-9.15, 2.86]	3.06	0.31	0.04	1.06	17.533	

Note. IV = Independent Variable, DV = Dependent Variable, LL = Lower Limit, UL = Upper Limit, SE = Standard Error, US = Unifinal STEM, UF = Unifinal Feminine, M = Multifinal, OLSOB = Overlap Sense of Belonging, OLGI = Overlap Group Identification. I, II, III, and IV are model labels as each of the models was executed independently (1 predictor, 1 outcome) in Jamovi (2022). The gray-shaded area reflects the probability of occurrence between cluster categories upon the introduction of the predictor.

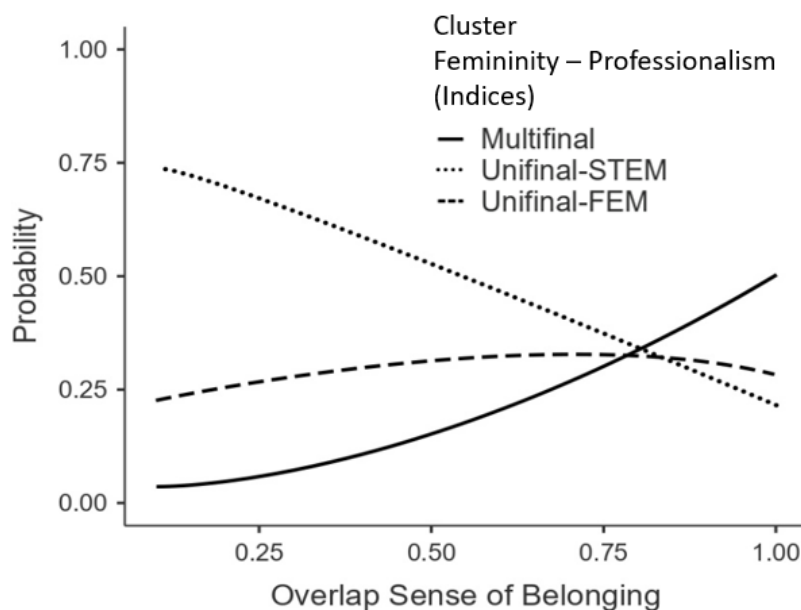
Identity Goal Overlap: Sense of Belonging. Identity goal overlap assessed via the

sense of belonging was not a significant predictor of the cluster membership based on the direct questions of femininity and professionalism, $\chi^2(2, 225) = 2.98, p = .23$. The odd ratios (OR) of being in the unifinal STEM cluster ($p = .11$) or the unifinal feminine cluster ($p = .72$) depending on the identity goal overlap were not significantly different in comparison to the multifinal cluster.

Identity goal overlap via a sense of belonging accounted for cluster membership based on indices, $\chi^2(2, 225) = 5.60, p = .06$. With higher overlap, the probability of being in the unifinal STEM cluster was significantly lower as compared to the multifinal cluster (OR = 0.14 [CI: 0.00 – 0.64], $p = .03$) (see Figure 3.4). There were no differences in the probability of belonging to the unifinal feminine cluster compared to the multifinal cluster due to overlap (OR = 0.07 [CI: 0.001 – 3.57], $p = .19$).

Figure 3.4

Identity Goal Overlap via Sense of Belonging Predicting the Cluster Membership based on Indices of Femininity and Professionalism.

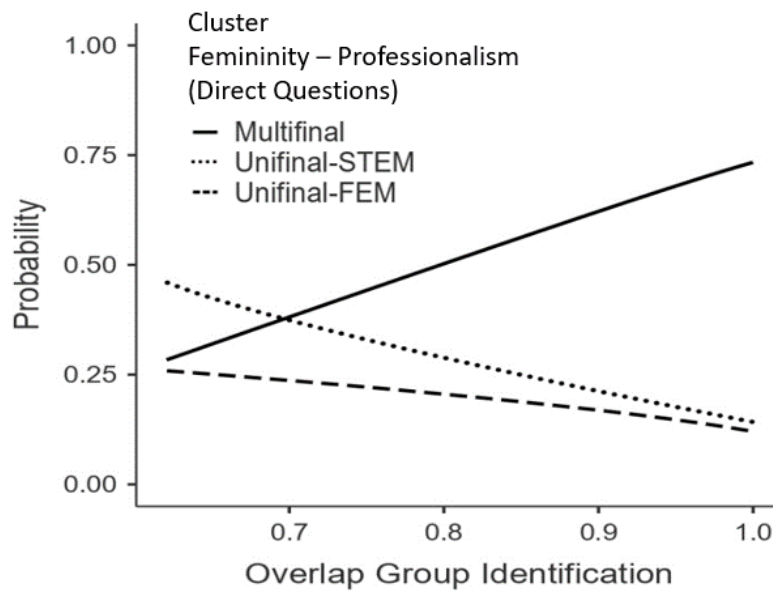


Note. Figure 3.4 shows the probability of being in the multifinal, unifinal STEM, or FEM/feminine cluster based on identity goal overlap via a sense of belonging. With high overlap, the probability of multifinal membership is higher whereas the probability of unifinal STEM membership is lower.

Identity Goal Overlap: Group Identification. Identity goal overlap via the group identification was a predictor of the cluster membership based on the direct questions of femininity and professionalism of an outfit, $\chi^2(2, 225) = 4.85, p = .08$. With higher overlap the probability of being in the unifinal STEM cluster was significantly lower as compared to the multifinal cluster (OR = 0.00346 [CI: 0.00 – 0.80], $p = .03$) (see Figure 3.5). There were no differences in the probability of belonging to the unifinal feminine cluster compared to the multifinal cluster due to overlap (OR = 0.01 [CI: 0.00 – 4.96], $p = .15$).

Figure 3.5

Identity Goal Overlap Group Identification Predicting the Cluster Membership of Outfits based on Direct Questions of Femininity and Professionalism.



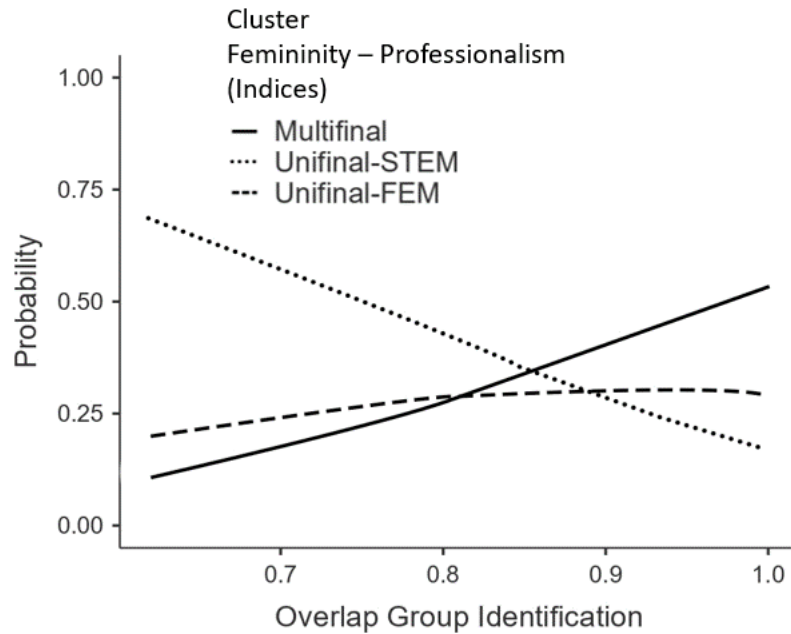
Note: Figure 3.5 shows the probability of being in the multifinal, unifinal STEM, or FEM/feminine cluster based on identity goal overlap via group identification. With high overlap, the probability of multifinal membership is higher whereas the probability of unifinal STEM membership is lower.

Identity goal overlap via the group identification was a significant predictor of the cluster membership based on indices, $\chi^2(2, 225) = 7.67, p < .05$. With higher overlap the probability of being in the unifinal STEM cluster was significantly lower as compared to the multifinal cluster (OR = 0.00004 [CI: 0.00 – 0.13], $p = .008$) (see Figure 3.6). There were no

differences in the probability of belonging to the unifinal feminine cluster compared to the multifinal cluster due to overlap (OR = 0.04 [CI:1.06 – 17.53], $p = .31$).

Figure 3.6

Identity Goal Overlap Group Identification Predicting the Cluster Membership of Outfits based on Indices of Femininity and Professionalism.



Note: Figure 3.6 shows the probability of being in the multifinal, unifinal STEM, or FEM/feminine cluster based on identity goal overlap via group identification. With higher overlap, the probability of multifinal membership is higher whereas the probability of unifinal STEM membership is lower.

3.4.3. Discussion

The results showed that participants' choice of a multifinal or unifinal outfit (as categorized based on the results of Study 4) was not related to identity goal overlap. However, the evaluation of the chosen outfit as multifinal or unifinal was related to the identity goal overlap. Participants with higher overlap evaluated their outfits as multifinal, independent of the categorization (i.e. STEM/feminine/multifinal) assigned to each of the outfits based on the results of Study 4. Having lower overlap predicted belonging to the unifinal STEM cluster, and a high overlap (i.e., belonging and group identification to both

identity goals) predicted belonging to the cluster in which participants saw their choice as multifinal.

Stronger effect sizes were observed when testing overlap via group identification as compared to the sense of belonging. The brevity of the measure might have affected the reliability and validity of the measure (Morgado et al., 2017; Spsychalska-Waszek et al., 2022). Study 5 took a person-centered approach via cluster analyses and is predicated on an individual's distinctive experience and perception (Everitt et al., 2011).

Outfit preferences and evaluation were related to overlap regarding a sense of belonging and group identification. Sense of belonging and group identification are social (Diekmann et al., 2017, 2011). When a person pursues two identity goals for these social reasons, outfits may serve as relevant symbols to “set off an acknowledgment from others” (p. 48, Gollwitzer & Wicklund, 1982). Outfits have the utilitarian aspect of keeping a person covered but also exhibit the individual's status and group belongingness (Allport, 1932; Fasoli et al., 2018; Gruber et al., 2023).

Unifinal STEM outfits reflecting professional characteristics were found to be easily distinguishable from unifinal feminine as well as multifinal outfits in both studies. While there is no specific dress code for STEM as a profession, men dominate the field (Docter-Loeb, 2023; Su et al., 2009). Therefore, attire with masculine features may be considered the norm for what is perceived as professional. In contrast, distinguishing the feminine-only and multifinal outfits in both studies (4 & 5) was not as clear. Feminine outfits apparently can signal sublime professional characteristics such as skill, efficiency, or competence (Lower, 2018). Since there is not one prototypical example of a feminine outfit, there is room for individual judgments and preferences.

