UNIVERSITY OF OKLAHOMA

GRADUATE COLLEGE

A DYNAMIC, PERSON-CENTERED APPROACH TO EMOTIONS IN COMPLEX SKILL LEARNING: ANTECEDENT AND PERFORMANCE OUTCOMES OF TRAJECTORY PROFILES

A DISSERTATION

SUBMITTED TO THE GRADUATE FACULTY

in partial fulfillment of the requirements for the

Degree of

DOCTOR OF PHILOSOPHY

By

MADDISON NORTH
Norman, Oklahoma
2025

A DYNAMIC, PERSON-CENTERED APPROACH TO EMOTIONS IN COMPLEX SKILL LEARNING: ANTECEDENT AND PERFORMANCE OUTCOMES OF TRAJECTORY PROFILES

A DISSERTATION APPROVED FOR THE
DEPARTMENT OF PSYCHOLOGY

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In loving memory of my granny, Arline Rummell. Although you are not here to celebrate this milestone, your influence remains an indelible part of who I am. I strive to honor your memory through my faith in Jesus, my pursuit of education, and my love of reading. I am forever grateful for the time we shared and the impact you had on my life.

To my parents, Amy and David, and my sisters, Kennady and Reegan, there has been no greater blessing than being part of our family. Thank you for your unconditional love, constant support, and for celebrating every accomplishment—both big and small—along the way.

To my other family members, including but not limited to, Papa (Leon), Aunt Leanne, Uncle Jerry, Courtney, Brian, Carter, Beckett, and Baylor, who have watched me on this journey and encouraged me every step of the way. What joy it is to be known and loved by you!

To my dearest friends, both in and out of the program, thank you for cheering me on, letting me vent when needed, and helping me step outside of "grad school mode" every now and again.

And above all, I am grateful to God for His faithfulness throughout this journey.

Acknowledgements

There are many individuals I want to thank for helping me achieve this milestone. First, I am deeply grateful to my advisor, Dr. Eric Anthony Day, for his unwavering support, mentorship, and guidance throughout my graduate school career. It is due to Eric's encouragement, instruction, and example that I have grown into the researcher I am today. He has equipped me with the skills and confidence to take my next steps as a professor in academia, and I aspire to emulate the qualities he displays that define exceptionalism as a researcher, advisor, and instructor. I would also like to thank my committee members—Dr. Shane Connelly, Dr. Erin Freeman, and Dr. Stephanie Burge—for providing valuable feedback, thoughtful questions, and support throughout this process. In addition, I am grateful to Dr. Jane Silovsky and Dr. Alex Dopp, who have each served as mentors and provided opportunities to develop my skills as a researcher. Finally, I want to thank the members of my lab, my colleagues within the psychology department, and the friends I made throughout the program, all of whom provided encouragement, collaboration, and community. I am truly thankful to all who have supported me on this journey.

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Abstract

In modern workplace environments where dynamic performance demands are becoming commonplace, adaptive performance is critical for employee and organization success. Although emotions and shifts in emotion are recognized as important factors that relate to task performance, there is limited understanding regarding the dynamic interplay between emotions and adaptive performance. To investigate research questions surrounding emotion-performance relationships, researchers have primarily relied on variable-centered approaches, which seek to explain the relationship between variables at a population-level (Howard & Hoffman, 2018). However, these approaches do not account for nuanced experiences of emotion and assume affect patterns that are homogeneous across the population, leading to critical oversights in the scholarly literature. This dissertation builds theory on emotion-performance relationships by utilizing person-centered approaches, which can handle heterogeneity in multiple variables simultaneously to identify clusters of individuals with shared characteristics within a population (Howard & Hoffman, 2018; Woo et al., 2018). Emotion scores were collected repeatedly from participants across two samples of college undergraduates (N_1 = 303, 100% male; N_2 = 615, 52% male) while they engaged with a complex video game used in prior research on skill acquisition and adaptive performance (Hardy et al., 2014, 2024; Hughes et al., 2013). Growth mixture modeling, antecedent correlate analysis, and repeated measures ANOVA were used to identify and examine (a) profiles of emotion experiences that emerged during skill acquisition and adaptive performance, (b) factors that influence profile membership, and (c) the relationship between profile membership and performance. Distinct profiles with varied emotion trajectories were identified and characterized by their experience of greater positive emotions (e.g., happy, at ease), negative emotions (e.g., angry, anxious), or deactivating emotions (e.g., bored, calm, discouraged), with profiles that reported greater positive emotions performing best and profiles that reported greater negative emotions generally performing worst. Importantly, the person-centered approach leveraged in this study revealed a substantial proportion of individuals (over 60% across samples) experienced low emotional arousal following increases in task complexity, paired with moderate performance levels in adaptation relative to other individuals—a result variable-centered approaches have not uncovered. This work challenges simplistic valence-based models of emotion and provides novel insights regarding the dynamic and nuanced role of emotions in complex, high-demand performance environments. My findings advance emotion theory in performance contexts, particularly by clarifying the role of activation potential, how emotion trajectories inform emotion-performance relationship theory, and affective differences between acquisition and adaptation.

A Dynamic, Person-Centered Approach to Emotions in Complex Skill Learning: Antecedent and Performance Outcomes of Trajectory Profiles

Technological advancement, globalization, and demands for flexibility have created dynamic workplace environments where change should be expected (Park & Park, 2020; Pataki-Bittó & Kapusy, 2021; Trenerry et al., 2021). As such, adaptive performance, or the behaviors individuals engage when faced with change (Jundt et al., 2015), has become of greater research interest alongside efforts to ensure employee and organization success (Baird & Griffin, 2006; Park & Park, 2020; Trenerry et al., 2021). Adaptive performance has been accepted as particularly critical to an employee's general performance in work environments where changing or dynamic tasks are commonplace (Jundt & Shoss, 2023). As such, it is theoretically and practically important to consider underlying factors that affect an individual's ability to acquire skills, adapt following a change, and meet desired performance levels. It has long been established that emotions play important roles in task performance and productivity (Hersey, 1932; Weiss & Cropanzano, 1996; Nübold et al., 2020). In terms of adaptive performance, emotions likely influence the success and speed with which people adapt to job-related task changes (Jundt & Shoss, 2023). There is also evidence that changes in affect are critical to understanding behavior, performance, and well-being (Neal et al., 2023). Although recent findings have found affect change can be harmful for skill acquisition and adaptive performance (Li et al., 2021; North et al., 2024; Richels et al., 2020), other findings suggest the relationship between affect change and task performance may be positive or negative depending on the direction of the change (Yang et al., 2016). Despite recent empirical advances in the scholarly literature, researchers are far from a theoretical consensus regarding the dynamic interplay between emotions and performance, and adaptive performance in particular.

Research on affect as relevant for the workplace has primarily relied on variable-centered approaches, which seek to explain the relationship between variables at a population-level (Howard & Hoffman, 2018), parsing affect by valence (e.g., positive/pleasant versus negative/unpleasant affect) or focusing on specific discrete emotions and their relationship with work outcomes. These conceptualizations of affect do not fully account for nuanced experiences of affect (e.g., experiencing an array of emotions simultaneously) and assume affect patterns that are homogeneous across the population. It is thus possible the use of more traditional variable-centered approaches has led to important oversights in the research literature. Person-centered approaches are optimal for handling heterogeneity in multiple variables simultaneously, including their change over time, and identifying patterns that describe subgroups (i.e., clusters of individuals based on shared characteristics) within a population (Howard & Hoffman, 2018; Woo et al., 2018). By identifying subgroups or profiles based on similarity in patterns of emotion trajectories, and examining antecedents and outcomes of these profiles, a person-centered approach enables theory advancement and new empirical insights regarding affect (e.g., Gabriel et al., 2015).

Thus, the purpose of this dissertation is to provide a better understanding of emotion-performance relationships and build theory on the relationship between emotions, accounting for their dynamic nature, and adaptive performance by using a person-centered approach. My goals are to identify (a) profiles of emotion experiences (i.e., level of emotion domains and growth over time) that emerge during processes of skill acquisition and adaptive performance, (b) factors that influence profile membership, (c) how profile membership in acquisition is associated with profile membership in adaptive performance, and (d) associations between profile membership and performance.

Recent findings provide some theoretical guidance for how affect moves during periods of skill acquisition (Neal et al., 2023) and how movement in affect is related to work performance (Bledow et al., 2011; Yang et al., 2016). Neal et al. (2023) examined how the rate of change in performance towards achieving a performance goal affected change in affective valence and activation and found support for Russell's (2003) core affect theory which suggests that performance gains will shift affect toward a more positive state and poor performance gains or losses will move affect toward a negative state. Additionally, increases in task demands tend to create a more activated affective state, while decreases in task demands tend to foster a more deactivated state.

Although Neal et al. (2023) demonstrated that affect will change in predictable ways based on discrepancies in performance and goal attainment, it is common for individuals to function within work domains where goals are ambiguous. It is thus unclear whether affective trajectories will function in a similar manner as proposed by core affect theory when a performance goal is not in place. Additionally, the work from Neal et al. (2023) did not speak to how affect may move following changes in task demands that create increased complexity. I plan to address these gaps in the literature by examining what emotion trajectories emerge during engagement with a complex task and their relationship with adaptive performance in a setting where goals are ambiguous.

When examining the relationship between changes in affect (i.e., upshifts and downshifts in positive and negative affect) and work outcomes, Bledow et al. (2011) found that an upshift in positive affect was related to work engagement, and Yang et al. (2016) found that upshifts in positive *and* negative affect were beneficial for task performance. However, Bledow et al. (2011) and Yang et al. (2016) did not parse out the effect of activation potential, only including emotion adjectives in their assessment of affect that were more activating in nature (e.g., determined, alert, excited, nervous, upset). The inclusion of deactivating emotions likely would have revealed a more nuanced relationship between emotion change and work outcomes (cf. Jorgensen et al., 2021). Additionally, this previous work does not speak to performance differences that may exist between individuals with high stable positive affect and individuals that experience an upshift in positive affect, nor does it consider different rates of change. I seek to illuminate these gaps by examining emotion trajectories in affect, accounting for valence and activation, and comparing subgroups that emerge based on their relationship with performance. This work contributes to the broader research literature, advances theory, and builds on prior work by (a) determining if core affect theory predicts affect change in performance domains where goals are ambiguous, (b) delineating emotion trajectories, accounting for valence and activation, over periods of skill acquisition and adaptive performance, (c) comparing what individual differences predict (i.e., cognitive versus noncognitive traits) emotion trajectories, (d) examining how change or increases in task complexity may affect emotion experiences, and (e) developing a better understanding of the role of emotions in adaptive performance.

Empirical investigations that focus on trait affect, incidental emotions, or one-time measurements of emotion fail to capture the dynamic nature of emotion, underestimating the value of emotion as a predictor of learning and adaptive performance (Huang et al., 2014). Although needed, research that measures emotion experiences from a temporal perspective (i.e., emotion growth trajectories) is limited (Brondino et al., 2020; Nübold et al., 2020). To gather a better understanding of emotion-adaptive performance relationships, I examined the association between emotions and adaptive performance through a person-centered approach. This approach can account for the highly variable nature of emotions over time and the nuanced individual heterogeneity in the levels and types of emotions experienced across people within dynamic performance environments (Muthén & Muthén, 2000; Zheng et al., 2023). Across two samples, data were collected from undergraduate students (N_1 = 303 males; N_2 = 615 males and females) engaging with a complex computer game used in prior research on skill acquisition and adaptive performance (e.g., Hardy et al., 2014, 2024; Hughes et al., 2013). To gather insights regarding participants' adaptive performance, I leveraged a task-change paradigm (Lang & Bliese, 2009) such that the game became unexpectedly more complex halfway through the protocol, increasing task demands. Following profile membership identification, this research examined whether people shift between profiles following a change in task demands and determined whether profile membership predicts performance on a complex task. Growth mixture modeling was used for profile member identification of different emotion trajectories. I used antecedent correlation and logistic regression analyses to determine whether individual differences in cognitive and noncognitive traits changed the probability of being assigned to a certain profile. A Chi-square Test or Fisher's Exact Test using Monte Carlo simulation was used to examine the shift between profiles after participants experienced a change in task demands. Repeated measures ANOVA was used to determine how profile membership was associated with acquisition and adaptive performance. Identifying subgroups and defining their emotional trajectories may be beneficial for developing targeted interventions to improve learning processes and long-term performance (Cintron & Ong, 2024; Nübold et al., 2020; Zheng at al., 2023), such as emotion regulation training for those dealing with high intensity or fluctuations in emotions.

This work provides an exploratory yet comprehensive examination of emotion-performance relationships relevant for performance domains where individuals are learning new, complex tasks where unpredictable changes are likely. It addresses a key limitation of variable-centered research which cannot fully uncover the different emotion trajectories individuals experience during acquisition and adaptation. Using a person-centered approach, this study's findings indicate emotion experiences are more nuanced than positive versus negative distinctions, low emotional arousal is a common response following change, and emotion profiles differ in terms of their antecedents and performance outcomes.