In Study 5, higher overlap did not predict the choice of outfits that were evaluated as multifinal in Study 4. There are certain universal indicators to reflect gender via outfits, for example, aesthetics, shape, texture, form, and color (Buss, 2016). This research suggests that preference for such indicators might depend on identity goal overlap, but remains subjective and individual. Apparently, there is no universal attire that represents the ideal match for symbolizing women in STEM who pursue both of the two identity goals. Previous studies have attempted to investigate what professional women should wear by examining others' judgments of women's professionalism based on neutral-colored, shapeless, field-oriented, or unisex outfits (Fasoli et al., 2018; Lower, 2018). However, present research showed that women in STEM might feel that a specific outfit serves both of the two identity goals, without having to adhere to a specific style, conventionally considered masculine, feminine, or mixed. The multifinality or unifinality of the choice appears to be subjective and rests in the eye of the beholder.

A detailed discussion of identity goal overlap, symbolic representation, and the experiences of women in STEM across various subdisciplines is provided in Chapter 5: General Discussion.

Chapter 4. Overlapping Identity Goals among STEM Employees and Imposter Syndrome³

As of March 2024, the number of women in STEM occupations has surpassed one million; however, they still represent only 29% of the STEM workforce in the UK (*More Women to Be Supported Back into STEM Jobs in Government-Backed Training*, n.d.). The NSF report (2023) on the STEM workforce highlights disparities by gender, noting that men earn more than women, particularly in engineering and computing. Additionally, men are more likely than women to hold advanced degrees within STEM fields, leading to higher representation in top-level STEM positions. These patterns underscore ongoing gender gaps in STEM employment and earnings (*Diversity and STEM: Women, Minorities, and Persons with Disabilities 2023 / NSF - National Science Foundation*, n.d.). Research further highlights the ongoing gender bias in STEM fields, emphasizing that women face significant challenges. Despite the growing proportion of women in STEM, biases persist, affecting women's experiences and perceptions within these professions (*How Is the Current STEM Gender Bias?*, 2022).

Women in STEM fields face significant societal pressures and stereotypes that discourage them from pursuing STEM careers. These stereotypes can shape self-concept and aspirations, leading to a lack of interest in STEM subjects at different education levels (García-Holgado et al., 2020; García-Holgado & García-Peñalvo, 2022). This underrepresentation of women in STEM fields is largely attributed to societal stereotypes and expectations (Beede et al., 2011). Reilly et al. (2019) highlight that the extent to which women are aware that they are negatively stereotyped in STEM is a critical factor in the

³ **Zaman, S.,** Spychalska-Waszek, H., Doerflinger, J. T., Gollwitzer, P. M., & Byrka, K. (2025). Overlapping identity goals among STEM employees and imposter syndrome (Manuscript in Preparation).

underrepresentation of women in STEM, as it affects women's career choices and fosters feelings of alienation in traditionally male-dominated STEM environments.

The structures of STEM fields often favor males through institutional norms, policies, and practices that prioritize competition, long hours, and hierarchical power dynamics, which may conflict with societal expectations placed on women. Eventually, leading female professionals to feel pressured to leave STEM positions mid-career due to experiences of exclusion and a lack of belonging (Cadaret et al., 2017; Reilly et al., 2019). Many female STEM workers feel unwelcome, reinforcing the notion that STEM roles are "better suited" for males, further discouraging women from entering or remaining in these fields (Beede et al., 2011; Reilly et al., 2019).

The environments that women face in STEM fields, marked by a sense of being unwelcome, often contribute to experiences of imposter syndrome (Price et al., 2024; Tao & Gloria, 2019). As women work in STEM, the belief that they do not belong or that they are less capable compared to their male counterparts can intensify feelings of inadequacy. The perception that STEM is more suited to men may exacerbate these feelings, reinforcing the notion that they are "impostors" in an environment where they struggle to meet social expectations, despite their qualifications and abilities.

4.1. Imposter Syndrome and STEM

Imposter syndrome, a psychological phenomenon where individuals feel like frauds despite evident success, affects many professionals and students, particularly within STEM fields. Originally documented in women by Clance and Imes (1978), this syndrome has since been recognized in men as well, although gender experiences differ. In STEM, a highly competitive and male-dominated domain, imposter syndrome can create significant

barriers to career progress and mental health, particularly for women (Price et al., 2024). The study by Clance and Imes (1978) identifies imposter syndrome as stemming from societal pressures and expectations tied to gender roles, such as the belief that women are less capable in certain fields. It also highlights the influence of family dynamics, where individuals may feel pressured to meet high standards or are doubted despite their success. Additionally, the historical underrepresentation of women in academia and prestigious professions contributes to feelings of not belonging or being unworthy of their achievements.

Imposters may belong to one of two groups: first, are the individuals who grew up with a family member who was seen as "the smart one." As a result, they felt the need to prove their intelligence to gain approval. They often turned to academic achievements in school as a way to validate their worth, striving to show they were just as capable. The second group is of individuals who were frequently praised as exceptional or superior in their abilities. However, when they encountered challenges or situations where they couldn't meet these high expectations, they experienced anxiety and self-doubt. This led them to question their intelligence and feel like frauds, believing their success was undeserved (Clance & Imes, 1978).

Women in STEM often experience greater levels of imposter syndrome compared to their male counterparts (Bravata et al., 2020; Clance & Imes, 1978; Fleischhauer et al., 2021; Jöstl et al. 2012; King & Cooley 1995; Lee et al., 2022; Stone et al. 2018). This stems from gendered stereotypes, and stereotype threat (Steele & Aronson, 1995; Shih et al., 2012) that imply women are less capable in these fields, causing them to doubt their abilities even when they have the necessary expertise. Additionally, the lack of representation and support

in male-dominated STEM environments reinforces feelings of being an outsider, intensifying self-doubt and the belief that they do not truly belong. These pressures can cause women to attribute their successes to external factors, such as luck or chance, rather than acknowledging their skills and achievements (Price et al., 2024).

Meyers's (1987) work on the paradox of feminine socialization argues that it threatens personal autonomy by creating a traditional woman, characterized by grooming of feminine roles, emotional ties, and a home-centered orientation. This stereotyping, beginning in early childhood, directs women away from academic and professional spaces, while masculine socialization promotes work-oriented options without stigmatization. Individuals with imposter syndrome often wrestle with persistent thoughts that they are *not good enough* or unworthy of their success. Despite evidence of their abilities or accomplishments, they doubt their competence and attribute their achievements to luck, external factors, or even deception. This leads to a deep-seated fear that their peers, colleagues, or superiors will eventually uncover the *truth*—that they are not as capable or intelligent as they appear. This fear of *discovery* creates ongoing anxiety and can hinder confidence, professional growth, and overall well-being (Cole & Carlin, 2009). They often focus on their mistakes and feel shame or disappointment when they fail. They can push themselves to the limit to prevent *exposure* not accepting when an effort is good enough (Cole & Carlin, 2009; Heslop et al., 2023).

Women are often encouraged to prioritize relationships, while men are typically guided to focus on tasks that require spatial and mechanical reasoning. This societal expectation shapes women to be more relationship-oriented, while men are more task- or object-focused (Su et al., 2009). These gendered differences, where men excel in technical

areas like systemizing (Archer, 2019) and spatial tasks (Flores-Mendoza et al., 2013), and women in verbal and empathizing abilities (Miller & Halpern, 2014; Reilly et al., 2019; Reynolds et al., 2015), create a divide in how each gender is perceived in STEM. This disconnection between women's traditionally nurtured strengths and the male-dominated, technical focus of STEM leads many women to doubt their abilities, particularly in environments that prioritize systemizing and technical skills (Cheryan et al., 2009; 2015). As a result, women often experience imposter syndrome, feeling like they do not truly belong in these spaces, despite their accomplishments. This constant struggle to reconcile personal identity with societal expectations contributes significantly to the higher levels of imposter syndrome reported by women in STEM. Societal norms often depict a feminine woman as ill-suited for the technical demands of STEM, leading to a conflict that reduces identity overlap for women. In contrast, men face less of this disconnection, as their masculine identities are more naturally aligned with the technical and problem-solving aspects of STEM.

In this research dissertation, Identity goals overlap between femininity and STEM was examined through the reasons of belonging and group identification. Belonging and identification with the STEM community involve recognizing STEM as a central part of one's professional identity (Xu & Lastrapes, 2022). As well as feminine identity, which is tied to social roles and group affiliation with other women (Fausto-Sterling, 2012; Tate et al., 2013; West & Zimmerman, 1987). Women may perceive lower identity goal overlap between femininity and their STEM identity goals because these two domains are often perceived as conflicting. Women may find it challenging to reconcile these identities and feel a sense of exclusion, undermining their belonging in STEM. This lack of congruence

between one's gender and profession can hinder their self-confidence, contributing to higher levels of imposter syndrome.

In contrast, men in STEM generally may experience higher identity goal overlap between masculinity and their professional identity. Masculine traits, such as assertiveness and technical skill, align well with the values and expectations of STEM fields, which often prioritize problem-solving and systemizing abilities. This congruence between their personal and professional identities strengthens their sense of belonging in STEM and fosters confidence. Men are less likely to face the identity conflict that women experience, enabling them to integrate their masculine and STEM identities more seamlessly and feel a stronger connection to the STEM community.

The stereotype that women are less capable in STEM fields exacerbates imposter syndrome (Bravata et al., 2020; Clance & Imes, 1978; Fleischhauer et al., 2021), as this stereotype threatens their sense of belonging. An overlap i.e. perfect alignment between gender and professional identity goals, grounded in the reasons of a sense of belonging and group identification, may help reduce imposter syndrome. For women, a higher identity goal overlap i.e. the shared belonging and identification with femininity and STEM may foster a sense of authenticity and provide a protective buffer against self-doubt and the fear of being an imposter. Research suggests that group identification enhances motivation, lowers the likelihood of leaving the field, and buffers against feelings of inadequacy (Diekmann et al., 2017; Lee, 2013).

4.2. Aim of the Study

This study aimed to examine the differences between women and men working in STEM. The imposter syndrome (i.e., feelings that the achievements are undeserved and

worries that the individual is likely to be exposed as a fraud) and identity goal overlap (i.e. perceived similarity between two identity goals based on a shared reason such as a sense of belonging and group identification) were examined among these STEM samples.

It was hypothesized that women will have a higher level of imposter syndrome as compared to men (H_8) (Bravata et al., 2020; Clance & Imes, 1978; Fleischhauer et al., 2021). Furthermore, women will have lower identity goal overlap as compared to men (H_9). Identity goal overlap is a perceived similarity between two goals (Doerflinger et al., 2021; Spychalska-Waszek et al., 2022, 2024), regardless of how conflicting they are. On the other hand, STEM being a masculine domain, the masculine identity and STEM may automatically warrant a higher overlap for men in STEM.