Emotions at Work

Emotions are defined as brief, distinct states that are elicited in response to some form of stimuli or event (Grandey, 2008; Mulligan & Scherer, 2012; Nübold et al., 2020). Affect has been used as an umbrella term for mood, emotions, and feeling, or in reference to one's trait affectivity (i.e., stable emotional dispositions; Becerra & Campitelli, 2013; Grandey, 2008; Shockley et al., 2012). Emotions can be mapped onto a circumplex structure (referred to as the affect circumplex; Russel, 1980) with dimensions of valence (pleasure/displeasure or pleasant/unpleasant) and arousal (activation/deactivation potential; Barrett et al., 2007; Barsade et al., 2003; Jefferies et al., 2008; Neal et al., 2023). Emotions described as high in pleasure and high in arousal (e.g., excited, happy) are positive activating (PA), whereas emotions high in pleasure but low in arousal (e.g., calm, relaxed) are positive deactivating (PD). Emotions high in displeasure and high in arousal (e.g., angry, anxious) are negative activating (NA), whereas negative deactivating (ND) emotions are high in displeasure but low in arousal (e.g., bored, disappointed).

Although early workplace research subsumed emotions and affect within constructs such as job satisfaction, there has since been a proliferation of research that has expanded our understanding of emotion and its dynamic nature as it relates to work outcomes (e.g., motivation, leadership, performance, team dynamics; Ashkanasy & Dorris, 2017; Weiss & Cropanzano, 1996). Performance at work varies as a function of emotion (Weiss & Cropanzano, 1996), with emotions changing in response to events or stimuli in the workplace (Basch & Fisher, 2000; Hökkä et al., 2020; Nübold et al., 2020). Affective experiences can lead to behavioral responses or actions that are relevant for the triggering event (Becerra & Campitelli, 2013). This response is functional in its design to help individuals manage the complexities in their environments (e.g., attention, reasoning, decision making; Chaffer & Frasson, 2004; Taylor, 2001; Tyng et al., 2017). Although emotional information is prioritized when engaging with a task (Vuilleumier, 2005), the effect of this information on performance is not clear, with research suggesting it may be helpful, harmful, or nonconsequential (Weiss & Cropanzano, 1996). One perspective suggests that emotional information may be helpful by increasing arousal or spurring behaviors that help performance (Blanchette et al., 2014; Weiss & Cropanzano, 1996). Another perspective suggests that emotions are harmful by pulling attention and leaving fewer cognitive resources for task performance or leading to behaviors that are incongruent to effective task performance (Chaffar & Frasson, 2004; Ochs & Frasson, 2004; Weiss & Cropanzano, 1996). Alternatively, emotion dynamics may be epiphenomena, having little or no effect on performance (Weiss & Cropanzano, 1996).

Research on emotions as related to task performance typically takes a variable-centered approach (i.e., examining the relationship between variables of interest—emotions and performance—at a population level) to determine how emotions might be “good” or “bad” for performance. Findings through this lens tend to parse emotions by valence and suggest that positive emotions are beneficial and negative emotions are detrimental for performance (Pekrun, 1992; Shockley et al., 2012). Research on the relationship between emotions and performance suggests that positive affect is related to productivity, openness to new ideas, collaboration, and problem-solving (Fodor & Pintea, 2017; Fortunato & Williams, 2002; Graziotin, 2016; Hu & Kaplan, 2015; Isen, 2001). Conversely, negative affect is associated with lower supervisor ratings, increased task errors, and behaviors harmful to the organization (Chi et al., 2015; Jorgensen et al., 2021; Lester et al., 2022; Lin et al., 2014; Shockley et al., 2012). However, other empirical results have been mixed, inconsistent, or more nuanced (Jefferies et al., 2008; Martinent & Ferrand, 2015).

Given the often used valence-only distinction does not recognize that emotions are experienced concurrently (Nübold et al., 2020; Zheng et al., 2023) and fails to account for the role of emotional arousal (i.e., activating/deactivating), this conceptualization of affect may be too coarse, masking nuanced effects that likely exist (Barsade et al., 2003). Additionally, it is critical to note that emotions are not static. By definition, emotions change, culminating in patterned emotion trajectories reflected over time (Nübold et al., 2020; Weiss & Cropanzano, 1996). An overreliance on cross-sectional data (Nübold et al., 2020) that measures trait affect and/or incidental emotions (i.e., emotions experienced that are irrelevant to the task or are evoked prior to engaging with a task) fails to account for the dynamic nature of emotions (Ashkanasy & Dorris, 2017; Zheng et al., 2023) and their role at work. Although efforts have been made to examine the dynamic nature of emotions, with recent evidence suggesting that variability in affect is detrimental to performance, both in acquisition and adaptation (Li et al., 2021; North et al., 2024; Richels et al., 2020), the tendency to view affective dimensions separately or utilize single scores to denote variability (e.g., affect spin and pulse; see Kuppens et al., 2007) limits our understanding of the role emotional experiences play in performance.

Although events at work lead to work behaviors and attitudes mediated by the affective reaction to the work event (Weiss & Cropanzano, 1996), limited research has examined how integral emotions (i.e., emotions that are experienced in response to engagement with a task; Han et al., 2007) relate to performance (Li et al., 2021; Nübold et al., 2020). This needs to be remedied, as a relative paucity of research has indicated the effect of integral emotions on performance may be stronger or simply different than that of incidental emotions or trait affectivity (Hillebrandt & Barclay, 2017; Strasbaugh & Connelly, 2022; Summers & Duxbury, 2012). Thus, the role of emotions should be examined in ways that account for temporal effects (Ashkanasy & Dorris, 2017) while individuals are managing the various tasks in their environments.

Skill Acquisition and Adaptive Performance

Skill acquisition refers to the learning processes an individual engages to acquire the skills necessary to achieve a desired level of performance (Kanfer & Ackerman, 1989). Affect is tied with learning, as the learning process can evoke emotional responses and be influenced by emotions (D'Mello, 2013). Emotions may enhance or hinder learning by affecting behavioral and cognitive processes critical for learning such as attention, decision-making, memory retrieval, and reasoning (Chaffar & Frasson, 2004; Ochs & Frasson, 2004; Tyng et al., 2017). For example, emotions can narrow focus to assist with memory retrieval and spur task engagement (Pekrun, 2011). Alternatively, emotions can distract attention and on-task effort by increasing working memory load (Wagner & Heatherton, 2014), thus preventing individuals from focusing on task demands and effective learning strategies (Kanfer & Ackerman, 1989).

Following a change in the task environment, individuals will typically initiate a relearning process in response to the changes (Jundt et al., 2015; Niessen & Jimmieson, 2016). Adaptive performance refers to the behaviors an individual engages when faced with change, which can be focused on adaptive skills or strategies, interpersonal behaviors, or emotional behaviors (Jundt et al., 2015). As outlined in the process framework of adaptive performance by Jundt and Shoss (2023), individuals must be able to detect change, diagnose the nature of change, strategize on what to do, learn needed knowledge and skills, and perform. Individuals can progress across stages, revisit a previous stage, or exit the adaptation process (i.e., goal abandonment). Adaptive performance is complex and progress involves dynamic emotional, cognitive, motivational, and contextual self-regulatory components (e.g., emotions, stress, feedback, appraisals, and past adaptation experiences; Jundt & Shoss, 2023).

The role of affect in adaptive performance needs to be examined because change itself can be highly emotional (Jundt et al., 2015; Kiefer, 2002). Emotional processes are proximal self-regulatory inputs that likely play an integral role throughout adaptation (Jundt & Shoss, 2023). Emotions act as both inputs and outcomes of the adaptation process, which aligns with research on self-regulation, goal-related processes, and affect (Carver & Scheier, 1990). Research suggests that in the face of change, positive affect may be beneficial for processing greater information and generating more strategies, whereas negative affect may be distracting by pulling cognitive resources away from task demands (Jundt & Shoss, 2023). Change likely brings uncertainty and can be perceived as threatening, indicating potential loss and evoking an emotional response that harms one's ability to adapt and meet performance demands (Jundt & Shoss, 2023; Niessen & Jimmieson, 2016). Over time, dealing with continual change can deplete emotional and cognitive resources, harming one's ability to give attention or effort towards their adaptive performance and deal with their emotions or other distractions (Jundt & Shoss, 2023; Niessen & Jimmieson, 2016). Considering the dynamic nature of emotions and adaptive performance, there has been a call for researchers to examine emotion-change trajectories during phases of change to clarify the role of emotions in adaptive performance (Jundt & Shoss, 2023).

Taking a Person-Centered Approach

Person-centered approaches investigate subpopulations or unobserved latent groups that emerge based on variables of interest and the relationship between those subgroups with predictors, correlates, and/or outcomes (Howard & Hoffman, 2018; Ryoo et al., 2018). Typical person-centered data analysis methods include latent class analysis, latent profile analysis, latent transition analysis, and growth mixture modeling (Howard & Hoffman, 2018). These approaches can identify distinct subgroups or clusters of individuals within a population that share certain characteristics and their unobserved heterogeneous patterns (Huang et al., 2010). Thus, person-centered approaches can be leveraged to provide greater insights into the nuances or complexity that may exist but cannot be uncovered using variable-centered approaches, which look for patterns across a population. For example, Gabriel et al. (2015) found evidence for five emotional labor profiles with different predictors and outcomes, whereas the literature previously conceptualized emotional labor into two constructs of surface acting and deep acting. The present study utilized person-centered approaches that account for the temporal, evolving nature of emotions simultaneously (Nübold et al., 2020) to determine whether latent subgroups or profiles emerged based on patterns of emotion experiences in skill acquisition and adaptive performance. The profiles and their relationships with predictors, correlates, and outcomes of interest (i.e., performance) were then examined.

Emotion Profile Identification and Description

Although there is a lack of research using person-centered approaches to examine emotion trajectories over the course of skill acquisition and adaptive performance, researchers have begun to use these methods to study emotion trajectories, their causes, and their relationship with a variety of outcomes, such as emotion regulation, health markers, subjective well-being, problem-solving, and resilience (Brondino et al., 2020; Cintron & Ong, 2024; Moreno-Agostino et al., 2021; Zheng et al., 2023; Zhang et al., 2021). It is common for research to utilize an exploratory lens to identify profiles and describe the course of dynamic emotion trajectories (i.e., a description of the ways a trajectory may change, grow, or remain stable). However, the variety of methodological choices made by researchers is important to consider when making sense of any differences in the findings appearing in this burgeoning literature. For example, some have chosen to identify profiles of positive and negative subgroups separately (Brondino et al., 2020; Moreno-Agostino et al., 2021; Zhang et al., 2021), whereas others have considered what emotion trajectories or profiles may emerge when considering all facets of affect (Cintron & Ong, 2024). There have also been differences in measurement timeline, with varying choices to examine emotion trajectories across a day to a week to over a decade. Despite these differences, researchers typically identify two to four emotion profiles.

Brondino et al. (2020) and Zhang et al. (2021) explored the course of emotions over 1 week, measuring participants on a daily basis for ratings of experienced positive affect and negative affect (Brondino et al., 2020 examined positive affect only). Latent growth mixture modeling was used to identify profiles. Brondino et al. (2020) identified three profiles: “constantly high positive affect (PA),” “increasing PA,” and “decreasing PA.” Zhang et al. (2021) found evidence for five profiles: “constant high NA,” “slowly decreasing low NA,” “slowly increasing high PA,” “rapidly decreasing medium PA,” and “constant medium PA.” Cintron and Ong (2024) and Moreno-Agostino et al. (2021) examined emotion trajectories across the lifespan, measuring affect with a single measurement occasion every few years. Moreno-Agostino et al. (2021) identified four profiles: “modal” NA/PA and “worse” NA/PA, whereas Cintron and Ong (2024) identified three profiles: “improving” (increasing PA, decreasing NA), “deteriorating” (decreasing PA, increasing NA), and “flourishing” (high, stable PA, low, stable NA). Although the profiles identified through these studies may provide insight into what profiles may emerge in this research, trajectories of affect while engaged with a complex task wherein performance is salient will likely differ from that of routine life (Zheng at al., 2023). Thus, I sought to answer the following research questions regarding profile identification and description:

> *Research Question 1*: Are there different subgroup profiles that emerge based on emotion change and trajectory in periods of skill acquisition and adaptive performance when engaged with a complex task?
>
> *Research Question 2*: Do subgroup profiles differ in skill acquisition and adaptive performance?
>
> *Research Question 3*: How can emergent subgroups be defined in terms of (a) valence, (b) activation, and (c) emotion change and trajectory?

Antecedents to Profiles

Some of the prior studies also considered what factors are related to belonging to one profile over others. For example, Brondino et al. (2020) found that engaging in certain emotion regulation strategies was related to profile membership, such that individuals were less likely to belong to the increasing PA profile relative to the constantly high PA profile. Clear links between trait affect, personality, and emotions (Ashkanasy & Dorris, 2017; Revelle & Scherer, 2009) suggest that trait affect and personality may be related to profile membership. However, in the midst of complex task performance, cognitive variables such as general mental ability may also play a role in an individual’s emotional response (e.g., via emotion regulation; Peña-Sarrionandia et al., 2015). Thus, I developed research questions focused on whether certain antecedent cognitive and noncognitive variables are related to profile membership:

> *Research Question 4*: Are certain cognitive and noncognitive antecedent variables (e.g., prior task-relevant experience, general mental ability, trait affect, goal orientation, Big Five personality) related to profile membership?
>
> *Research Question 5:* How do cognitive versus noncognitive antecedents compare in the magnitude of their relationships to profile membership?
>
> *Research Question 6:* Do the relationships between antecedents and profiles in skill acquisition differ to those in adaptive performance?

It is appropriate to use an exploratory approach to identify potential covariates in studies such as this one where specific research hypotheses are not being tested (Huang et al., 2010). Although additional validation may be required, the findings may be used for future model specification.

Profile Stability and Changes from Acquisition to Adaptation

Considering the dynamic nature of affect, it may be possible that individuals shift between different emotion trajectory patterns. Research has only recently begun to examine changes in profile membership and what precipitates change. Zheng and colleagues (2023) examined discrete academic emotions and the profiles that emerged from students engaging in a clinical problem-solving task. Three profiles were identified: “curious-positive” (high levels of curiosity, pride, and enjoyment), “confused-negative” (high levels of confusion, boredom, and anxiety), and “medium–low” (moderate or low levels of all emotions). Curious-positive students maintained a relatively stable profile throughout the learning phases, whereas students in the confused-negative and medium–low groups exhibited specific transition patterns in their emotions. Martinent et al. (2018) followed students’ emotion profiles across intensive training (i.e., before, middle, and end of the training) and found four profiles: “high positive and low negative,” “moderate-high positive and low negative,” “moderate-high positive and negative,” and “moderate positive and negative.” Individuals in the high positive and low negative profile and the moderate-high positive and low negative profile were most likely to remain in their profile across learning phases. Students in the moderate-high positive and negative profile were more likely to shift to one of the other profiles. These findings highlight that shifts in affect trajectory profile membership may be expected and that individuals in certain profiles may be more prone to transition than others. Unexpected changes and increases in task demands, like those used in this study, evoke an emotional response (Ashkanasy & Dorris, 2017; Jundt et al., 2015; Kiefer, 2002). The changes in profile membership that occurred due to shifts in emotion trajectories between skill acquisition and adaptive performance were investigated using the following research questions:

> *Research Question 7*: Following an unexpected increase in task complexity, to what extent are there changes in profile membership (i.e., do individuals remain in or transition between latent groups)?
>
> *Research Question 8a*: Are there differences in the stability of membership between acquisition profiles when individuals face unexpected increases in task complexity?
>
> *Research Question 8b*: If so, what are the characteristics of these profiles that may contribute to changes in profile membership?

Performance Differences between Profiles

Profile membership may have consequences for outcomes of interest, such as when Cintron and Ong (2024) found that profile membership had implications for well-being and health outcomes, specifically mortality risk. They found that the “improving” group had the lowest mortality risk and the “deteriorating" group had the highest mortality risk. Although prior research has not used person-centered approaches to examine the relationship between emotions and performance, it is possible to leverage prior research using variable-centered approaches for guidance. Yang et al. (2016) examined the interplay of simultaneous upshifts and downshifts in positive and negative affect and found that simultaneous upshifts in positive and negative affect were beneficial for performance. Although positive affect is related to task motivation, Yang et al. (2016) argued that an upshift in positive affect may lead to complacency. However, if accompanied by an increase in negative affect, which is associated with greater focus, individuals will be in an ideal state for successful task performance. Bledow et al. (2011) posited a similar explanation when they found that upshifts in positive affect were related to work engagement if the increase in positive affect was after the individual reported higher levels of negative affect. It is important to note that Yang et al. (2016) and Bledow et al. (2011) only examined activating emotions, so it is unclear how shifts in deactivating emotions may be related to performance. Although I expect profiles characterized by positive and/or activating emotions will be related to task performance based on these findings, it is unclear how profiles that differ in their trajectories of positive and/or activating emotions will compare. For example, how is a profile characterized by stability in positive and/or activating emotions versus a profile characterized by growth in positive and/or activating emotions associated with performance or growth in performance? Additionally, although a shift in affect toward a more activating state should be expected following a change in task demands (Neal et al., 2023), which in turn may be related to adaptive performance, large shifts in affect trajectories have been found to be cognitively depleting and associated with poor performance (Frank et al., 2021). Since it was unknown what profiles would emerge (Research Questions 1-3), it was difficult to predict how profiles may be related to performance beyond stating broad expectations. Thus, I sought to answer the following research question:

> *Research Question 9*: Are certain profiles more positively or negatively related to performance?

Study Overview

This study utilized a person-centered approach to uncover unobserved latent groups, while accounting for the evolving nature of emotions, in skill acquisition and adaptive performance, and examined the relationship between profile membership and performance in acquisition and adaptation. Participants were tasked with learning how to play a first-person shooter computer game over a series of 14 sessions. When empirically investigating adaptive performance, it is beneficial to utilize a task-change paradigm that disentangles skill acquisition (i.e., initial performance gains), transition adaptation (i.e., performance loss following a task change), and reacquisition adaptation (i.e., performance gains following the task change as individuals relearn the required skills; Lang & Bliese, 2009). Game complexity was increased halfway through the sessions to examine periods of acquisition (pre-task change) and adaptation (post-task change). Participants provided self-reports of emotions between sessions. Growth mixture modeling was used to identify subgroups and repeated measures ANOVA was used to examine the effect of profile membership on performance.

As mentioned previously, this research expands prior work (i.e., Bledow et al., 2011; Neal et al., 2023; Yang et al., 2016) by examining how affect moves in performance domains where goals are ambiguous and following a change in task demands (i.e., adaptive performance). Other limitations I address include examining what cognitive and noncognitive factors may contribute to belonging to certain emotion profiles, utilizing a more precise measure of affect that encompasses greater space on the affect circumplex, and accounting for activation potential and valence simultaneously. I address these limitations by examining emotion trajectory course, cause, and consequence. Course refers to a description of the trajectories themselves, exploring the ways a certain trajectory may change, grow, or remain stable. An examination of trajectory cause encompasses investigating predictors that may contribute to profile membership. Finally, consequences refer to an examination of how these trajectories affect outcomes of interest.

Although the use of person-centered approaches has grown due to its ability to identify unobserved subgroups with moderate specificity, it is difficult to suggest whether the findings will generalize to broader subpopulation due to the unique attributes that may exist within the study sample (Howard & Hoffman, 2018). As such, it is critical to establish replicability in findings. I leveraged two samples to determine the robustness of the findings and whether the profiles and effects are replicable. The procedure, performance task, and measures are identical across both samples. Both samples were undergraduate students from The University of Oklahoma Psychology participant pool. Males and females comprised the second sample, whereas only males comprised the first sample.

Method

Participants

Participants were told that they would be playing a computer-based first-person-shooter video game in exchange for research credit in a psychology course and entry into a gift card drawing. No restrictions were placed on participants in Sample 1 beyond being a) male, b) 18 or older (or obtaining parental permission if under 18), and c) proficient in English. Sample 1 consisted of 303 male students (M_{age} = 19.4 years, *SD* = 1.94). One hundred eighty-six participants self-reported as White (61.4%), 31 Latinx (10.2%), 27 multiple ethnicities (8.9%), 25 Asian (8.3%), 13 Black (4.3%), 12 Native American (4%), five Middle Eastern (1.7%), and four preferred not to say (1.3%).

The restrictions for study participation were identical for Sample 2, aside for the exclusion of female participants. This sample comprised of 615 students (52.2% males): 342 White (55.6%), 71 Latinx (11.5%), 67 multiple ethnicities (10.9%), 44 Black (7.2%), 43 Asian

(7.0%), 18 Native American (2.9%), 11 Middle Eastern (1.8%), and 19 preferred not to say (3.1%); ages ranging from 18 to 36 (*M* = 19.12, *SD* = 1.82).

Performance Task

The performance task used in this study was Unreal Tournament 2004 (UT2004; Epic Games, 2004), which is a commercially available first-person shooter computer game used in previous research on complex skill acquisition and adaptive performance (e.g., Hardy et al., 2014, 2024; Hughes et al., 2013). UT2004 was selected as the performance task because it reflects the demands of a complex and fast-paced environment. It is also relatively easy to learn yet difficult to master, which allows a skill acquisition curve to be observed.

The objective of UT2004 is to destroy computer-controlled opponents (i.e., bots), while minimizing the damage to one's own character. While completing this objective each game, participants also have the opportunity to collect new weapons or resources (i.e., power-ups) to increase their character's health or offensive or defensive capabilities. When a participant's character is destroyed, the character reappears in a random location with the default weapons and capabilities. The game is designed as "every character for them self," which means that the computer-controlled bots were competing against each other, as well as the participant's character. Performance in UT2004 involves strong cognitive and perceptual-motor demands. Participants used a keyboard and mouse simultaneously to control their character, while also learning the strengths and weaknesses of different strategies and weapons and quickly deciding which to use in different circumstances.

Procedure

Upon entering the lab, participants were told that the purpose of the study was to investigate how people learn to play a dynamic and complex video game. Participants completed the study at individual computer stations and no more than six individuals participated at the same time. Participants completed an informed consent form, followed by a battery of self-report individual difference measures to collect antecedent variable information. Participants were told they would be entered into a performance-based lottery to win one of five $25 gift cards for each trial in which their score was in the top 50% of all study participants for that specific trial. Participants next watched a 15-minute training presentation on UT2004 which explained the game's basic controls, rules, and power-ups. This was followed by a 1-minute practice trial that was free of competing bots so participants could become familiar with the controls, display, and game environment without having to face any opponents.

Participants completed 14 training sessions, each consisting of two 4-minute trials (i.e., 28 trials total). The length of the trials was chosen based on previous research using UT2004 (Hardy et al., 2014, 2019, 2023). Performance across the trials was collapsed into 14 measurement sessions (i.e., an average of the performance across each pair of two trials).

To track emotions across time, participants completed self-report measures of state-based affect following each session. Since the same self-report measures were used throughout the study, the breaks between sessions were similar in length at approximately 2 minutes. There were two additional 4-minute breaks before Sessions 4 and 11. For the first seven sessions, participants competed against two bots which were set to a difficulty level of 5 on a 1-to-8 scale. After the 7th session (i.e., the halfway point), several task demands changed without any warning, designed to prompt reactive adaptation due to an increased task complexity (Hughes et al., 2013). Participants had to compete against nine bots at a difficulty setting of 6. In addition, the game environment (i.e., the game map) was much larger, with more open spaces, multiple levels of platforms, and edges that could lead to player character destruction if they were to fall.

Task characteristics for the pre- and post-change trials were similar to those used by Hardy et al. (2014). Participants were debriefed following the 14th session.

Measures

Emotions. After each session of gameplay participants' emotions were measured using a 16-item version of the Positive and Negative Affect Schedule which was adapted for this study (PANAS; Watson et al., 1988). The 16 different emotions varied in valence and arousal/activation, measuring four different areas of affect: positive activating (PA; enthusiastic, excited, happy; mean coefficient alpha: Sample 1 = .97, Sample 2 = .97), positive deactivating (PD; ease, calm, relaxed; mean alpha: Sample 1 = .96, Sample 2 = .97), negative activating (NA; angry, anxious, frustrated, irritated, tense, uneasy; mean alpha: Sample 1 = .98, Sample 2 = .98), and negative deactivating (ND; bored, disappointed, discouraged, fatigued; mean alpha: Sample 1 = .97, Sample 2 = .97). Participants responded to each word on a 9-point Likert scale (1 = *very slight/not at all*, 3 = *a little*, 5 = *moderately*, 7 = *quite a bit*, 9 = *extremely*).