I expected that women in STEM face more conflict between their gender and professional identity goals compared to men, due to the societal expectations placed on them. Despite this, many women strive to pursue both their femininity and their STEM identity goals at the same time. If they possess a high level of identity overlap, they may experience fewer feelings of imposter syndrome, as their sense of authenticity and belonging in both identity goals is strengthened. therefore, I hypothesized that identity goal overlap moderates the relation between gender and imposter syndrome i.e., women with higher overlap will report lower imposter syndrome as compared to women with lower overlap; overlap will not affect men's report of imposter syndrome (H_{10}).

4.2.1. Method

4.2.1.1. Design and Participants. Data for Study 6 was collected via convenient purposive sampling from the UK as a cross-sectional research design. It was collected once at a single point in time, and comparisons were made between groups (e.g., men and women

in STEM). Demographics, identity goal overlap via the sense of belonging and group identification, and imposter syndrome were measured. For a statistical power of $1-\beta = .80$ at the .05 significance level, a sample size of $N = 387$ was needed to detect effect sizes $f \geq .14$ (Faul et al., 2007). A total of 400 participants including $n = 198$ women and $n = 202$ men working in STEM from the United Kingdom entered Prolific.Co (Palan & Schitter, 2018) in exchange for £2 for a 15-20 minute survey. See Table 4.1 for the demographic details.

Table 4.1

Gender Differences in Demographic Variables

Demographic Characteristics	Females ($n = 197$)	Males ($n = 202$)
Age (Years)	$M = 29.66$ ($SD = 7.21$) Range = 18-61	$M = 29.51$ ($SD = 7.61$) Range = 20-59
Field of Specialization		
Science	69.7% ($n = 138$)	42.1% ($n = 85$)
Technology	11.6% ($n = 23$)	30.7% ($n = 62$)
Engineering	9.1% ($n = 18$)	21.8% ($n = 44$)
Math	2.5% ($n = 5$)	1.5% ($n = 3$)
Others	6.6% ($n = 13$)	4.0% ($n = 8$)
Chi-Square	$\chi^2(4) = 43.03, p < .001$	

Note: Table 4.1 shows the demographic breakdown of participants by gender, age, and field of specialization in STEM. The results indicated a significant association between gender and STEM subdisciplines, that gender significantly influences the choice of field within STEM disciplines.

4.2.1.2. Procedure. Participants in this cross-sectional study were recruited through the Prolific online platform. After expressing informed consent, participants completed an online survey that contained demographic information, including gender and age, as well as their field of specialization within STEM, identity goal overlap, and the measure of imposter syndrome. Upon completion of the survey, the data were analyzed as per pre-defined hypotheses. The Internal Faculty Board of the institution approved the experimental procedure (Decision 02/E/04/2024). The hypotheses of the study were pre-registered on a public database AsPredicted (no. 176271, see appendices). Data sets and analysis files for

the study are available at:

https://osf.io/6cvp8/?view_only=396a154f85f6495c8d5c9b0c2a6b6c3d

4.1.2.3. Measures.

Gender. The prolific database provides the opportunity to already filter the participants as per research needs. Therefore, through the preset system, the study was set on equal distribution of gender i.e. men or women. Upon entering the Qualtrics survey, participants were once again asked “*Please confirm your gender affiliation*” with the option of Male or Female. From a sample of 400, $n = 198$ women and $n = 202$ men working in STEM from the United Kingdom entered Prolific.Co (Palan & Schitter, 2018).

Identity Goal Overlap. Similar to empirical studies in Chapter 3, the overlap was measured with the same method and formula. A version of overlap was created for men and women for gender identity and then for the STEM professional identity for both reasons i.e. sense of belonging and group identification. Identity goals overlap based on a sense of belonging (Roccas, 1997; as cited in Tartakovsky, 2002, 2009, 4 items) was measured with a 7-point Likert scale (0 = *strongly disagree* to 6 = *strongly agree*), i.e., 8 items of sense of belonging as a feminine woman and STEM professional for women, and 8 items of sense of belonging as a masculine man and STEM professional for men. Identity goals overlap based on a group identification (Cameron, 2004, 12 items, 4 reverse coded) was measured 7-point Likert scale (0 = *strongly disagree* to 6 = *strongly agree*), i.e., 24 items as a feminine woman and STEM professional for women, and 24 items as a masculine man and STEM professional for men.

The overlap via a sense of belonging scale had a median score of 0.97 and a mode of 1. The distribution was negatively skewed (skewness = -2.83) with high kurtosis (kurtosis =

10.08). Scores ranged from 0.24 to 1, with a variance of 0.012. For group identification overlap, the median score was 0.94, and the mode was 1. The group identification scale showed a skewness of -1.63 and kurtosis of 3.15. Scores ranged from 0.63 to 1, with a variance of 0.004. For more details on the measures see Chapter 3, measures section.

Imposter Syndrome. The main dependent variable of the study was measured via the Imposter Syndrome Scale (Clance IP Scale; Clance, 1986, 1978) measures the degree to which an individual experiences the feelings that their achievements are undeserved and worries that they are likely to be exposed as fraud with 20 items; 7-point Likert scale (0 = *strongly disagree* to 6 = *strongly agree*). The sample items of the scale were; *“I have often succeeded on a test or task even though I was afraid that I would not do well before I undertook the task. I can give the impression that I’m more competent than I really am. I avoid evaluations if possible and have a dread of others evaluating me. When people praise me for something I’ve accomplished, I’m afraid I won’t be able to live up to their expectations of me in the future. I sometimes think I obtained my present position or gained my present success because I happened to be in the right place at the right time or knew the right people. I’m afraid people important to me may find out that I’m not as capable as they think I am”* and so on. The mean score on the scale was $M = 4.67$ ($SD = 1.06$) and Cronbach’s alpha of the scale was $\alpha = .93$.

4.2.2. Results

Imposter Syndrome and Gender Differences. An independent samples t-test was conducted to examine gender differences in levels of imposter syndrome. The results indicated a significant difference between men ($M = 4.40$, $SD = 1.03$, $n = 202$) and women ($M = 4.94$, $SD = 1.02$, $n = 198$), $t(398) = -5.23$, $p < .001$. The mean difference was -0.54

with a 95% confidence interval ranging from -0.74 to -0.34 . Cohen's $d = .53$ (medium effect size). This suggests that women reported significantly higher levels of imposter syndrome compared to men. These results were consistent with the pre-registered hypothesis (H_8).

Identity Goal Overlap and Gender Differences. Due to the distribution of identity goal overlap scores on the sense of belonging (skewness = -2.83 , kurtosis = 10.08) and group identification scales (skewness = -1.62 , kurtosis = 3.15), non-parametric Mann-Whitney U test (Mann & Whitney, 1947) was used as a nonparametric test that compares two groups on both overlap reasons. Table 4.2 shows the details of the analyses;

Table 4.2

Gender Differences in Identity Goal Overlap

Identity goal overlap reasons	Men ($n = 202$)		Women ($n = 198$)		U - test	(2-sided test) p
	Median	Mean Rank	Median	Mean Rank		
Sense of belonging	0.96	172.42	0.97	211.08	22034.00	.001
Group identification	0.93	184.55	0.95	214.60	22789.00	.009

The results for an overlap-based sense of belonging indicated that men reported lower levels of overlap as compared to women indicating a statistically significant difference between genders. Similarly, for group identification, men again reported lower levels of overlap than women. rank-biserial effect sizes for this test were $r = 0.54$ for a sense of belonging and $r = 0.55$ for group identification, suggesting a medium to large effect, indicating a meaningful difference in identity goal overlap between men and women.

More importantly, these results were opposite to the initial assumptions (H_9) that women will have lower identity goal overlap as compared to men. On the contrary, it was found that women reported a higher overlap between their gender and STEM professional identity goals.

Association between Identity Overlap and Imposter Syndrome. Before examining the third hypothesis (H_{10}), for preliminary analysis, a Spearman correlation was conducted to examine the relationships between variables. There was a significant negative correlation between the group identification overlap and imposter syndrome $r_s = -.124, p = .007, n = 398$ and no relation between a sense of belonging overlap and imposter syndrome $r_s = -.068, p = .092, n = 383$. When examined among men only, there was a significant negative correlation between the group identification overlap and imposter syndrome $r_s = -.183, p = .005, n = 200$ and sense of belonging overlap and imposter syndrome $r_s = -.142, p = .025, n = 189$. Whereas, among women, there was a significant negative correlation between the group identification overlap and imposter syndrome $r_s = -.125, p = .040, n = 198$ and no relation between sense of belonging overlap and imposter syndrome $r_s = -.083, p = .126, n = 194$.

Additionally, there was a significant positive correlation between a sense of belonging and group identification overlap $r_s = .411, p < .001, n = 382$ overall, $r_s = .459, p < .001, n = 188$ among men, and $r_s = .320, p < .001, n = 194$ among women.

Identity Goal Overlap as a Moderator between Gender and Imposter Syndrome. It was expected that identity goal overlap would moderate the relation between gender and imposter syndrome; i.e., women with higher overlap will report lower imposter syndrome than women with lower overlap; overlap will not affect men's report of imposter syndrome. Considering gender (dummy coding) as an independent variable, imposter syndrome as the dependent variable, and identity goal overlap as the moderator, the hypothesis (H_{10}) was as follows;