Antecedents. Self-reported ACT scores (Sample 1: *M* = 26.20, *SD* = 4.08; Sample 2: *M* = 24.23, *SD* = 7.09) were used as a measure of general mental ability (GMA). Prior task-relevant experience (i.e., video game experience) was measured using a 4-item scale to gather information about participants pre-training video game knowledge. Utilizing a 5-point Likert scale (1 = *not at all*, 2 = *rarely, just a few times*, 3 = *monthly*, 4 = *weekly*, 5 = *daily*) for the first two items, participants responded to: (a) "Over the last 12 months, how frequently have you typically played video/computer games?" (Sample 1: *M* = 3.69, *SD* = 1.17; Sample 2: *M* = 2.93, *SD* = 1.40) and "Over the last 12 months, how frequently have you typically played first-person shooter video/computer games (e.g., Call of Duty, Half-Life, Halo, Unreal Tournament, etc.)?" (Sample 1: *M* = 3.02, *SD* = 1.28; Sample 2: *M* = 2.24, *SD* = 1.25). The following two items asked participants how many hours per week they play (a) video/computer games (Sample 1: *M* = 7.27, *SD* = 7.86, min. = 0.00, max. = 35.00; Sample 2: *M* = 4.74, *SD* = 6.87, min. = 0.00, max. = 43.00) and (b) specifically first-person shooter video/computer games (Sample 1: *M* = 3.84, *SD* = 5.48, min. = 0.00, max. = 30.00; Sample 2: *M* = 2.28, *SD* = 4.95, min. = 0.00, max. = 42.00). The scores for these items were standardized and averaged into a prior videogame experience score.

Goldberg's 100 Unipolar Markers (Goldberg, 1992) was used to assess The Big Five personality dimensions. Using a 9-point Likert scale, with anchors at (1) *extremely inaccurate* and (9) *extremely accurate*, participants rated a list of 100 common human traits as to how accurately they described the participant. The five factors were made of 20 items each, with a scale score consisting of the average of their corresponding item scores. Trait goal orientation was assessed using a 13-item scale with items from Baranik et al. (2007) and VandeWalle (1997). Participants responded to each item using a 5-point Likert scale (1 = *strongly disagree*, 5 = *strongly agree*). A trait performance-approach (PAp) item was, "I like to show that I can perform better than my peers." A trait performance-avoidance (PAv) item was, "I would avoid taking on a new task if there was a chance that I would appear rather incompetent to others." A trait mastery-approach (MAp) item was, "I am willing to select a challenging task that I can learn a lot from." Trait affect was assessed using the same 16-item version of the PANAS to measure emotions, but participants were prompted to indicate how often they feel the emotions on average. I also assessed sex in Sample 2 as prior research has demonstrated differences in prior video game experience and performance (Hopp & Fisher, 2017). Sex was measured through self-report.

Performance. Following the formula as described by Hardy et al. (2014, 2019, 2024), task performance scores were calculated by taking the number of kills (i.e., number of times a participant destroyed a bot), divided by the quantity of kills plus deaths (i.e., the number of times a participant themselves is destroyed), plus player rank (i.e., the participant's rank relative to the bots within the trial). These scores were then multiplied by 100 to increase the ease of interpretability. A single performance score for each session was calculated by taking the average score for both trials in that session.

Analyses

Testing for Emotion Profile Identification and Description

Using Mplus, growth mixture modeling (GMM) was used to identify and model latent subgroups that exhibit unique trajectories of growth or change over time (Jung & Wickrama, 2008). Each model used 1000 sets of starting values with 100 iterations. I compared models with one profile up to eight profiles. Four model selection techniques were used to inform appropriate model selection and number of profiles: Akaike information criterion (AIC), Bayesian information criterion (BIC), entropy, and the Lo-Mendell-Rubin likelihood ratio test (LMR). The AIC and BIC indicate better model fit if their value decreases when adding an additional profile. Entropy examines the classification quality of the model and provides a value from 0 to 1, with a value closer to 1 suggesting a clear distinction between profiles. A value of 0.8 and above is acceptable (Bigelow et al., 2024; Tein et al., 2013; Wang & Bodner, 2007). The LMR test compares models, such that the 2-profile model is compared to the 1-profile model, the 3-profile model is compared to the 2-profile model, and so on and so forth. If the results of the LMR are significant, it suggests that the addition of a profile improves model fit. Although indices such as the AIC, BIC, entropy, and LMR can be insightful for determining best model fit, it is also critical to consider theoretical rationale, precedent, and what is conceptually viable (Howard & Hoffman, 2018). I took the following steps when selecting the best model or amount of profiles: (1) confirmed which model solutions converged (i.e., the best loglikelihood value was replicated), (2) compared models by fit indices (entropy, AIC, BIC, LMR), and (3) considered whether there was anything theoretically of value in other models beyond what was indicated to be best by the fit indices. When comparing models by fit indices, I relied strongly on entropy's threshold value and the BIC, preferring its conservative nature for this exploratory study. Prior to accepting the candidate model, I examined the models iteratively by creating individual line graphs for each profile using their intercept and slope values of PA, PD, NA, and ND emotions to ensure the profiles were distinct and theoretically of value.

Following the identification of profiles of emotion trajectories over time, it is critical to test for measurement invariance (MI) to ensure the stability of the measurement model (Ryoo et al., 2018). Measure invariance was formally tested across models of skill acquisition and adaptive performance, respectively, by comparing three models that were progressively more constrained: (1) configural invariance; all parameters are freely estimated, (2) metric invariance; factor loadings are constrained across profiles, and (3) scalar invariance; factor loadings and intercepts are constrained across profiles. Comparisons across models were by AIC and BIC values.

Testing for Antecedents to Profiles

After identifying profiles in acquisition and adaptation, and following procedures outlined by Bigelow et al. (2024) and Klotz et al., (2018), antecedent correlate analyses were conducted in Mplus with the R3STEP command. This process runs a series of multinomial logistic regressions to determine whether increases in certain variables are related to an increased or a decreased probability of profile membership (Asparouhov & Muthén, 2014). I examined whether there were relationships between profile membership and various individual difference characteristics (i.e., GMA, video game experience, Big Five personality, goal orientation, trait affect).

Testing for Profile Stability and Changes from Acquisition to Adaptation

To examine the relationship between profile membership in skill acquisition and profile membership in adaptive performance, and compare profile stability and change, contingency tables of membership in skill acquisition and adaptive performance were created. Chi-square tests were conducted to compare observed frequencies to expected frequencies. If criteria for conducting a chi-square test were violated (e.g., more than 20% of the cells had expected frequencies less than 5) a Fisher's Exact Test was used.

Testing for Performance Differences between Profiles

SPSS was used to perform separate repeated measures ANOVAs to examine differences in performance across skill acquisition and adaptive performance, accounting for time and profile membership. The within-subjects factor was time (i.e., the first seven sessions for skill acquisition; the latter seven sessions for adaptive performance). Profile membership was the between-subjects factor.

Sample 1

Results

General descriptives (i.e., means, standard deviations, correlations) of variables of interest, including internal consistency reliabilities, for Sample 1 are listed in **Table 1**.

Emotion Profile Identification and Description

Growth Mixture Modeling (GMM) was used to: (1) discover whether different subgroup profiles emerge based on emotion change and trajectory (Research Question 1), (2) determine if profiles differ across periods of skill acquisition and adaptive performance (Research Question 2), and (3) define profiles by valence, activation, and emotion change and trajectory (Research Question 3). **Table 2** lists the fit indices comparing models from one up to eight profiles during periods of skill acquisition and adaptive performance. When examining the fit of the different model solutions, I considered models with two to five profiles as being viable solutions due to the model solutions converging and holding entropy values above 0.8. I then compared the models by their AIC, BIC, and LMR values. **Figure 1** depicts elbow plots comparing AIC and BIC of models. In addition to comparing these fit indices, I examined these models iteratively in graphic form to determine if the addition of each additional profile provided anything theoretically of value. The BIC indicated that the best fitting model was the three-profile model in skill acquisition and the four-profile model in adaptive performance. Upon close examination of the different profiles, I determined these models provided theoretically relevant differences than the proceeding models. To ensure the characteristics of the identified profiles can be explained by the observed items over time, I tested for longitudinal measurement invariance across a series of models that became more constrained (i.e., configural, metric, and scalar invariance models). AIC and BIC values indicated that measurement invariances held for the three-solution model in acquisition and the four-solution model in adaptation.

The three profiles that were identified in acquisition and their unique emotion trajectories are displayed in **Figure 2**. **Table 3** provides the intercept and slope values for these trajectories. The first profile (4%) represents individuals that had low, stable positive activating (PA) emotions, low positive deactivating (PD) emotions that sharply increased over time, moderate negative activating (NA) emotions that sharply decreased over time, and moderate, stable negative deactivating (ND) emotions. In an effort to keep the various profiles and their properties salient and memorable, I label and refer to these profiles using popular Disney characters. Thus, the first profile is referred to as "Beast" from *Beauty and the Beast* moving forward due to this character's experience of high negative activating emotions (e.g., anger, frustration) that decrease over time and low positive deactivating emotions (e.g., calm, content) that increase over time (Trousdale & Wise, 1991). The second profile (24%) distinguishes participants that had moderate PA emotions that decreased over time, moderate, stable PD emotions, high NA emotions that slightly increased over time, and moderate ND emotions that increased over time. Henceforth, I refer to the second profile as "Scar" from *The Lion King*, as this character is known for his increasing negative emotions (e.g., boredom, disappointment, anger) and low positive emotions (e.g., happy, relaxed; Allers & Minkoff, 1994). The third profile (72%) is characterized by moderate PA emotions that slightly decreased over time, moderate PD emotions that slightly increased over time, moderate NA emotions that slightly decreased over time, and low ND emotions that slightly increased over time. I refer to this profile as "Mary Poppins," since this is a character that is calm, steadily cheerful, and low in negative emotions (e.g., fatigue, anxiety; Stevenson, 1964).

Four profiles were identified in adaptive performance. The emotion trajectories of these profiles are displayed in **Figure 3** and **Table 4** provides the intercept and slope values for these trajectories. The first profile (10%) represents individuals with high PA emotions that slightly decreased over time, moderate PD emotions that slightly increased over time, low NA emotions that slightly decreased over time, and low ND emotions that slightly increased over time. I refer to this profile, which is unique from the profiles identified in skill acquisition, as “Judy Hopps” from *Zootopia*, due to the character’s propensity to experience high positive emotion and very low negative emotions (Moore et al., 2016). Participants in the second profile (67%) had low PA emotions that slightly decreased over time, moderate PD emotions that slightly increased over time, low NA emotions that slightly decreased over time, and moderate ND emotions that slightly increased over time. The emotion trajectories of this profile are different to those found in skill acquisition. I refer to this profile as “Eeyore” from *Winnie the Pooh* due to this character’s tendency to experience emotions that are deactivating in nature, regardless of valence (e.g., bored, calm; Anderson & Hall, 2011). The third profile (8%) is characterized by low, stable PA emotions, low PD emotions that sharply increased over time, moderate NA emotions that decreased over time, and moderate, stable ND emotions. I refer to this profile as “Beast,” since the pattern of emotion trajectories matches the Beast profile identified in skill acquisition. The fourth profile (15%) distinguishes participants that experienced moderate PA emotions that slightly decreased over time, moderate PD emotions that slightly decreased over time, moderate NA emotions that increased over time, and high ND emotions that increased over time. Due to this pattern of emotion trajectories matching the Scar profile identified in skill acquisition, I also refer to this profile as “Scar.”

GMM results provide answers to my first three research questions. Research Question 1 asked whether different subgroup profiles emerge based on emotion change and trajectory in periods of skill acquisition and adaptive performance. Yes, different subgroup profiles emerged. Three profiles were identified in acquisition and four profiles were identified in adaptation. Research Question 2 asked whether profiles differed across periods of acquisition and adaptive performance. Although two similar profiles were identified in acquisition and adaptive performance (i.e., Scar, Beast), yes, there were differences in the profiles that emerged in acquisition and adaptation. The Mary Poppins profile that emerged in acquisition was not found in adaptive performance and two new profiles emerged in adaptation—i.e., Judy Hopps, Eeyore. Research Question 3 sought to define profiles by valence, activation, and emotion change and trajectory. A description of the profiles is above and graphs of the emotion trajectories in acquisition and adaptive performance can be found in **Figures 2** and **3**, respectively. In general, profiles differed as a function of mean intercept values of PA, PD, NA, and ND emotions as well as the extent to which different emotion trajectories did or did not exhibit increasing or decreasing values. In acquisition, there was a profile that exhibited greater, increasing negative emotions (i.e., Scars), a profile that exhibited greater, stable positive emotions (i.e., Mary Poppins), and a profile that had a sharp shift in NA and PD emotions (i.e., Beasts). The profiles that emerged in adaptation tended to show larger differences as a function of valence as well as a profile that showed a marked activation contrast. With respect to valence, the differences between positive and negative emotions for Judy Hopps in adaptation were larger than they were for Mary Poppins in acquisition. Although Scars emerged in both acquisition and adaptation, the difference in mean levels between negative and positive emotions was larger in adaptation than in acquisition. The Eeyore profile that emerged in adaptation showed a marked contrast of higher deactivating emotions versus lower activating emotions.

Antecedents to Profiles

After identifying profiles in acquisition and adaptation, the next step was to (1) examine whether there were differences in profile membership by individual difference characteristics (i.e., GMA, video game experience, Big Five personality, goal orientation, trait affect; Research Question 4), (2) compare relationship magnitudes of cognitive and noncognitive antecedents with profile membership (Research Question 5), and (3) determine whether there were differences in the relationships between antecedents and profiles in skill acquisition versus antecedents and profiles in adaptive performance (Research Question 6).

Skill Acquisition. Results of the antecedent correlate analysis, which can be used to determine whether increases in certain variables are related to an increased or decreased probability of profile membership (Bigelow et al., 2024), are displayed in **Table 5**. **Appendix A (Table A1)** compares means and standard deviation of antecedent variables by profile and provides Cohen's *d* of antecedent variables between profiles in skill acquisition.

***Cognitive Antecedent Variables*.** Participants in the Beast (0.19; $OR = 0.83$, $p = 0.02$; $d = 0.71$) or Mary Poppins (−0.09; $OR = 1.09$, $p = 0.03$; $d = 0.35$) profiles were more likely to have higher GMA compared to Scar. Participants from the Mary Poppins profile were more likely to have greater video game experience than those in the Scar profile (−0.60; $OR = 1.82$, $p = 0.02$; $d = 0.43$).

Noncognitive Antecedent Variables. Participants in the Scar profile were more likely to score higher in extraversion than those in the Mary Poppins profile (0.35; $OR = 0.71$, $p = 0.03$; $d = 0.05$). Those in the Scar (−0.84; $OR = 2.32$, $p < 0.001$; $d = 0.67$) and Mary Poppins (−0.94; $OR = 2.56$, $p < 0.001$; $d = 0.85$) profiles were more likely to score higher in agreeableness than participants in the Beast profile. Participants in the Mary Poppins profile were more likely to score higher in emotional stability than those in the Scar profile (−0.87; $OR = 2.39$, $p < 0.001$; $d = 0.60$), and higher in openness to experience than those in the Beast profile (−0.99; $OR = 2.69$, $p = 0.01$; $d = 0.78$). Conscientiousness scores were not significantly different across profiles.

In terms of goal orientation, participants belonging to the Beast profile were more likely to have a higher performance avoidance orientation than those belonging to the Scar (1.04; $OR =$

0.35, $p = 0.02$; $d = 0.44$) or Mary Poppins (1.10; $OR = 0.33$, $p = 0.01$; $d = 0.71$) profiles, and were more likely to have a higher mastery approach orientation than those in the Scar profile (1.11; $OR = 0.33$, $p = 0.04$; $d = 0.18$). Participants in the Scar profile were more likely to have greater performance approach orientation than participants in the Mary Poppins profile (0.57; $OR = 0.56$, $p = 0.02$; $d = 0.33$).

Findings for trait affect indicate that individuals in the Scar (−0.66; $OR = 1.93$, $p = 0.02$; $d = 0.84$) and Mary Poppins (−0.64; $OR = 1.90$, $p = 0.03$; $d = 0.76$) profiles were more likely to have higher PA trait affect than those in the Beast profile. Participants belonging to the Scar profile were more likely to have greater NA trait affect than those in the Mary Poppins profile (0.81; $OR = 0.45$, $p < 0.001$; $d = 0.92$). Participants across the profiles did not differ by trait PD or trait ND affect.

Adaptive Performance. Results of the antecedent correlate analysis are displayed in **Table 6**. **Appendix A (Table A2)** compares means and standard deviation of antecedent variables by profile and provides Cohen's *d* of antecedent variables between profiles in adaptive performance.

***Cognitive Antecedent Variables*.** There were no differences in general mental ability or video game experience between the four adaptation profiles.

Noncognitive Antecedent Variables. Participants in the Judy Hopps profile were more likely to score higher in emotional stability than those in the Eeyore (0.76; $OR = 2.14$, $p = 0.02$; $d = 0.43$) or Scar (1.53; $OR = 4.61$, $p < 0.01$; $d = 1.06$) profiles, and higher in openness than those in the Eeyore (0.78; $OR = 2.18$, $p = 0.04$; $d = 0.43$) or Scar (0.78; $OR = 2.19$, $p = 0.05$; $d = 0.39$) profiles. Those in the Eeyore profile were more likely to score higher in emotional stability than participants in the Scar profile (0.77; $OR = 2.16$, $p < 0.01$; $d = 0.67$), whereas participants in the

Scar profile were more likely to score higher in extraversion than those in the Eeyore profile (−0.39; *OR* = 0.68, *p* = 0.03; *d* = 0.15). Participants across the profiles did not differ by conscientiousness or agreeableness.

There were no differences in goal orientation between the four adaptation profiles.

Findings for trait affect indicate that individuals in the Judy Hopps profile were more likely to have higher PA trait affect than those in the Beast profile (0.78; *OR* = 2.18, *p* = 0.05; *d* = 0.76). Participants belonging to the Scar profile were more likely to have greater NA trait affect than those in the Eeyore profile (−0.54; *OR* = 0.58, *p* = 0.01; *d* = 0.56). Participants across the profiles did not differ by trait PD or trait ND affect.

These results provide answers for Research Questions 4-6. Research Question 4 sought to uncover whether antecedent variables were related to profile membership. As described above, the majority of the cognitive and noncognitive antecedent variables examined (i.e., GMA, video game experience, personality, goal orientation, and trait affect) were related to profile membership in skill acquisition. Although some relationships were found in adaptive performance, antecedent variables were not as important for participant profile membership assignment. In acquisition, 50% of the cognitive antecedent effects and 33% of the noncognitive antecedent effects examined were statistically significant, whereas none of the cognitive antecedent effects and 11% of the noncognitive antecedent effects examined in adaptive performance were significant. This finding is relevant to Research Question 6 which asked whether the relationships between antecedents and profiles in skill acquisition differ from those in adaptive performance. Certain antecedent variables that affected profile membership assignment probabilities in skill acquisition did not inform assignment in adaptive performance (i.e., general mental ability, video game experience, goal orientation, agreeableness). Among the antecedents relevant to profiles found in both skill acquisition and adaptive performance (i.e., Scar, Beast), higher extraversion and trait NA affect increased the probability of belonging to the Scar profile regardless of the performance phase. However, antecedents associated with the Beast profile in skill acquisition were not important in adaptive performance. Research Question 5 asked whether there were differences in how cognitive and noncognitive antecedent variables related to profile membership. The reported effect sizes indicate the magnitude of the relationships was slightly stronger for noncognitive antecedent variables (acquisition noncognitive mean effect = |0.50|; adaptation noncognitive mean effect = |0.41|) than cognitive variables (acquisition cognitive mean effect = |0.40|; adaptation cognitive mean effect = |0.16|).

Profile Stability and Changes from Acquisition to Adaptation

Due to findings indicating the set of profiles in skill acquisition and adaptive performance differed, I sought to determine the extent to which there were (1) changes in profile membership (i.e., whether individuals remained in or transitioned between latent groups; Research Question 7), and (2) differences in the stability of membership between acquisition profiles following the increase in task complexity (Research Question 8a) and their characteristics (Research Question 8b). **Table 7** depicts the 3 × 4 contingency table of profile membership in skill acquisition and adaptive performance. To examine whether profile membership in skill acquisition was related to profile membership in adaptive performance, I conducted a Fisher's Exact Test using Monte Carlo simulation (10,000 replications). Findings indicate a significant relationship between profile membership in skill acquisition and adaptive performance ($p < 0.001$). Participants in the Beast profile in skill acquisition were most likely to be in the Eeyore profile (66.7%) in adaptive performance, with few in the Scar (16.7%) or remaining in the Beast (16.7%) profiles. None were in the Judy Hopps profile. That majority of participants from the Scar profile in acquisition had an equal probability of remaining in the Scar profile (40.3%) or being in the Eeyore profile (45.8%). Few individuals were in the Beast (12.5%) or Judy Hopps (1.4%) profiles. Most participants in Mary Poppins were identified in the Eeyore profile (74.4%), with some in the Judy Hopps (12.8%), Scar (6.8%), and Beast (5.9%) profiles. **Figure 4** provides a Sankey diagram of the proportions of participants from profiles in skill acquisition that were found in the profiles in adaptive performance.

Following the unexpected increase in task complexity, new emotion trajectories emerged alongside the Beast and Scar profiles (i.e., Eeyore, Judy Hopps). Research Question 7 asked the extent to which profile membership changed after the increase in task complexity. The majority of individuals in the Beast profile in skill acquisition did not remain in that profile in adaptive performance but instead were in the Eeyore profile. In contrast, a large proportion of participants in Scar profile remained in that profile following the change in task demands. Research Question 8a asked if there were differences in the stability of membership between acquisition profiles, and if so, Research Question 8b asked what characteristics of the profiles in skill acquisition may contribute to these changes. The Scar profile was more stable than the Beast profile, possibly due to its consistent emotion trajectories. The Scar profile was characterized by increasing negative emotions and decreasing positive emotions during skill acquisition, a pattern that continued in adaptive performance. In comparison, by the end of acquisition (i.e., Session 7), Beast participants reported higher deactivating emotions (ND, PD) and lower activating emotions (NA, PA). The Eeyore profile in adaptive performance was similarly characterized by higher deactivating emotions and lower activating emotions. Thus, participants maintained the emotion trajectories established in skill acquisition; Beast participants' emotions did not revert to their levels at the start of acquisition (i.e., Session 1) following the task change. Although the Scar profile was more stable in terms of the proportion of individuals who remained in that profile from skill acquisition to adaptive performance, it should be noted that a larger proportion of participants in the Beast and Mary Poppins profiles remained grouped together in the profiles that emerged in adaptive performance.

Performance Differences between Profiles

I conducted repeated measures ANOVAs to examine differences in performance across skill acquisition and adaptive performance, respectively, accounting for time and profile membership.

Skill Acquisition. Due to a lack of sphericity (Mauchly's test; χ^2 (20) = 33.49, p = 0.03), degrees of freedom were corrected using Huynh-Feldt estimates of sphericity (ε = 0.99). There was a statistically significant main effect of time, F(5.94, 1782.54) = 8.69, $p < 0.001$, $\eta_p^2 = 0.03$, indicating performance in general increased significantly across the seven sessions. There was also a statistically significant main effect of profile membership, F(2, 300) = 18.27, $p < 0.001$, $\eta_p^2 = 0.11$, indicating there were differences in performance overall between profiles in skill acquisition. The interaction between time and profile membership was not significant, F(11.88, 1782.54) = 1.61, p = 0.08, $\eta_p^2 = 0.01$. **Figure 5** graphically represents performance means across acquisition sessions by profile. The Mary Poppins profile had greater performance means across all sessions of skill acquisition in comparison to the other profiles. The Scar and Beast profiles had similar performance means across the first five sessions of skill acquisition. After Session 5 performance dropped for the Beast profile but increased or remained steady for the Scar profile.

Adaptive Performance. Similar to acquisition, degrees of freedom were corrected using Huynh-Feldt estimates of sphericity (ε = 0.97) due to a lack of sphericity (Mauchly's test; χ^2 (20) = 51.16, $p < 0.001$). The main effect of time was not statistically significant, F(5.85, 1747.86) =

1.65, $p = 0.13$, $\eta_p^2 = 0.01$, suggesting that performance in general did not change significantly across the seven adaptive performance sessions. However, there was a statistically significant main effect of profile membership, $F(2, 300) = 18.27$, $p < 0.001$, $\eta_p^2 = 0.11$, indicating there were differences in performance overall between profiles in adaptive performance. The interaction between time and profile membership on participants' performance was also significant, $F(3, 299) = 13.81$, $p < 0.001$, $\eta_p^2 = 0.12$, indicating performance trajectories over time varied by profile. Performance means across adaptive sessions by profile are depicted in **Figure 6**. The Judy Hopps profile had greater performance means across all sessions of adaptive performance in comparison to the other profiles. Although the Eeyore and Beast profiles had similar performance means across all sessions of adaptive performance, Beast performance means were lower and more stable than Eeyore performance means, which varied across the sessions. The Scar profile had lower performance means across all sessions of adaptive performance that looked relatively flat in comparison to the other profiles.

Appendix B contains the results of BCH analyses (Bigelow et al., 2024) and relevant tables (**Tables B1** and **B2**), which were used to determine whether statistically significant mean differences in performance across sessions by profile existed.

Research Question 9 asked whether certain profiles were more positively or negatively related to performance. The results indicate that the Mary Poppins profile was more positively related to performance in skill acquisition, whereas the Judy Hopps profile was more positively related to performance in adaptive performance.

Discussion

In Sample 1, I identified three profiles in skill acquisition (i.e., Beast, Scar, Mary Poppins) and four profiles in adaptive performance (i.e., Judy Hopps, Eeyore, Beast, Scar).