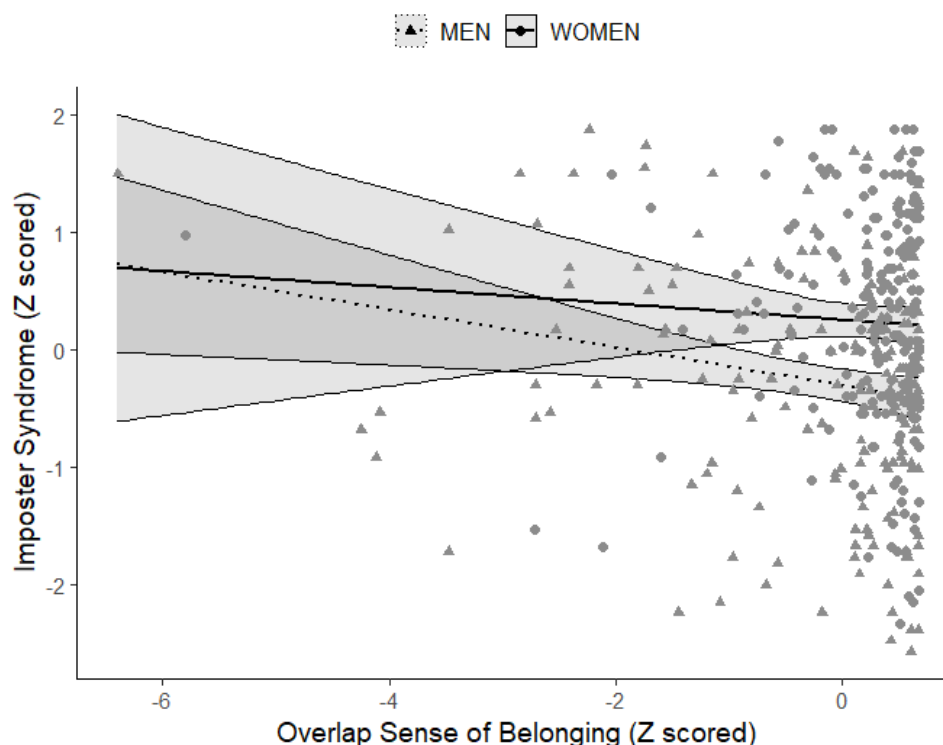
Moderation by Identity Goal Overlap Measured with the Sense of Belonging. The

analysis was performed using RStudio (2020) [package interactions 1.1.5 & ggplots 3.5.1 versions], and all variables were z-scored. The regression model revealed a significant overall model, $F(3, 378) = 11.41, p < .001$ with an R^2 of .083, indicating that approximately 8.3% of the variance in imposter syndrome can be explained by the model. The intercept was $\beta = -0.30, SE = 0.07, t = -4.22, p < .001, 95\% \text{ CI } [-0.44, -0.16]$, indicating the expected level of imposter syndrome for men at the mean level of overlap. Gender affiliation was significant, $\beta = 0.55, SE = 0.10, t = 5.47, p < .001, 95\% \text{ CI } [0.36, 0.75]$, suggesting that women reported significantly higher levels of imposter syndrome than men. Identity goal overlap was also significant a significant predictor, $\beta = -0.16, SE = 0.06, t = 2.67, p < .01, 95\% \text{ CI } [-0.28, -0.04]$, as overlap increased, levels of imposter syndrome decreased. However, the interaction term between gender affiliation and overlap was not statistically significant $\beta = .09, SE = 0.15, t = .78, p = .43, 95\% \text{ CI } [-0.14, 0.32]$, suggesting that the effect of overlap sense of belonging on imposter syndrome did not differ by gender.

Slope analysis (see Figure 4.1) was conducted to further explore the relationship between overlap and imposter syndrome for each gender. For men, the regression model indicated a significant negative relationship between overlap and imposter syndrome, $\beta = -1.57, SE = 0.59, t = -2.66, p < .01, 95\% \text{ CI } [-2.73, -0.41]$ indicating that increased overlap sense of belonging was associated with decreased imposter syndrome in men. For women, the relationship between overlap and imposter syndrome was not significant, $\beta = -0.67, SE = 0.97, t = -0.69, p = .49, 95\% \text{ CI } [-2.60, 1.25]$ suggesting that overlap did not significantly predict imposter syndrome in women.

Figure 4.1

Interaction of Gender and Overlap Sense of Belonging on Imposter Syndrome



Note: The interaction between Gender (moderator) and Overlap (IV) was not significant ($\beta = .09$, $p = .43$) on Imposter Syndrome (DV), and the slope is only significant for Men ($\beta = -1.57$, $p < .01$) and not for women ($\beta = -0.67$, $p = .49$) for this interaction model. Figure 1, shows that only men with high overlap scores have lower scores on imposter syndrome.

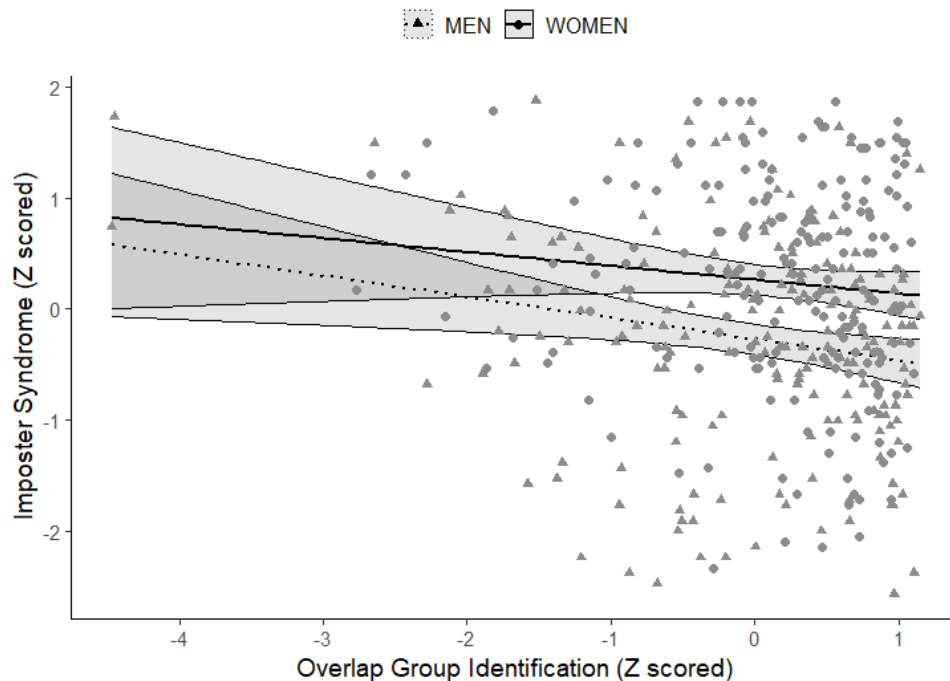
Moderation by Identity Goal Overlap Measured with Group Identification. The regression model revealed a significant overall model, $F(3, 378) = 11.89$, $p < .001$ with an R^2 of .086, indicating that approximately 8.6% of the variance in imposter syndrome can be explained by the model. The intercept was $\beta = -0.27$, $SE = 0.07$, $t = -3.90$, $p < .001$, 95% CI [-0.41, -0.14]. Gender affiliation was significant, $\beta = 0.54$, $SE = 0.10$, $t = 5.40$, $p < .001$, 95% CI [0.34, 0.73], suggesting that women reported significantly higher levels of imposter syndrome than men. Identity goal overlap was also significant a significant predictor, $\beta = -0.19$, $SE = 0.07$, $t = -2.63$, $p < .01$, 95% CI [-0.33, -0.05], as overlap increased, levels of imposter syndrome decreased. However, the interaction term between gender affiliation and overlap was not statistically significant $\beta = .07$, $SE = 0.11$, $t = .58$, $p = .56$, 95% CI [-0.16,

0.30]), suggesting that the effect of overlap group identification on imposter syndrome did not differ by gender.

Slope analysis (see Figure 4.2) was conducted to further explore the relationship between overlap and imposter syndrome for each gender. For men, the regression model indicated a significant negative relationship between overlap and imposter syndrome, $\beta = -0.20$, $SE = 0.08$, $t = -2.62$, $p < .01$, 95% CI [-0.35, -0.05] indicating that increased overlap group identification was associated with decreased imposter syndrome in men. For women, the relationship between overlap and imposter syndrome was not significant, $\beta = -0.13$, $SE = 0.09$, $t = -1.42$, $p = .16$, 95% CI [-0.31, 0.05] suggesting that overlap did not significantly predict imposter syndrome in women.

Figure 4.2

Interaction of Gender and Overlap Group Identification on Imposter Syndrome



Note: The interaction between Gender (moderator) and Overlap (IV) was not significant ($\beta = .07$, $p = .56$) on Imposter Syndrome (DV), and the slope is only significant for Men ($\beta = -0.20$, $p < .01$) and not for women ($\beta = -0.13$, $p = .16$) for this interaction model. Figure 2, shows that only men with high overlap scores have lower scores on imposter syndrome.

4.2.3. Discussion

Consistent with previous research (Fleischhauer et al., 2021), women in STEM reported to experience more imposter syndrome than men in the current study. This may be due to gendered differences combined with stereotypes, contributing to women's doubts about their abilities in STEM, a field that values systemizing and technical skills (Su et al., 2009; Archer, 2019; Reynolds et al., 2015; Cheryan et al., 2015).

The experience of imposter syndrome as a mismatch between women's gender vs. profession in STEM might indicate a potential conflict between both identity goals. This led to the original assumption (H_9) that women would have lower scores on identity goal overlap compared to men, considering the natural alignment between masculine identity and STEM. However, the results showed that women in this sample had significantly higher identity goal overlap. The possible reason for women having higher overlap is probably the mechanism of identity complexity and integration despite the conflicting nature of identity goals (Roccas & Brewer, 2002). Integration refers to the degree to which individuals can reconcile, merge, harmonize, and balance different aspects of their identity (e.g., social, cultural, or personal identities) into a coherent whole. Women in STEM may have developed a way to redefine and align both femininity and STEM. For instance, they may view feminine belonging and identification as enhancing, rather than diminishing, their STEM identity, fostering a high degree of goal overlap. Women who persist in STEM may possess strong resilience and coping mechanisms that allow them to balance (Ortiz-Martínez et al., 2023) multiple identity goals effectively.

On a more technical level, the observed distributions of sense of belonging and group identification overlap exhibited high negative skewness, indicating that most participants reported equally high levels of identity integration with both femininity and STEM, with

scores clustering near the upper limit (1). This pattern was further emphasized by the high kurtosis for a sense of belonging, reflecting a peaked distribution concentrated around high values, and the smaller variance in group identification overlap compared to the sense of belonging, suggesting even greater homogeneity in responses for the former. The limited range of scores, particularly the minimum of 0.63 for group identification, reinforces this interpretation, suggesting a sample already high overlap with both groups.

This study investigated whether high identity goal overlap mitigates imposter syndrome, specifically among women in STEM, by examining the interaction between gender (women vs. men) and overlap. The non-significant interaction effect suggests that while identity goal overlap, was associated with lower imposter syndrome overall, it did not significantly differentiate the experiences of men and women. This absence of a statistically significant moderation effect could be due to insufficient statistical power. It is possible that the hypothesized moderation effect exists in the population but was not observed in the present study due to limitations in sample size. A more detailed discussion of identity goal overlap, imposter syndrome, and the experiences of men and women working in STEM, is further elaborated in the next Chapter 5: General Discussion.