Tables 8 and **9** provide an overview of the findings for the profiles that emerged in skill acquisition and adaptive performance, respectively. The Beast profile was characterized by sharp decreases in NA emotions and sharp increases in PD emotions, and participants were more likely to have lower PA trait affect. Participants in the Beast profile had lower performance scores than Mary Poppins and Scar in skill acquisition and Judy Hopps in adaptive performance, but greater performance scores than Scar in adaptive performance. The Scar profile was characterized by higher, increasing negative emotions and lower, decreasing positive emotions. Participants in the Scar profile were more likely to have higher extraversion and NA trait affect. The Scar profile had lower performance scores than Mary Poppins in skill acquisition and Judy Hopps, Eeyore, and Beast in adaptive performance, but greater performance scores than Beast in skill acquisition. The Mary Poppins profile identified in skill acquisition was exemplified by moderate positive emotions and low negative emotions, and participants more likely to have higher video game experience, emotional stability, and openness. Mary Poppins had the highest performance scores in skill acquisition. The Judy Hopps profile identified in adaptive performance is like Mary Poppins as they both experienced low negative emotions, but differ in that Judy Hopps experienced high positive emotions, rather than moderate positive emotions. Judy Hopps and Mary Poppins were also similar in that they were more likely to have higher emotional stability, openness, and performance scores. The Eeyore profile identified in adaptive performance was unique to the profiles identified in skill acquisition as they experienced greater deactivating than activating emotions. Like Judy Hopps, they were more likely to have higher emotional stability, but they had lower performance scores than Judy Hopps. Eeyore did not have significantly different performance scores than Beast and performed better than Scar in adaptive performance.

The emergence of new profiles in adaptive performance suggests the increase in task complexity evoked emotion responses relevant for performance. Most participants in skill acquisition were in the Mary Poppins profile which had the highest performance scores. Following the task change, most of those that were in Mary Poppins formed the new profile, Eeyore, characterized by their experience of deactivating emotions. These emotion trajectories may suggest that participants were discouraged or that they disengaged with the task. However, some participants from the Mary Poppins profile split off to form the Judy Hopps profile, characterized by their experience of high positive emotions, suggesting that the change may have brought feelings of excitement. Similar to the Mary Poppins profile, Judy Hopps had the highest performance scores. These findings may indicate that the experience of positive emotions was critical for engagement and performance.

Sample 1's results suggest that (a) individuals experience different emotion trajectories during complex task performance, (b) these trajectories are informed in part by antecedent traits, (c) emotion trajectories may change following increases in task complexity suggesting differences between skill acquisition and adaptive performance, and (d) performance differences exist between emotion profiles. In Sample 2, I attempted to replicate these findings, incorporating females in the sample.

Sample 2

Results

General descriptives (i.e., means, standard deviations, correlations) of variables of interest, including internal consistency reliabilities, for Sample 2 are listed in **Table 10**.

Emotion Profile Identification and Description

Table 11 lists the fit indices comparing models from one up to eight profiles during periods of skill acquisition and adaptive performance. When examining the fit of the different model solutions, I initially considered the 2-profile model solution in skill acquisition and the models with two to five profiles in adaptation as viable solutions due to the model solutions converging and entropy values being above 0.8. I then compared the models by their AIC, BIC, and LMR values. **Figure 7** depicts elbow plots comparing AIC and BIC of models. In addition to comparing these fit indices, I examined the models iteratively in graphic form to determine if the addition of each additional profile provided anything theoretically of value. Within the models that fit my pre-established criteria (i.e., model convergence), entropy indicated that the best fitting model was the two-profile model in skill acquisition and the BIC suggested the five-profile model fit best in adaptive performance. A significant LMR value also supported the two-profile model in skill acquisition. However, when examining whether other models provided anything theoretically of value, I determined the three-profile model to be valuable due to the emergence of a profile that was relevant in Sample 1. The lower BIC value also supported this model versus the two-profile model. When testing for longitudinal measurement invariance, AIC and BIC values indicated that measurement invariances held for the three-solution model in acquisition and the five-solution model in adaptation.

The three profiles that were identified in acquisition and their unique emotion trajectories are displayed in **Figure 8**. **Table 12** provides the intercept and slope values for these trajectories. The first profile (24%) represents individuals that had high, stable positive activating (PA) emotions, moderate, stable positive deactivating (PD), moderate negative activating (NA) emotions that slightly decreased over time, and moderate negative deactivating (ND) emotions that slightly increased over time. Due to similar patterns in emotion trajectories identified in Sample 1, I refer to this profile as “Judy Hopps.” Participants in the second profile (15%) had moderate PA emotions that decreased over time, low, stable PD emotions, high NA emotions that slightly increased over time, and moderate ND emotions that increased over time. I refer to this profile as “Scar,” since the pattern of emotion trajectories matches the Scar profile identified in Sample 1. The third profile (61%) distinguishes participants that had moderate PA emotions that decreased over time, moderate, stable PD emotions, moderate NA emotions that slightly decreased over time, and moderate ND emotions that slightly increased over time. This profile exhibits emotion trajectory patterns not identified previously in Sample 1. Henceforth, I refer to the second profile as “Bagheera” from *The Jungle Book*, as this character is known to have a relatively flat emotional arc and has a tendency to demonstrate more deactivating than activating emotions (Reitherman, 1967).

Five profiles were identified in adaptive performance. The emotion trajectories of these profiles are displayed in **Figure 9** and **Table 13** provides the intercept and slope values for these trajectories. The first profile (11%) represents individuals with low PA emotions that slightly decreased over time, low, stable PD emotions, high, stable NA emotions, and high ND emotions that slightly increased over time. I refer to this profile as “Scar,” due to matched emotion trajectory patterns identified previously in Sample 1 and in acquisition in this same sample. Participants in the second profile (7%) had low PA emotions that slightly decreased over time, high, stable PD emotions, low, stable NA emotions, and moderate ND emotions that slightly increased over time. The emotion trajectories of this profile are different to those identified previously. I refer to this profile as “Duchess” from *The Aristocats* due to this character’s propensity to remain calm and composed, very rarely showing activating emotions such as excitement or frustration (Reitherman,1970). The third profile (5%) is characterized by high PA emotions that increased over time, high PD emotions that increased over time, low, stable NA emotions, and moderate, stable ND emotions. Due to similar patterns in emotion trajectories identified in skill acquisition, I refer to this profile as "Judy Hopps." The fourth profile (23%) distinguishes participants that experienced moderate, stable PA emotions, moderate PD emotions that slightly increased over time, moderate NA emotions that slightly decreased over time, and moderate ND emotions that slightly increased over time. Due to this pattern of emotion trajectories matching the Mary Poppins profile identified in skill acquisition in Sample 1, I also refer to this profile as "Mary Poppins." The fifth profile (54%) distinguishes participants that experienced low PA emotions that slightly decreased over time, moderate, stable PD emotions, moderate NA emotions that slightly decreased over time, and moderate ND emotions that slightly increased over time. These trajectories align with the patterns exhibited by those in the Eeyore profile in Sample 1. Thus, I refer to this profile as "Eeyore."

Research Question 1 asked whether different subgroup profiles emerge based on emotion change and trajectory in periods of skill acquisition and adaptive performance. Yes, different subgroup profiles emerged. Three profiles were identified in acquisition and five profiles were identified in adaptation. Research Question 2 asked whether profiles differed across periods of acquisition and adaptive performance. Although two similar profiles were identified in acquisition and adaptive performance (i.e., Scar, Judy Hopps), yes, there were differences in the profiles that emerged in acquisition and adaptation. The Bagheera profile that emerged in acquisition was not found in adaptive performance and three new profiles emerged in adaptation (i.e., Duchess, Mary Poppins, Eeyore). Research Question 3 sought to define profiles by valence, activation, and emotion change and trajectory. A description of the profiles is above and graphs of the emotion trajectories in acquisition and adaptive performance can be found in **Figures 8** and **9**, respectively. Profiles differed as a function of mean intercept values of PA, PD, NA, and ND emotions as well as the extent to which different emotion trajectories did or did not exhibit increasing or decreasing values. In acquisition, there was a profile that exhibited greater, increasing negative emotions (i.e., Scar), a profile that exhibited greater, stable positive emotions (i.e., Judy Hopps), and a profile that had similar intercept values across all emotions with decreasing activating emotions and increasing or stable deactivating emotions (i.e., Bagheera). Although Scars and Judy Hopps emerged in both acquisition and adaptation, the difference in mean levels between negative and positive emotions was larger in adaptation than in acquisition. In addition to the Scar and Judy Hopps profiles, adaptation profiles tended to show larger differences as a function of activation. The differences between activating and deactivating emotions for Eeyore and Duchess in adaptation were larger than they were for Bagheera in acquisition, with those in Eeyore having greater ND emotions and those in Duchess having greater PD emotions. The Mary Poppins profile that emerged in adaptation showed moderate emotion levels with slightly greater positive emotions.

Antecedents to Profiles

Skill Acquisition. Results of the antecedent correlate analysis for Sample 2 are displayed in **Table 14**. **Appendix C (Table C1)** compares means and standard deviation of antecedent variables by profile and provides Cohen's *d* of antecedent variables between profiles in skill acquisition.

***Cognitive Antecedent Variables*.** Participants in the Judy Hopps profile were more likely to have greater video game experience than those in the Scar (0.64; $OR = 1.89$, $p < 0.001$; $d = 0.51$) or Bagheera (0.53; $OR = 1.70$, $p < 0.001$; $d = 0.42$) profiles. There were no differences in general mental ability between the three acquisition profiles.

***Noncognitive Antecedent Variables*.** Participants in the Judy Hopps profile were more likely to score higher in agreeableness than those in the Bagheera profile (0.34; $OR = 1.40$, $p =$

0.04; $d = -0.15$). Participants in the Scar profile were less likely to score higher in emotional stability than those in the Judy Hopps (0.85; $OR = 2.33$, $p < 0.001$; $d = 0.72$) and Bagheera (−0.71; $OR = 0.49$, $p < 0.01$; $d = -0.54$) profiles. Extraversions, conscientiousness, and openness scores were not significantly different across profiles.

In terms of goal orientation, participants belonging to the Scar profile were more likely to have a higher performance approach orientation than those that belonged to the Judy Hopps (−0.80; $OR = 0.45$, $p < 0.001$; $d = -0.49$) or Bagheera (0.94; $OR = 2.56$, $p < 0.001$; $d = 0.27$) profiles. Participants in the Judy Hopps (0.84; $OR = 2.32$, $p < 0.001$; $d = 0.49$) and Bagheera (−0.64; $OR = 0.53$, $p = 0.01$; $d = -0.28$) profiles were more likely to have mastery approach orientation than those in the Scar profile. There were no differences in performance avoidance orientation between the three acquisition profiles.

Findings for trait affect indicate individuals in the Judy Hopps (0.22; $OR = 1.24$, $p = 0.02$; $d = 0.36$) and Scar (0.34; $OR = 1.41$, $p < 0.001$; $d = 0.35$) profiles were more likely to have higher PA trait affect than those in the Bagheera profile. Participants in the Judy Hopps profile were more likely to have higher PD trait affect than those in the Scar (0.28; $OR = 1.32$, $p = 0.02$; $d = 0.42$) or Bagheera (0.21; $OR = 1.24$, $p = 0.03$; $d = 0.33$) profiles. Participants in the Scar profile were more likely to have higher NA trait affect than those in the Judy Hopps (−0.34; $OR = 0.71$, $p = 0.01$; $d = -0.57$) or Bagheera (0.45; $OR = 1.56$, $p < 0.001$; $d = 0.58$) profiles. Participants across the profiles did not differ by trait ND affect.

Sex. Participants in the Judy Hopps profile were more likely to identify as male than those in the Scar (−1.90; $OR = 0.15$, $p < 0.001$) or Bagheera (−1.29; $OR = 0.28$, $p < 0.001$) profiles. Individuals in the Scar profile were more likely to be female than those in the Bagheera profile (0.61; $OR = 1.85$, $p = 0.04$).

Adaptive Performance. Results of the antecedent correlate analysis are displayed in **Table 15**. **Appendix C (Table C2)** compares means and standard deviation of antecedent variables by profile and provides Cohen's *d* of antecedent variables between profiles in adaptive performance.

Cognitive Antecedent Variables. Participants in the Judy Hopps profile were more likely to have greater video game experience than those in the Scar (−0.53; $OR = 0.58$, $p = 0.02$; $d = -0.58$) or Eeyore (0.49; $OR = 1.63$, $p < 0.001$; $d = 0.49$) profiles. Those in the Mary Poppins profile were also more likely to have greater video game experience than those in the Eeyore profile (0.31; $OR = 1.36$, $p = 0.03$; $d = 0.23$). There were no differences in general mental ability in the five adaptation profiles.