Chapter 5. General Discussion

Extensive prior research has documented the personal and professional challenges women face while pursuing STEM careers (Adikaram & Razik, 2022; Diekman et al., 2020; Ortiz-Martínez et al., 2023; Price et al., 2024; Women in STEM Statistics, 2022). A key issue highlighted in the literature is the perceived struggle between gender and professional affiliations for women in STEM (Cundiff & Vescio, 2016; Dasgupta & Stout, 2014; Eagly & Karau, 2002; Sassler et al., 2017; Skelly & Johnson, 2011; Smyth & Nosek, 2015). My research examines the simultaneous pursuit of both femininity and the STEM profession among women in STEM from an identity goals perspective.

Present dissertation focuses on the dual goal pursuit among women in STEM exploring concepts such as symbolic self-completion (Gollwitzer, 2018; Wicklund & Gollwitzer, 1982) and symbolizing via unifinal versus multifinal means (Kruglanski et al., 2015). The research contributes to developing a framework examining identity goals at its center, which are attained through symbols at lower hierarchical levels and overlap at higher levels via overarching reasons.

Like other identity goals previously investigated, such as parenthood (Doerflinger et al., 2021), religiosity and nationality (Spsychalska-Waszek et al., 2022, 2024), environmentalism (Longoni et al., 2014), and professionalism (Marquardt et al., 2016; Sciara et al., 2022), femininity and STEM professional goals fit within the theoretical framework of the symbolic self-completion theory, encompassing experiences of incompleteness, completeness and symbolizing.

5.1. Affective Consequences of Identity Goals In(Completeness)

In the studies in Chapter 2, findings showed that pride is experienced due to the state

of completeness, and guilt is experienced due to the state of incompleteness. More specifically pride is experienced more when both identity goals are met with success and guilt is experienced more when both are met with failure (Study 1). The observed relationship between emotional experiences and identity goal fulfillment can be attributed to the need to attain a state of completeness and maintain the goal pursuit.

When individuals successfully fulfill their identity goals (completeness), they experience pride as a reward for aligning actions with certain internalized values and societal expectations (Carver et al., 2010; Lewis, 2008; Sznycer, 2019). Pride, as an emotion tied to achievement, provides contentment and satisfaction (Tracy et al., 2009; Van Osch et al., 2018), often signaling that no further action is required. When women feel pride by experiencing completeness in their identity goals, they may attain a temporary sense of closure, with no further symbolizing requirement.

In contrast, incompleteness triggers guilt due to the perceived failure to attain the desired outcome for the goals' pursuit (Baumeister et al., 1995; Miceli & Castelfranchi, 2018; Tangney et al., 1996). Guilt is a negative emotion that serves as a psychological signal to address discrepancies between desired and current reality, prompting corrective actions to resolve the inconsistency (Castonguay et al., 2012; Lickel et al., 2014; Liss et al., 2013). Guilt motivates individuals to compensate for perceived failure and work toward achieving their identity goals. Spsychalska-Waszek et al. (2025) found that guilt mediates the relationship between religious identity goal incompleteness and symbolizing behavior. Previously, Spsychalska-Waszek et al. (2024) reported that individuals compensate for incompleteness in one identity goal by symbolizing another (religious into patriotic or vice versa).

When women in STEM felt incompleteness in one identity goal, they experienced guilt and then were given the opportunity to compensate in another identity goal. This resulted in a lower level of guilt and higher pride as compared to participants who were not compensating (Study 2). Compensatory actions following guilt can arise because individuals prone to guilt tend to adopt an approach-oriented response, seeking to make amends or correct their behavior (Sheikh & Janoff-Bulman, 2010). My research did not measure the effectiveness of symbolizing directly, instead, I examined the emotional outcomes when participants got the opportunity to symbolize or not. The affective outcomes especially compensation after guilt leading to pride align with Sheikh and Janoff-Bulman (2010), who found that guilt drives positive action and accountability. Applying to the women in STEM fields, feelings of guilt may motivate them to overcome challenges and strive for success despite systemic obstacles i.e. gender bias, lack of mentorship, workplace discrimination, poor work-life balance, underrepresentation, etc.

The relationship between pride and guilt in response to the (in)completeness of identity goals was not symmetrical. Guilt was significantly higher in cases of double incompleteness compared to single incompleteness. However, pride levels remained unchanged for women, regardless of the completeness in whether one or both identity goals (Study 1). The findings for guilt experience underscore the weight of failure when both critical aspects of identity are compromised. Prior research shows that guilt arises when individuals perceive a significant discrepancy between their ideal and actual selves (Lickel et al., 2014; Miceli & Castelfranchi, 2018; Tangney et al., 1996). There may be more intense guilt when incompleteness is experienced in two significant identity goals.

Pride is recognized as an emotion of resilience and recovery (Fredrickson, 2001). In

the context of identity goals, experiencing pride despite incompleteness in one domain suggests an ability to maintain positive emotions in the face of partial setbacks. A key factor in this process is the presence of multiple identity goals—when success is achieved in at least one, it may be enough to sustain positive emotions. This idea aligns with Roccas and Brewer's (2002) work on multiple identities, which was found to be positively linked to overall well-being. For women in STEM, pursuing both a STEM and femininity identity can serve as a psychological buffer, where completeness in one domain helps counterbalance incompleteness in the other. For individuals with integrated multiple identities, as seen in women navigating STEM and femininity simultaneously, the fulfillment of one identity goal may carry positive emotional spillover to the broader self-concept. Thus experience of pride as a consequence highlights the adaptive value of maintaining diverse, overlapping identity goals.

Moving on to Study 3 in Chapter 2, I attempted to examine the impact of double incompleteness vs double completeness on symbolizing via creative tasks such as decoration. I did not find any statistically significant differences. The basic concept behind the empirical examination was driven by Doerflinger et al., (2022) work that participants experiencing double incompleteness will engage more in a symbol that serves both goals (multifinal). While emotive mechanisms were not directly measured in this study, linguistic analysis of the writing samples revealed distinct emotional tones across conditions. Participants in the incompleteness condition expressed a negative emotional tone while completing the writing task for the experimental manipulation, whereas those in the completeness condition showed a positive emotional tone, consistent with prior research (Studies 1 & 2). Perhaps the lack of significant differences can be attributed to the following

possible reasons.

Experiencing completeness can create a positive mood that encourages engagement in certain tasks. Individuals who experience a sense of completeness may approach activities with positive affect and a certain degree of enthusiasm. He (2023) confirmed that positive emotional states can enhance motivation and creativity. When people feel good about themselves, they are more likely to put effort into activities that allow them to express their positive self-image (Waugh et al., 2018). In this context, participants with double completeness engaging in a decoration task may be seen as an opportunity to showcase feelings of pride and accomplishment.

Experiencing incompleteness and especially double incompleteness (with intensified guilt emotion as shown in study 1) can be the reason for the potential struggle to connect with the symbolizing task of decoration. This lack of connection likely stems from their perception that the task does not adequately reflect their identity goals' related setback. When individuals feel incomplete, they may be less motivated to engage in activities that seem irrelevant or superficial. Without meaningful symbols that resonate with their experiences, they might experience inaction or disengagement. To effectively symbolize, individuals need tasks that connect with their identity goals on a deeper level. However, if identity goals share similarities—and overlap using symbols that reflect both aspects could help in effectively symbolizing.

The above-discussed three studies examined states of (in)completeness, affective consequences, and compensatory symbolizing. A more complex and detailed design for future research may contain all components together. Emotions such as pride and guilt not only reflect individual experiences of success or failure but also act as drivers of actions

aimed at resolving discrepancies between identity goals and current realities. Future studies could explore how emotions like guilt and pride influence the type, intensity, and effectiveness of symbolizing efforts. For example, guilt in a STEM identity goal may lead to a certain type of symbolizing like working overtime or presenting research, to an increase in the intensity of their lab work or research efforts, and whether these efforts lead to tangible achievements or burnout on effectiveness level.

Emotions can be examined as potential mediators (Spychalska-Waszek et al., 2025). For example, future research might examine guilt between incompleteness and subsequent symbolizing and the role of pride as the cessation of further symbolizing in a completeness state. The asymmetry of emotions i.e. guilt only when double incompleteness is experienced whereas, pride even in single completeness (Study 1) may manifest in such mediation models. The pattern may become more complex when people focus on multiple identity goals at once versus just one, influencing how guilt and pride are experienced further leading to or hindering the symbolizing.

Additionally, the longitudinal approach spanning over weeks or months could provide valuable insights into how pride and guilt evolve as individuals work toward fulfilling their identity goals. Such research could examine whether guilt, arising from incompleteness, leads to immediate corrective symbolizing behaviors or whether these efforts are delayed until meaningful opportunities for symbolizing become available. Similarly, it could investigate whether pride, associated with completeness, remains stable or diminishes over time in the absence of continuous symbolizing.

5.2. Outfits as Symbols and Overlapping Identity Goals

When it comes to symbolizing via different symbols, studies 4 & 5 confirmed that

outfits may serve to symbolize the pursuit of these goals. Women in STEM can find symbols that serve either one or two of identity goals at the same time. I found that the preference for (Study 4) and evaluation of (Study 5) outfits as multifinal symbols was positively associated with identity goal overlap. When their identity goals overlapped, women in STEM showed a higher preference for multifinal symbols and evaluated their chosen outfits as multifinal. Identity goal overlap is an important constituent of the pursuit of multiple identity goals. Previous research explored two perspectives on identity goal overlap. One confirmed that overlap moderates cross-goal symbolizing, influencing the relationship between conflicting (Doerflinger et al., 2021) and facilitating identity goals (Spychalska-Waszek et al., 2024). The other posited that identity goal overlap is malleable and may depend on exposure to either multifinal or unifinal situations (Spychalska-Waszek et al., 2022). The present researcher found that overlap can influence the evaluation of multifinality versus unifinality.

In Study 5, higher overlap did not predict the choice of outfits that were evaluated as multifinal in Study 4. Apparently, there is no universal attire that represents the ideal match for symbolizing women in STEM who pursue both of the two identity goals. Previous studies have attempted to investigate what professional women should wear by examining others' judgments of women's professionalism based on neutral-colored, shapeless, field-oriented, or unisex outfits (Fasoli et al., 2018; Lower, 2018). However, this study showed that women in STEM might feel that a specific outfit serves both of the two identity goals, without having to adhere to a specific style, conventionally considered masculine, feminine, or mixed. The multifinality or unifinality of the choice appears to be subjective and rests in the eye of the beholder. Unifinal STEM outfits reflecting professional characteristics were

found to be easily distinguishable from unifinal feminine as well as multifinal outfits in both studies.

There are certain universal indicators to reflect gender via outfits, for example, aesthetics, shape, texture, form, and color (Buss, 2016). My research suggests that preference for such indicators might depend on identity goal overlap, but remains subjective and individual. Future research should explore whether identity goal overlap affects the number and intensity of these indicators, such as adding accessories to make an outfit multifinal. The customization of outfits (Clark & Rossi, 2020) to serve multiple identity goals appears to be a viable solution for addressing the gender gap in clothing (Bain, 2015). Preference and evaluation of an outfit as multifinal may create a more equitable approach to clothing choices for STEM professionals regardless of gender. Furthermore, examining the choices of multifinal outfits among men in STEM can serve as a reference group to distinguish the gender-related differences when it comes to using outfits as symbols.

In studies 4 & 5, women in STEM showed individual perceptions of outfits that they chose as symbols of femininity and or STEM profession. For instance, the outfit that was found to be unifinal STEM in Study 4 was perceived as multifinal in Study 5 by participants declaring higher overlap. It might seem paradoxical because the outfits express aspects of social reality and group norms. However, in line with Bellezza et al. (2014) group norms may be flexible enough to allow members of the group to express their individual identity. Moreover, nonconformist choices often signal autonomy and confidence (Bellezza et al., 2014). Hornsey and Jetten (2004) further described this as a strategy for seeking uniqueness within group membership. This opens a path for future research to explore factors like age, professional seniority, or subgroups within the larger group that might influence women's

comfort in using attire that does or does not match the conventional group norms.

Beyond masculinity-driven professionalism, *genius* or *nerd* are stereotypical traits associated with some STEM fields such as computer sciences (Cheryan et al., 2013), engineering (Ehrlinger et al., 2018), or physics (Johansson, 2020). These traits are often understood in pejorative terms such as socially awkward, introverted, and unattractive (Ehrlinger et al., 2018; Starr & Leaper, 2024). While present research focused on general professional and feminine attire in STEM, future studies could explore how women in STEM balance these identity goals by examining whether e.g., *nerdiness* is visible in specific attire such as an ungroomed T-shirt, lab coat, scrub, or construction gear. Nonetheless, testing preference for outfits that express nerdiness might pose a challenge in the sense that especially women are motivated to avoid associations with unattractiveness and social awkwardness. These characteristics clash with stereotypically female domains that is physical attractiveness and social skills (Star & Lipper, 2024). A potential approach to addressing this challenge is to examine fashion preferences linked to *nerd* or *geek* culture—a subculture associated with science and fandoms such as *Star Trek* (McCain et al., 2015). This subculture may serve as an identity goal in itself, yet it likely shares significant overlap with STEM professional identity. For STEM women committed to a feminine identity goal, geek culture offers an additional layer of symbolic representation. These women may use outfit choices strategically to balance and express their feminine, professional, and geek identity goals.

Future research could explore how the evaluation of multifinal symbols and multifinality changes based on context. For example, a woman in STEM might choose different symbols and accessories depending on the situation. In a high-stakes work meeting,

she may opt for a formal outfit, heels, and dark-toned colors to project professionalism and authority. In contrast, for a casual team lunch, she might select soft-tone colors, loafer shoes, and minimal accessories to foster connection and approachability. These shifts highlight how situational factors, such as formality, audience, and desired outcomes, can influence the selection and interpretation of symbols that represent various identity goals.

5.3. Overlapping Identity Goals and Imposter Syndrome

Identity goal overlap between feminine and STEM identities, was central to Study 6, investigating its potential to buffer against imposter syndrome—a frequent obstacle for women in male-dominated STEM environments. Women in STEM report higher levels of imposter syndrome compared to their male counterparts. This disparity can be attributed to gender-based differences and pervasive stereotypes, which often undermine women's confidence in their abilities within STEM fields—domains traditionally associated with systemizing and technical expertise (Archer, 2019; Cheryan et al., 2015; Fleischhauer et al., 2021; Reynolds et al., 2015; Su et al., 2009).

Moreover, the experience of higher imposter syndrome can be due to the stereotype threat (Steele & Aronson, 1995; Shih et al., 2011). A frequently experienced situation where underrepresented individuals such as women feel pressured by the possibility of being adversely judged by prevailing negative gender and/or racial stereotypes associated with STEM. This is manifested as a fear of confirming the negative stereotypes of being a woman and not competent enough in STEM, which may heighten the feeling of imposter syndrome (Tomasetto & Appoloni, 2013). Additionally, the lack of relevant role models, especially females in STEM exacerbates these feelings, and women feel that they do not belong adding to imposter experiences (Bravata et al., 2020).

Contrary to the initial assumption, women reported higher identity goal overlap as compared to men. Previously it was found that women with supportive mentors or networks in STEM maintain their womanhood and STEM simultaneously (Dasgupta & Stout, 2014). Social support could facilitate higher goal overlap by helping women feel they can pursue both identities without compromise (Ortiz-Martínez et al., 2023). Some women in STEM might strategically frame their femininity as compatible with, or even beneficial to, their STEM roles. For instance, they might emphasize soft skills, such as empathy or communication, that are often associated with femininity but also valuable in STEM, thus reinforcing a sense of identity goal overlap.

The hypothesis that identity goals' overlap moderates the relationship between gender and imposter syndrome was not supported; no significant interaction effect was observed. This absence of a significant moderation effect is worth further investigation. Several potential explanations warrant consideration. First, despite having sample size sufficient to detect the main effects, the study may have been underpowered to detect the hypothesized interaction in moderation. Moderation analyses often require larger sample sizes to achieve adequate statistical power (Memon et al., 2019; Schmidt & Hunter, 1978). An even larger sample size may reveal an undetected statistically significant interaction in the present study.

Second, the lack of variance (high kurtosis and left skewness) of identity goal overlap scores may have limited its potential to function as a moderator. For a variable to effectively moderate a relationship, it must exhibit sufficient variance to influence the independent-dependent variable link across its spectrum differentially (Mishra et al., 2019). The limited variability observed in identity goal overlap scores may have constrained its

capacity to modulate the gender-imposter syndrome relationship.

While the interaction was non-significant, both main effects (gender and identity goal overlap) on imposter syndrome were significant. Intriguingly, post-hoc analysis revealed a significant association between high identity goal overlap and reduced imposter syndrome specifically among *men*. This finding can be considered in the direction that men in STEM fields often experience greater congruence between their masculine and professional identities (Schmader et al., 2008). This congruence may reduce the need to actively integrate these identities, potentially mitigating imposter syndrome. Furthermore, men in STEM may experience less stereotype threat compared to women, further diminishing barriers to identity integration and potentially reducing imposter feelings (Schmader et al., 2008).

In contrast, women in STEM may face a greater challenge in aligning their feminine and professional identities due to prevailing societal expectations and stereotypes (Diekmann et al., 2020; Eagly & Carli, 2007; Miner et al., 2018; Skelly & Johnson, 2011). Even with high overlap, women may still experience scrutiny and judgment for not fully conforming to traditional STEM or feminine norms. This persistent scrutiny could weaken or negate the potential protective effects of overlap against imposter syndrome.

It is plausible that additional moderating variables, such as social support or stereotype threat, play a crucial role in understanding the complex interplay between gender, identity goal overlap, and imposter syndrome among women in STEM. Future research should explore these factors to elucidate the underlying mechanisms contributing to the persistent imposter experience, particularly for women. As Leonhardt et al. (2017) suggest, imposter syndrome is a dynamic phenomenon influenced by both state and trait factors,

which should be considered in future research designs.

For women in STEM, carrying femininity and professional identity often carries a heavier emotional and cognitive burden due to societal expectations and stereotypes (Diekmann et al., 2020; Eagly & Carli, 2007; Miner et al., 2018; Skelly & Johnson, 2011). Even when they achieve high identity overlap, women may still feel judged for not fully aligning with traditional STEM norms or feminine expectations. It is possible and warrants the exploration of the underlying mechanism that this persistent and pervasive scrutiny may weaken or diminish the potential protective effects of overlap against imposter syndrome.

Belonging and group identification are crucial for motivation and well-being (Baumeister & Leary, 1995; Pickett et al., 2004; Umberson et al., 2010ab; Wakefield et al., 2017), but they may not fully protect women in STEM from imposter syndrome due to persistent institutional and cultural biases (Adikaram & Razik, 2022; Smyth & Nosek, 2015; Steinke, 2017). Women, often seen as tokens that represent their entire gender in STEM, face intensified scrutiny and undervaluation (Glass et al., 2013; Kanter, 1977). Even with strong identity overlap, societal biases persist, fostering self-doubt and limiting the protective effects of identity alignment. Therefore, identity goal overlap alone may not be sufficient to reduce imposter syndrome.

Nevertheless, overlap via belonging equally high to womanhood and STEM (Diekmann et al., 2017) can bring women in STEM closer to their in-group thus creating a more secure and stable environment to thrive. The challenges that women experience due to their femininity and the pursuit of masculinized professions (Alzaabi et al., 2021; Simon et al., 2017) may be reduced by seeing multifinality in solutions and enhancing overlap based

on a sense of belonging and group identification. Future research might explore whether multifinality resolves some of the problems that women in STEM face, such as the recurring question of proving their efficacy in STEM yet maintaining their femininity. For example, a woman in STEM might use social media to showcase both her research achievements and personal interests, such as fitness or family, or as a team leader, she may blend assertiveness with empathy, meeting leadership expectations while expressing a nurturing feminine side.

5.4. Limitation of the Dissertation

The research in this dissertation is subject to certain limitations that should be discussed when considering the broader applicability of its findings. First of all, does being born a woman/female inherently imply femininity? This highlights a gap in the present research, as femininity was not concretely operationalized, leaving room for ambiguity in how it was measured and understood. The sample consisted of individuals who self-identified as "*women/female*" during recruitment and later confirmed this in demographic questions. However, it remains unclear whether participants perceived themselves as traditionally feminine women pursuing a career in a male-dominated field or whether their gender identity and professional aspirations were shaped by more egalitarian views. Future research could benefit from comparing women in STEM who align with more traditional gender roles versus those who embrace more egalitarian perspectives. Such a comparison could provide deeper insights into the complexities of dual identity goal pursuit and how different conceptualizations of femininity influence experiences in STEM fields.

Women in STEM represent a niche sample, and their recruitment was facilitated through an online platform Prolific with an existing participant database. This resolution raises two key concerns. Firstly, it is unclear whether individuals who voluntarily enroll in

such platforms are truly representative of the broader population of women employed in STEM worldwide. Their self-selection into research studies may introduce bias, limiting the generalizability of the findings. Secondly, there is the issue of whether participants' choices and engagement in experimental tasks reflect real-world decision-making. While hypothetical scenarios allow for controlled examination of behaviors, they may not fully capture the complexities of real-life choices, where social and professional pressures come into play. Observational methods that track real-world decisions would provide more ecologically valid insights than self-reported preferences. Real-life decisions may intensify the experienced conflict between identity goals, making the tension between feminine and professional identity goals more pronounced. Nevertheless, the choices made in a hypothetical setting were still informative in assessing the relationship between outfit perception as a symbolic expression and identity goal overlap.