Noncognitive Antecedent Variables. Participants in the Scar profile were less likely to score higher in emotional stability than those in the Duchess (−1.06; $OR = 0.35$, $p < 0.001$; $d = -0.82$), Judy Hopps (−1.03; $OR = 0.36$, $p < 0.001$; $d = -0.92$), Mary Poppins (−0.73; $OR = 0.48$, $p < 0.001$; $d = -0.63$), and Eeyore (−0.61; $OR = 0.55$, $p < 0.001$; $d = -0.52$) profiles. Those in the Judy Hopps profile were more likely to have higher emotional stability scores than those in the Eeyore profile (0.43; $OR = 1.53$, $p = 0.04$; $d = 0.42$), and more likely to have higher openness scores than those in the Scar (−0.68; $OR = 0.51$, $p = 0.03$; $d = -0.45$), Duchess (−0.74; $OR = 0.48$, $p = 0.04$; $d = -0.62$), and Eeyore (0.60; $OR = 1.82$, $p = 0.02$; $d = 0.56$) profiles. Extraversion, agreeableness, and conscientiousness scores were not significantly different across profiles.

Participants belonging to the Mary Poppins profile were more likely to have a higher mastery approach orientation than those belonging to the Scar (−1.00; $OR = 0.37$, $p < 0.001$; $d = -0.55$) and Duchess (−0.68; $OR = 0.51$, $p = 0.04$; $d = -0.20$) profiles. Participants in the Mary

Poppins profile were also more likely to have higher performance avoidance orientation than those in the Duchess profile (−0.55; $OR = 0.58$, $p = 0.04$; $d = -0.23$). Participants belonging to the Eeyore profile were more likely to have a higher mastery approach orientation than those belonging to the Scar profile (−0.61; $OR = 0.54$, $p = 0.02$; $d = -0.27$), and more likely to have performance avoidance orientation than those in the Duchess profile (−0.66; $OR = 0.52$, $p = 0.02$; $d = -0.41$). There were no differences in performance approach orientation between the five adaptation profiles.

Findings for trait affect indicate that participants in the Scar profile had higher PA trait affect than those in the Duchess (0.49; $OR = 1.64$, $p < 0.001$; $d = 0.36$) or Eeyore (0.24; $OR = 1.28$, $p = 0.04$; $d = 0.33$) profiles. Individuals in the Duchess profile were less likely to have higher PA trait affect than those in the Judy Hopps (−0.63; $OR = 0.53$, $p = 0.01$; $d = -0.56$) and Mary Poppins (−0.41; $OR = 0.66$, $p < 0.001$; $d = -0.40$) profiles. Participants in the Duchess profile had greater PD trait affect than those in the Scar (−0.76; $OR = 0.47$, $p < 0.001$; $d = -0.79$), Judy Hopps (0.63; $OR = 1.89$, $p = 0.01$; $d = 0.22$), Mary Poppins (0.53; $OR = 1.70$, $p = 0.01$; $d = 0.43$), and Eeyore (0.85; $OR = 2.35$, $p < 0.001$; $d = 0.77$) profiles. Individuals in the Mary Poppins profile had greater PD trait affect than those in the Eeyore profile (0.32; $OR = 1.38$, $p = 0.01$; $d = 0.34$). Participants in the Scar and Mary Poppins profiles were more likely to have greater NA trait affect than those in the Judy Hopps (0.74; $OR = 2.10$, $p < 0.001$; $d = 0.98$; −0.65; $OR = 0.52$, $p = 0.01$; $d = -0.59$) and Eeyore (0.42; $OR = 1.53$, $p < 0.001$; $d = 0.54$; 0.33; $OR = 1.39$, $p = 0.01$; $d = 0.16$) profiles. Participants across the five adaptation profiles did not differ by trait ND affect.

Sex. Participants in the Judy Hopps (−1.04; $OR = 0.35$, $p = 0.02$) and Mary Poppins (−1.12; $OR = 0.33$, $p = < 0.001$) profiles were more likely to identify as male than those in the

Eeyore profile. Those in the Scar profile were more likely to be female than Judy Hopps (1.41; *OR* = 4.10, $p = 0.01$) or Mary Poppins (1.49; *OR* = 4.42, $p < 0.001$).

These results provide answers for Research Questions 4-6. Research Question 4 sought to uncover whether antecedent variables were related to profile membership. As described above, the majority of the cognitive and noncognitive antecedent variables examined (i.e., video game experience, personality, goal orientation, and trait affect) were related to profile membership in skill acquisition and adaptive performance. Research Question 5 asked whether there were differences in how cognitive and noncognitive antecedent variables related to profile membership. Similar to Study 1, although cognitive and noncognitive antecedent variables were both important, the reported effect sizes indicate the magnitude of the relationships was slightly stronger between profile membership and noncognitive antecedent variables compared to the cognitive antecedent variables, especially with respect to adaptive performance (acquisition cognitive mean effect = |0.21|; acquisition noncognitive mean effect = |0.29|; adaptation cognitive mean effect = |0.14|; adaptation noncognitive mean effect = |0.30|). In acquisition, 33% of the cognitive antecedent effects and 36% of the noncognitive antecedent effects examined were significant, whereas 15% of the cognitive antecedent effects and 22% of the noncognitive antecedent effects examined in adaptive performance were significant. Research Question 6 asked whether the relationships between antecedents and profiles in skill acquisition differ from those in adaptive performance. Generally, the antecedent variables that changed profile membership assignment probabilities in skill acquisition also were relevant for adaptive performance (i.e., video game experience, emotional stability, mastery approach goal orientation, sex, trait PA, trait PD, and trait NA). Some antecedent variables were relevant for profile membership assignment probabilities in skill acquisition but not in adaptive performance (i.e., agreeableness, performance approach goal orientation), and vice versa (i.e., openness, performance avoidance goal orientation). Among the antecedents relevant to profiles found in both skill acquisition and adaptive performance (i.e., Judy Hopps, Scar), higher video game experience, emotional stability, trait PA, and lower trait NA increased the probability of belonging to the Judy Hopps profile regardless of the performance phase. Similarly, lower video game experience, emotional stability, mastery approach orientation, trait PD, and higher trait PA and NA increased the probability of belonging to the Scar profile regardless of the performance phase.

Profile Stability and Changes from Acquisition to Adaptation

Table 16 depicts the 3 × 5 contingency table of profile membership in skill acquisition and adaptive performance. I conducted a chi-square test to examine whether profile membership in skill acquisition was related to profile membership in adaptive performance. Findings indicate a significant relationship between profile membership in skill acquisition and adaptive performance, χ^2 (8, N = 615) = 281.05, $p < 0.001$. Participants in the Judy Hopps profile in skill acquisition were most likely to be in the Mary Poppins profile (57.8%) in adaptive performance, with some in the Eeyore (23.8%) or remaining in the Judy Hopps (15%) profiles. Very few were in the Scar (2%) or Duchess (1.4%) profiles. The majority of participants from the Scar profile had an equal probability of remaining in the Scar profile (38.3%) or being in the Eeyore profile (41.5%). Few individuals were in the Mary Poppins profile (16%), and fewer still were in the Duchess (2.1%) or Judy Hopps (2.1%) profiles. Most participants in Bagheera were in the Eeyore profile (69.3%) in adaptive performance, with some in the Mary Poppins (11.2%), Duchess (10.4%), Scar (7.5%), and Judy Hopps (1.6%) profiles. **Figure 10** provides a Sankey diagram of the proportions of participants from profiles in skill acquisition that were identified in the adaptive performance profiles.

Following the unexpected increase in task complexity, new emotion trajectories emerged in addition to the Judy Hopps and Scar profiles (i.e., Duchess, Mary Poppins, Eeyore). Research Question 7 asked the extent to which profile membership changed after the increase in task complexity. The majority of individuals in the Judy Hopps profile in skill acquisition did not remain in that profile in adaptive performance but instead were in the Mary Poppins profile. In contrast, a large proportion of participants in Scar profile remained in that profile following the change in task demands. Research Question 8a asked if there were differences in the stability of membership between acquisition profiles, and if so, Research Question 8b asked what characteristics of the profiles in skill acquisition may contribute to these changes. The Scar profile was more stable than the Judy Hopps profile, possibly due to its consistent emotion trajectories. Similar to Sample 1, the Scar profile was characterized by increasing negative emotions and decreasing positive emotions during skill acquisition, a pattern that continued in adaptive performance. The Mary Poppins profile has similar (i.e., higher levels of positive than negative emotions), but tempered emotion patterns compared to the Judy Hopps profile. It is possible that the unexpected change in task demands curbed the experience of positive emotions for participants, leading to dropped positive emotion levels. Although the Scar profile was more stable in terms of the proportion of individuals who remained in that profile from skill acquisition to adaptive performance, it should be noted that a larger proportion of participants in the Judy Hopps and Mary Poppins profiles remained grouped together in the profiles that emerged in adaptive performance.

Performance Differences between Profiles

I conducted repeated measures ANOVAs to examine differences in performance across skill acquisition and adaptive performance, respectively, accounting for time and profile membership.

Skill Acquisition. Due to a lack of sphericity (Mauchly's test; χ^2 (20) = 114.52, $p <$ 0.001), degrees of freedom were corrected using Huynh-Feldt estimates of sphericity ($\varepsilon = 0.95$). There was a statistically significant main effect of time, $F(5.69, 3483.48) = 50.07$, $p < 0.001$, $\eta_p^2 = 0.08$, indicating performance in general increased significantly across the seven acquisition sessions. There was also a statistically significant main effect of profile membership, $F(2, 612) = 24.41$, $p < 0.001$, $\eta_p^2 = 0.08$, indicating there were differences in overall performance between profiles in skill acquisition. The interaction between time and profile membership was also significant, $F(11.38, 3483.48) = 3.44$, $p < 0.001$, $\eta_p^2 = 0.01$, indicating performance trajectories varied by profile. **Figure 11** graphically represents performance means across skill acquisition by profile. The Judy Hopps profile had greater performance means across all sessions of skill acquisition in comparison to the other profiles. The Bagheera profile had greater performance means than the Scar profile across all sessions of skill acquisition. After Session 5 performance tapered off for the Scar and Bagheera profiles but continued to increase for the Judy Hopps profile.

Adaptive Performance. Similar to acquisition, degrees of freedom were corrected using Huynh-Feldt estimates of sphericity ($\varepsilon = 0.94$) due to a lack of sphericity (Mauchly's test; χ^2 (20) = 130.13, $p < 0.001$). The main effect of time was statistically significant, $F(5.62, 3425.88) = 5.84$, $p < 0.001$, $\eta_p^2 = 0.01$, suggesting that performance in general increased significantly across the seven sessions. There was a statistically significant main effect of profile membership, F(4,

610) = 4.00, $p < 0.01$, $\eta_p^2 = 0.03$ indicating there were differences in overall performance between profiles in adaptive performance. The interaction between time and profile membership was not significant, $F(22.47, 3425.88) = 1.39$, $p = 0.11$, $\eta_p^2 = 0.01$, which indicates performance trajectories over time did not vary by profile. Performance means across adaptive performance by profile are depicted in **Figure 12**. The Judy Hopps and Mary Poppins profiles had greater performance means across all sessions of adaptive performance in comparison to the Scar, Duchess, and Eeyore profiles. The Eeyore and Duchess profiles had similar performance means across all sessions of adaptive performance, aside from a performance increase during Session 12 for Duchess. The Scar profile had lower performance means across all sessions of adaptive performance in comparison to the other profiles.

Appendix D contains the results of BCH analyses (Bigelow et al., 2024) and relevant tables (**Tables D1** and **D2**) for Sample 2.

Research Question 9 asked whether certain profiles were more positively or negatively related to performance. The results indicate that the Judy Hopps profile was more positively related to performance in skill acquisition, whereas the Judy Hopps and Mary Poppins profiles were more positively related to performance in adaptive performance.

Discussion

In Sample 2, I identified three profiles in skill acquisition (i.e., Judy Hopps, Scar, Bagheera) and five profiles in adaptive performance (i.e., Scar, Duchess, Judy Hopps, Mary Poppins, Eeyore). **Tables 17** and **18** provide an overview of the findings for the profiles in Sample 2 that emerged in skill acquisition and adaptive performance, respectively. Four of these profiles—Judy Hopps, Scar, Mary Poppins, Eeyore—were identified in Sample 1 and shared similar emotion trajectories, suggesting the profiles are robust. The Judy Hopps profile was identified in skill acquisition and adaptive performance and participants were more likely to have higher video game experience. Similar to Judy Hopps in Sample 1, participants were more likely to have higher emotional stability and openness in adaptation. Judy Hopps had higher performance scores than Scar and Bagheera in acquisition, and higher performance scores than Scar in adaptation. Participants in the Scar profile in Sample 2 were more likely to have lower emotional stability and mastery approach orientation, and similar to Sample 1 in acquisition, higher NA trait affect. The Scar profile had the lowest performance scores in skill acquisition and lower performance scores than Judy Hopps, Mary Poppins, and Eeyore in adaptive performance. Like Sample 1, the Eeyore profile identified in adaptive performance experienced greater deactivating than activating emotions. Different from the Eeyore profile in Sample 1, which had higher emotional stability, participants in Eeyore in Sample 2 were more likely to have lower PA, PD, and NA trait affect. The Eeyore profile had lower performance scores than Mary Poppins and higher performance scores than Scar in adaptive performance. Like the Mary Poppins profile identified in Sample 1 acquisition, the Mary Poppins profile identified in Sample 2 adaptation had higher video game experience, in addition to higher master approach goal orientation. Performance scores were higher for Mary Poppins than Scar or Eeyore in adaptive performance.