My research has a substantial reliance on quantitative methodology, including experimental and cross-sectional designs. While quantitative methods offer the advantage of statistical rigor, objectivity, and generalizability, they may not fully capture the depth and complexity of how women in STEM operationalize their identity goals related to femininity and their professional roles. Prior research (Marx, 2017) in STEM has often employed qualitative methodologies, which allow for a richer exploration of personal narratives, lived experiences, and the subjective meaning individuals attach to their identities. A qualitative approach—such as in-depth interviews or focus group discussions—could provide deeper insights into how women see femininity and STEM from the identity goal perspective and what overlapping reasons and means they can identify from their day-to-day lives, encouraging them to pursue both goals simultaneously.

Previous research has established experimental manipulations as a valid method for inducing (in)completeness (i.e. recall task, Doerflinger et al., 2021; Sychalska-Waszek et al., 2024). While I conducted linguistic examinations to indirectly verify whether participants experienced (in)completeness, these analyses do not provide direct evidence that the manipulation successfully induced the intended psychological state. The extent to which (in)completeness was truly elicited remains an open question across studies 1, 2, and 3. There is a possibility that participants may have already begun to experience a sense of compensation while engaging in the manipulation task. For example, writing about past failures might trigger cognitive or emotional processes that help participants affirm their identity, inadvertently mitigating the intended sense of incompleteness. This raises concerns about whether the manipulation genuinely captures the psychological experience of incompleteness or if cognitive reappraisal or self-affirmation is influencing the results. Future research should explore more direct and objective measures, such as physiological or behavioral indicators, to assess the effectiveness of (in)completeness inductions and ensure their robustness across experimental conditions.

This research dissertation primarily relies on short-term data collection, ranging from single-time-point measurements to studies with a maximum gap of one week. While these methods effectively capture associations, trends, and immediate outcomes through experimental manipulations, they are limited in assessing the long-term impact of identity goal overlap over months or years. In contrast, longitudinal research would offer a more comprehensive perspective by tracking participants over time, allowing for a deeper understanding of how identity goals are pursued and how overlap evolves. Such studies could provide valuable insights into whether individuals seek identity completeness

continuously or if achieving it once is sufficient. Additionally, longitudinal data could examine the role of symbolic means in this process—whether individuals repeatedly rely on the same symbols for completeness or if they adapt and employ new ones over time. Furthermore, this approach could shed light on the long-term effects of identity goal overlap on women's experiences with imposter syndrome in STEM fields, revealing whether sustained overlap helps mitigate feelings of self-doubt or if fluctuations in identity alignment contribute to ongoing challenges. By capturing these dynamic processes, longitudinal research would enhance our understanding of identity goal management and its implications for career development and psychological well-being in STEM contexts.

The research did not examine a technical yet key aspect of identity categorization—whether women in STEM perceive themselves as belonging to two distinct identity groups (femininity and STEM) or as part of a unique, hybrid identity that integrates both. For example, bicultural and multiracial individuals, such as Asian-Americans are often seen as members of a distinct hybrid identity category (Cheng et al., 2006). Similarly, it remains unclear in this dissertation whether women in STEM experience their identities as a dual affiliation—where femininity and STEM are distinct yet coexisting—or as a singular, blended identity that forms a new social category. Future studies should explore this possibility, as recognizing a hybrid identity could have important implications for the perception of multifinality and symbolizing.

Finally, a significant limitation is the lack of diversity within the sample of women in STEM, particularly in age, career stage, and cultural context. For example, individuals at different career stages—such as early-career professionals versus those with extensive experience—may face distinct challenges and have different perspectives on symbolizing

perception, and choice of symbolic means and identity goal overlap. Similarly, the experiences of individuals from various age groups or cultural backgrounds may differ significantly, influencing how identity goals are seen in the workplace. For example, a younger woman in STEM might feel pressure to prove her competence and often face challenges related to gender stereotypes. In comparison, an older woman in the same field might experience identity goal conflict around balancing professional identity with evolving personal or familial responsibilities. Cultural background also plays a role; a woman from a collectivist culture and or non-western, educated, industrialized, rich, and democratic (WEIRD) might place greater emphasis on group harmony and family expectations, potentially shaping her identity goals differently than a woman from an individualistic culture, who may prioritize personal career success and self-expression in her professional role. Future research should aim to include a more diverse sample to explore how these factors interact and to enhance the external validity of the findings.

5.5. Conclusion

Pursuing multiple identity goals is inherently demanding, requiring effective symbolizing and a degree of overlap between these goals to facilitate the process. In six empirical studies, I attempted to examine the simultaneous pursuit of feminine and professional identity goals among women in STEM. The findings indicate that when women experience failures in one identity goal resulting in negative affective consequences, they often compensate through success in the other, and experience positive affective consequences. Symbols, such as outfits that are perceived to reflect both femininity and professionalism are associated with having a higher identity goal over belonging and identifying to both femininity and the STEM profession. The research also revealed that

women in STEM experience higher identity goal overlap and imposter syndrome as compared to men. The presented dissertation developed an elaborative framework with overlap, identity goals, and symbolizing means integrating the theoretical perspective of the symbolic self completion and the goal systems theories.

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Appendices (in the subsequent PDF files)

1. Preregistration: 2.4. Study 2 Identity goal compensation and emotions (As predicted no. 156958)
2. Preregistration: 4.2. Study 5 Overlapping identity goals among STEM employees and imposter syndrome (As predicted no. 176271)
3. Permission of artistic content usage from the artist: 2.5. Study 3. Identity goal (in)completeness and symbolizing (email correspondence)

CONFIDENTIAL - FOR PEER-REVIEW ONLY**STEM Women, emotions and identity goals. SWPS University, January 2024 (#156958)**

Created: 01/05/2024 04:30 AM (PT)

This is an anonymized copy (without author names) of the pre-registration. It was created by the author(s) to use during peer-review.
A non-anonymized version (containing author names) should be made available by the authors when the work it supports is made public.

1) Have any data been collected for this study already?

No, no data have been collected for this study yet.

2) What's the main question being asked or hypothesis being tested in this study?

This study will examine the affective consequences of compensating incompleteness with completeness among feminine women in STEM disciplines. We expect that incomplete women, who will get a chance to experience completeness (compensation) will report less negative emotions, guilt, and more pride than those who will not get a chance to experience completeness afterward.

3) Describe the key dependent variable(s) specifying how they will be measured.

Participants will be asked to assess the intensity of their currently experienced emotions using a 7-point Likert scale (1 = strongly disagree to 7 = strongly agree). They will be instructed to rate which degree, at that very moment, they were experiencing specific emotions such as guilt, pride, and PANAS short form scale (Thompson, 2007). Emotion i.e. guilt, pride, and PANAS will be measured three times as follows;

- 1- (t0) Baseline measurement
- 2- (t1) After a single identity goal (in)completeness
- 3- (t2) Post manipulation

4) How many and which conditions will participants be assigned to?

Participants will be randomly assigned to 4 experimental conditions, in a 2 x 2 x 3 design with compensation (possible vs. not possible) and identity goal incompleteness (STEM incomplete vs. Feminine incomplete) as between-subject variables and affective outcomes as within-subject variables (t0, t1, t2). Incompleteness will be induced by recalling the failures in the field of STEM and as a feminine woman. Whereas, compensation will be induced by recalling the accomplishments and success in the field of STEM and as a feminine woman. Data will be collected via convenient purposive sampling from STEM.

5) Specify exactly which analyses you will conduct to examine the main question/hypothesis.

We will use repeated measures ANOVA along with independent t-tests to examine the differences across four manipulation groups and subsequent affective outcomes.

In case the data distribution extremely deviates from normal, appropriate nonparametric tests for the data analyses will be opted for.

6) Describe exactly how outliers will be defined and handled, and your precise rule(s) for excluding observations.

We will exclude participants, who do :

- (1) not from either of the disciplines i.e. STEM
- (2) not fulfilling the inclusion criteria (gender and age above 18)
- (3) not completing the attention checks i.e. captcha
- (4) not follow the instructions of the manipulation task
- (5) did take part in previous studies related to the same study variables and design

7) How many observations will be collected or what will determine sample size? No need to justify decision, but be precise about exactly how the number will be determined.

We will stop data collection once approximately 260 participants respond on the online platform [Prolific (Palan & Schitter, 2018)]. Any change in this regard would be due to the Prolific software in particular.

To calculate the number of participants, we assumed a partial eta of 0.02, along with an effect size of 0.142, an error probability of 0.05, and a power of .95 as per the previous similar study. Based on effect sizes found before, in four groups and three times measurement, a sample of $n = 260$ will be sufficient to attain the effect size $f = 0.142$ with a statistical power greater than $1 - \beta = .95$ (Faul et al., 2007).

8) Anything else you would like to pre-register? (e.g., secondary analyses, variables collected for exploratory purposes, unusual analyses planned?)

In addition to the main objectives. The following variables will be studied for exploratory purposes:

- 1- Commitment to feminine and STEM/professional identity goals
- 2- Identity goal overlap via the sense of belonging and group identification
- 3- Demographic variables (i.e., age, SES, marital status, etc).

For these variables, mean differences, correlation analyses, and analyses of covariates will be executed.

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Overlap and Imposter Syndrome - STEM, SWPS - May 2024 (#176271)

Created: 05/23/2024 03:35 AM (PT)

This is an anonymized copy (without author names) of the pre-registration. It was created by the author(s) to use during peer-review.
A non-anonymized version (containing author names) should be made available by the authors when the work it supports is made public.

1) Have any data been collected for this study already?

No, no data have been collected for this study yet.

2) What's the main question being asked or hypothesis being tested in this study?

This study will examine the differences between women and men working in STEM. We will examine the imposter syndrome (i.e., feelings that the achievements are undeserved and worries that the individual is likely to be exposed as a fraud) and identity goal overlap (i.e. perceived similarity between two identity goals based on a shared reason such as a sense of belonging and group identification) among these STEM samples. We propose the following hypotheses based on the literature (see footnotes);

1. We expect that women will have a higher level of imposter syndrome as compared to men.
2. We expect that women will have lower identity goal overlap as compared to men.
3. We expect that identity goal overlap moderates the relation between gender and imposter syndrome i.e., women with higher overlap will report lower imposter syndrome as compared to women with lower overlap; overlap will not affect men's report of imposter syndrome.

[Hyp1 - We proposed a directional hypothesis because, previously, (Bravata et al., 2020; Clance & Imes, 1978; Fleischhauer et al., 2021) demonstrated that women reported higher levels of imposter syndrome as compared to men. However, there are no differences between women and men in some studies as well (e.g., Bravata et al., 2020; Leonhardt et al., 2017).

Hyp2 - Identity goal overlap is a perceived similarity between two goals, regardless of how conflicting they are. We assume that women in STEM experience more goal conflict than men but despite this they pursue femininity and STEM simultaneously. If they manage to resolve the conflict and pursue both identity goals (high identity goal overlap) they should have lower feelings of being an imposter.

Hyp3 - We assume that women in STEM stereotypically are not considered good in STEM. Therefore, because of stereotype threat, they might experience more imposter syndrome. This is not the case for men, because the male stereotype does not threaten STEM-identity. Overlap would work as protective against stereotype threat for women because for those with high overlap, being a STEM person is not perceived as anti-feminine. But what does high overlap for men mean? If the male identity goal (e.g., I want to be super manly.) overlaps strongly with the STEM identity goal, could this mean, those men are more susceptible to stereotypes? Perceived masculinity could determine for these men, how overlap is related to the imposter syndrome.]

3) Describe the key dependent variable(s) specifying how they will be measured.

This study involves examining the following outcome variables

Outcome:

The Imposter Syndrome Scale (Clance IP Scale; Clance, P. R., 1986) measures the degree to which an individual experiences the feelings that their achievements are undeserved and worries that they are likely to be exposed as a fraud with 20 items; 7-point Likert scale (0 = strongly disagree to 6 = strongly agree).

4) How many and which conditions will participants be assigned to?

Data will be collected via convenient purposive sampling from the UK from women and men working in STEM. The study is correlational.

Predictor:

Gender; Men and Women (self-declaration of gender identity)

Moderator:

Identity goals overlap based on a sense of belonging (Roccas, 1997; as cited in Tartakovsky, 2002, 2009, 4 items) 7-point Likert scale (0 = strongly disagree to 6 = strongly agree), i.e., 8 items of sense of belonging as a feminine woman and STEM professional for women, and 8 items sense of belonging as a masculine man and STEM professional for men.

Identity goals overlap based on a group identification (Cameron, 2004, 12 items, 4 reverse coded) 7-point Likert scale (0 = strongly disagree to 6 = strongly agree), i.e., 24 items as a feminine woman and STEM professional for women, and 24 items as a masculine man and STEM professional for men.

5) Specify exactly which analyses you will conduct to examine the main question/hypothesis.

To test hypotheses 1 & 2 we will use t-tests across gender to examine mean differences in imposter syndrome and identity goal overlap, respectively.

To test hypothesis 3, a moderation analysis will be conducted to examine the moderating role of overlap on gender and imposter syndrome effects.

In case the data distribution extremely deviates from normal, appropriate nonparametric tests for the data analyses will be opted for.

6) Describe exactly how outliers will be defined and handled, and your precise rule(s) for excluding observations.

We will exclude participants, who are:

- (1) not from either of the disciplines, i.e. STEM
- (2) not fulfilling the inclusion criteria (other than from assigned countries, less than age 18)
- (3) not completing the attention checks, i.e. captcha
- (4) did take part in previous studies related to the same study variables and design

7) How many observations will be collected or what will determine sample size? No need to justify decision, but be precise about exactly how the number will be determined.

We will stop data collection once approximately 400 participants (fulfilling the inclusion criteria) respond on the online platform [Prolific]. Any change in this regard would be due to the Prolific software in particular.

For a statistical power of $1-\beta = .80$ at the .05 significance level, a sample size of $N = 387$ is needed to detect effect sizes $f \geq .14$.

8) Anything else you would like to pre-register? (e.g., secondary analyses, variables collected for exploratory purposes, unusual analyses planned?)

In addition to the main hypotheses and study variables. The following variables will be studied for control and exploratory purposes:

- 1- Commitment to feminine/masculine and STEM/professional identity goals
- 2- Self-concept clarity (Campbell et al., 1996); Personal well-being (Ryff & Keyes, 1995)
- 3- Contextual variables such as variables related to the work environment (i.e. governmental support, interaction with colleagues, etc.)
- 4- Demographic variables (i.e., age, SES, marital status, etc).

For these variables, mean differences, correlation analyses, and analyses of covariates will be executed.

**Uniwersytet
SWPS**

Sadia Zaman <szaman@st.swps.edu.pl>

Consent to use MeganLeeStudio Art work in Scientific Research

7 messages

Sadia Zaman <szaman@st.swps.edu.pl>

11 April 2022 at 12:20

To: meganleestudio@gmail.com

Cc: Hanna Spychalska-Waszek <hpsychalska-waszek@st.swps.edu.pl>

Hi Megan,

I hope this gets you in the best of health.

Me and my research team are inspired by your artwork especially related to the theme of 'WOMEN IN STEM'.

I am a PhD student and my research theme is examining different behaviours and choices of individuals who are in the STEM field.

I intend to use your artwork, how so;

in a simple study, I'll ask my participants some questions related to science i.e. do they find it challenging, do they feel independent and motivated and so on. Later on they will be provided with the images (art-work posters) and they have to select as per their knowledge and preference. Thus we will learn about their own background and their choices in the STEM field. Using the artwork is a creative and engaging way to involve participants.

It is important for my PhD research and my purpose is purely scientific and research related and it does not intend any kind of theft and unethical procurement of your artwork. I'll be citing and crediting the material I have used from your pages [facebook_meganleestudio](#) and [etsy_meganlee](#).

I want to use your artwork, especially posters of scientists' surname, field, logo and year in my research study.

I hope you'll consent to me using your artwork in my research.

Fingers crossed to have a positive response from you.

Regards,

SADIA ZAMAN

researchgate - Sadia-Zaman

SWPS University of Social Sciences and Humanities

Wroclaw - Poland

Megan Lee <meganleestudio@gmail.com>

12 April 2022 at 15:27

To: Sadia Zaman <szaman@st.swps.edu.pl>

Hi Sadia,

Thank you so much for your interest in my work! I'm so glad my art speaks to you and you can see a use for it in your research.

The way you want to use my art (to help engage people about science) is one of the many reasons I have spent a decade of my life creating it, and why I offer so many various ways to enjoy it.

As a woman in STEM, you must have had your fair share of people undervaluing your work, and I'm sure you understand why I do not want people to undervalue my work and use it for free. So no, you may not use my work without purchasing it.

I ship worldwide and I have art prints ("posters") ranging from 5"x7" - 30"x40", but my most budget-friendly option are my packs of postcards here: https://www.etsy.com/shop/meganlee/?section_id=

28444781

I'd love to help you out, so here is a coupon code for 10% off any order: HAPPY10 (just enter at checkout for it to be applied).

Let me know if I can help with any questions, and thank you for reaching out to me.

Best,
Megan

[Quoted text hidden]

--

Megan Lee (she/her)
Megan Lee Studio, LLC
<http://meganleestudio.com>

Sadia Zaman <szaman@st.swps.edu.pl>
To: Megan Lee <meganleestudio@gmail.com>

12 April 2022 at 16:00

Thankyou for your prompt response.
I totally understand and value your spirit regarding your work.

With the specifications of my research work, I may require a custom package, only a profile of the selective STEM scientists and since the study will be online in which participants choose the post card (just like in any website of commodity), so I may purchase the softcopy of the cards. Which will be used completely ethically just for this particular research and not at all for commercial purposes.

I'll get back to you with the custom order details.

Once again, thanks a million for corresponding with me.

sadia
[Quoted text hidden]

Sadia Zaman <szaman@st.swps.edu.pl>
To: Megan Lee <meganleestudio@gmail.com>

20 April 2022 at 13:38

Hi Megan,

How are you?

I am attaching the order. I need 26 different images (13 female and 13 male scientists).

I need them in soft copy (fine details and proportionate sizes, so i can use them in online research questions)
Please provide me an estimate of the amount in the form of invoice.

regards,
Sadia

[Quoted text hidden]

 **order.docx**
15K

Megan Lee <meganleestudio@gmail.com>
To: Sadia Zaman <szaman@st.swps.edu.pl>

20 April 2022 at 14:22

Hi Sadia,

I think there may have been some confusion due to wording. When you said "they will be provided with the images (art-work posters)" in your first email, I understood that to mean an in-person event with

physical items/art prints. That is why my work was to be purchased first.

If this is purely for short-term online research, with NO commercial purposes or physical items needed, I would allow you to use my art images as long as credit ("art via meganleestudio.com") is clearly labeled with any images, but you will have to use images you find on my website as I do not share my high resolution files with anyone.

- Megan

[Quoted text hidden]

Sadia Zaman <szaman@st.swps.edu.pl>
To: Megan Lee <meganleestudio@gmail.com>

20 April 2022 at 17:09

Oh I am so sorry for the confusion.
Let me try again.

This research work will be conducted online, I am a POLAND based PhD student.
I am using an online survey platform such as qualtrics. Question of research will be for e.g. as following:

Q: Please tell what the key field(s) of the following renowned scientists:

		
Type here ...	Type here ...	Type here ...

Last time, when I asked you, I meant to use your art-work in this form for my research. and of course your credits will be shown in my dissertation and acknowledgements, wherever pictures will be used.

The problem is that I found some images but not all of them (26 scientist I mentioned) and resolution varied as well.

Some pictures on the Facebook and Etsy page were very small and part of a big poster, thus the name or the year of the scientist was not visible.

That's why me and my research team are willing to purchase these images for our research project. Though hardcopy in paper form is of no use, but since it is your creative effort and if this is how i can continue my work, I can buy hardcopy and scan them for study purpose.
To be honest, the size 2"x 3.5" (magnet) or 3.3"x 2.17" (stickers) is good enough.

I totally understand your concern on resolution,
but here you can guide me, what should I do in such case.

I am sorry for this inconvenience.

sadia

[Quoted text hidden]

Sadia Zaman <szaman@st.swps.edu.pl>
To: Megan Lee <meganleestudio@gmail.com>

20 April 2022 at 22:16

Hi,
me again.

I found the images on facebook (thoroughly checked your entire gallery - once again bravo for your effort, persistence and dedication through these many years.)
Images are in good shape, they have your logo and the information is visible.
I can't thank you enough for being supportive and allowing me to use your precious work.
I assure you again that this will be credited to MeganLeeStudio and strictly used for research purposes without any commercial or unethical intent.

Thank you,
and I hope I can contact you if I need some help and feedback from an artist and designer's perspective.

12/12/24, 7:06 PM

Uniwersytet SWPS Mail - Consent to use MeganLeeStudio Art work in Scientific Research

regards,
sadia

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