The Bagheera profile identified in skill acquisition was unique to what had been identified in Sample 1. Bagheera was characterized by emotion trajectories that started at similar moderate levels but over time had greater deactivating than activating emotions. Participants in the Bagheera profile were more likely to have lower PA trait affect and performance scores that were lower than Judy Hopps but greater than Scar in skill acquisition. The Duchess profile was not previously identified in Sample 1. Although similar to Eeyore and Bagheera in experiencing greater deactivating than activating emotions, the Duchess profile is unique in experiencing very high levels of positive deactivating emotions versus very low levels of positive activating emotions. Participants in the Duchess profile were more likely to have lower performance avoidance goal orientation and PA trait affect, and higher PD trait affect. There were no significant performance differences between Duchess and any other profile in adaptive performance.

Similar to the findings for Sample 1, the increase in task demands evoked additional or different emotion responses from participants. Participants had affective responses marked as being more positive, negative, activating, deactivating, or a combination thereof. For example, following the change in task demands, proportions of participants from Bagheera were identified in Scar (more negative), Duchess (more positive deactivating), Mary Poppins (more positive), or Eeyore (more deactivating). Like adaptive performance for Sample 1, profiles characterized for being more positive in nature (i.e., Judy Hopps, Mary Poppins) tended to perform best, whereas profiles that exemplified greater negative emotions (i.e., Scar) performed most poorly. Profiles that were more deactivating in nature (i.e., Bagheera, Duchess, Eeyore) had moderate performances. Similar to Sample 1, the majority of participants in adaptive performance were identified in the Eeyore profile, characterized for greater deactivating emotions. Although Mary Poppins and Judy Poppins were separated in Sample 1, with a proportion of participants in the Mary Poppins profile in acquisition forming the Judy Hopps profile in adaptation, the identification of both profiles in adaptive performance in Sample 2 indicates these are distinct profiles. Following the task change in Sample 2, some in the Judy Hopps profile remained in the Judy Hopps profile, indicating the change did not alter their experience of positive emotions, whereas others were identified in the Mary Poppins profile, suggesting the change may have tempered their positive emotions. Others from the Judy Hopps profile were in the Eeyore profile, which may indicate participants felt discouraged by the increase in complexity.

Like Sample 1, additional profiles were identified in adaptive performance beyond what was identified in skill acquisition, which suggests adaptive performance is distinct from skill acquisition in terms of individuals' emotional experiences. Although the findings between Sample 1 and Sample 2 were not identical, Sample 2 results support Sample 1 in that (a) individuals experienced different emotion trajectories, (b) antecedent traits were relevant, (c) emotion trajectories differed between skill acquisition and adaptive performance, and (d) performance differences existed between emotion profiles.

General Discussion

The broad aim of this exploratory study was to utilize person-centered approaches to garner a better understanding of emotion-performance relationships, specifically focusing on how individuals may be grouped into profiles based on similar emotion experiences and how these profiles may relate to complex task performance in periods of skill acquisition and adaptive performance. Using a repeated measures design across two samples, emotion scores were collected in between sessions of learning a complex video game. Research questions were formulated to (a) identify and describe profiles of emotion experiences, accounting for valence and activation, during acquisition and adaptation, (b) determine whether antecedent variables were relevant for profile assignment and compare cognitive and noncognitive traits, (c) investigate profile membership stability and change between skill acquisition and adaptive performance, and (d) examine performance differences by profile.

Profiles were successfully identified across both samples during skill acquisition (three profiles in both samples) and adaptive performance (four profiles in Sample 1, five profiles in

Sample 2). These profiles differed by the level (i.e., intercept) and change or lack thereof (i.e., slope) in positive activating (PA), positive deactivating (PD), negative activating (NA), and negative deactivating (ND) emotions, with marked differences found based on valence (positive versus negative emotions) and activation (deactivation). Although both cognitive (e.g., general mental ability, video game experience) and noncognitive (e.g., Big Five personality traits, trait affect, and goal orientation) antecedents were found to be relevant for profile membership assignment in acquisition, noncognitive traits were more important than cognitive variables for profile assignment in adaptation. Although changes in profile membership occurred following the increase in task demands, there were groups of individuals that remained stable. Participant profile membership in acquisition was related to profile membership in adaptation in both samples. Notably, most participants in the largest profile in skill acquisition (e.g., Mary Poppins, Bagheera) remained together to form the Eeyore profile in adaptation, suggesting stability. The Scar profile was less stable in both samples, with participants identified across all other profiles in adaptation. Profiles exhibited performance differences, with profiles that experienced greater levels and/or growth in positive emotions performing better than those that experienced greater negative emotions. Profiles characterized by greater deactivating emotions, which contained the majority of participants, exhibited moderate performance levels in comparison to the others. My findings demonstrate person-centered approaches may be leveraged to advance understanding and uncover nuance between distinct emotion trajectories during task performance, as well as the traits, changes, and outcomes associated with each emotion profile.

Theoretical Implications for Emotions

Despite a breadth of research on emotions, theories on emotion-performance relationships differ with varying perspectives suggesting emotions may be helpful, harmful, or not related to performance (Pekrun, 2011; Wagner & Heatherton, 2014; Weiss & Cropanzano, 1996). Using a person-centered approach, my findings indicate there is a relationship between emotions and performance, and the nature of this relationship is more nuanced than can be encompassed by broad generalizations of emotions being helpful or harmful. By leveraging techniques that account for heterogeneity in different variables (i.e., emotions) to identify groups of individuals (i.e., profiles) that share characteristics (i.e., emotion trajectories) within a population, it is possible to uncover the nuanced relationships that exist between emotions and performance that may be overlooked in traditional variable-centered analyses. Additionally, although other research has begun to examine emotion trajectories using person-centered approaches, this work contributes to the emotions literature by being the first to account for the role of emotional arousal (i.e., activating versus deactivating), examine multiple emotion trajectories concurrently, and investigate integral emotions during complex task performance.

Research from the emotion literature that uses a variable-centered approach tends to compare the effects of positive and negative trait affect or discrete positive and negative emotions, and suggests positive affect or emotions benefit performance, whereas negative affect or emotions are detrimental for performance (Pekrun, 1992; Shockley et al., 2012). I find some support for this perspective as the highest performing profiles were characterized by greater positive emotions (e.g., Judy Hopps, Mary Poppins), and profiles that typically had the lowest performance were marked by higher negative emotions (e.g., Scar). However, important nuances emerged that can expand understanding of emotion-performance relationships. For example, the Duchess profile in Sample 2 adaptation experienced the highest level of PD emotions, with an intercept value exceeding the Mary Poppins and Judy Hopps PA or PD emotions. Yet, Duchess did not demonstrate the highest performance scores. This may indicate activation potential (i.e., arousal) in combination with valence plays a critical role in how emotions relate to performance. The importance of activation potential will be explored in greater depth below. Another profile that did not align with traditional views was the Beast profile in Sample 1, which had lower performance scores in skill acquisition than Scar despite Scar experiencing greater negative emotions. The Beast profile was characterized by a sharp increase in PD emotions and a sharp decrease in NA emotions, or more simply put, by rapidly shifting emotions. Prior research using variable-centered approaches to examine affect variability—the extent to which an individual's emotions fluctuate—indicates greater changes in emotion can be detrimental for skill acquisition and adaptive performance (North et al., 2024; Richels et al., 2020). Emotion responses of high intensity can pull cognitive resources away from task performance (Vuilleumier, 2005). Thus, finding ways to curtail extreme emotion shifts may be beneficial for performance. However, it is important to note that the Beast profile did not replicate in Sample 2.

Activation Potential

Prior research that used person-centered approaches to examine emotion has generally parsed emotions by valence, distinguishing emotion profiles by the experience of positive or negative emotions (e.g., "increasing positive affect," "constant high negative affect"; Brondino et al., 2020; Moreno-Agostino et al., 2021; Zhang et al., 2021). Although my findings did reveal profiles distinguished by differences in positive and negative emotions (e.g., Judy Hopps, Scar), several profiles emerged characterized by their experience of greater positive and negative deactivating emotions (e.g., Eeyore, Duchess), rather than their experience of greater positive or negative emotions generally. Interestingly, the majority of participants tended to belong to profiles marked for their experience of higher deactivating emotions, particularly in adaptation. Negative deactivating emotions such as boredom or disappointment prime individuals to focus on expected failure and feelings of hopelessness (Pekrun et al., 2023), spurring mind wandering, shallow information processing, disengagement, and decreased effort which harms performance (Camacho-Morles et al., 2021). The novel methods used in this study indicate there is value in moving beyond valence-only distinctions when theorizing about and investigating the experience of emotions during performance, what drives those experiences, and the consequences that may occur. Thus, this work supports prior research that suggests it is theoretically and practically important to disentangle emotional valence and activation potential (i.e., activating/deactivating) due to emotional arousal playing a key role in the relationship between affect and behavioral phenomenon (Kuppens et al., 2013; North et al., 2024).

Finding profiles that are distinct due to their experience of deactivating emotions is important when considering the setting under which emotions were assessed. Distinct from prior work, this study examined emotions while participants actively engaged with a complex task. Integral emotions may have stronger or different effects than incidental emotions or trait affect (Hillebrandt & Barclay, 2017; Strasbaugh & Connelly, 2022; Summers & Duxbury, 2012). It is possible individuals who have greater positive or negative affect generally experienced other emotions more prominently when engaged with the task or following the change. Indeed, participants experienced qualitatively different emotions in skill acquisition than in adaptive performance (e.g., 16% of those in the Sample 2 Scar profile during acquisition were in the Mary Poppins profile in adaptation). Although prior work suggests positive emotions are better for performance—a conclusion consistent with my results—this may be less consequential in practice if most individuals experience deactivating emotions during task performance. My findings indicate most participants belonged to profiles characterized by greater deactivating emotions and overall moderate levels of performance, suggesting it may be critical to understand and address deactivating emotions when seeking to improve performance outcomes.

Emotion Change, Trajectories, and Configurations

Regarding emotion change over time during task engagement, prior research has found support for core affect theory (Neal et al., 2023; Russell, 2003) which posits: (a) performance gains shift affect toward a more positive state, whereas poor performance gains or losses move affect toward a negative state, and (b) increases in task demands lead to more activated affect, and decreases in demands move affect to a more deactivated state. As emotions and performance were measured simultaneously in the present study, it is difficult to determine whether performance gains or lack thereof moved affect in any particular direction, or vice versa. However, performance increased significantly during acquisition in both samples and during adaptation in Sample 2, yet emotion trajectories did not necessarily become more positive. It is possible that a performance threshold or goal progress is required to elicit an increase in positive affect. In terms of activation, most participants in both samples belonged to profiles with greater deactivating emotions following the task change, rather than shifting to a more activated state. However, a small proportion of participants were identified in profiles with greater activating emotions, either positive or negative. This indicates additional factors, such as interest in the task or emotional reactivity, may be required to become more activated in response to increased task demands. For example, profiles in adaptation that had higher PA emotions (i.e., Judy Hopps, Mary Poppins) also had greater video game experience, possibly indicating they were more engaged with the task and perceived the change as an opportunity or challenge, rather than feeling discouraged. Conversely, the profile in adaptation that had higher NA emotions (i.e., Scar) had lower emotional stability, suggesting they may have experienced greater frustration or anger when the task changed, moving affect toward a more activated state.

By examining multiple emotion trajectories and visualizing them graphically, this research offers a more nuanced exploration of emotion experiences. The person-centered approach used in this study allows for the examination and comparison of distinct emotion-trajectory configurations. For instance, although both Judy Hopps and Mary Poppins were characterized by lower negative emotions and greater positive emotions (specifically in Sample 2 during adaptation), they differed in their positive emotion trajectories—Judy Hopps exhibited greater positive emotion levels and growth than Mary Poppins. Similarly, although the Eeyore and Duchess profiles experienced similar levels of ND emotions, Duchess was distinct due to their higher PD emotions. Previous work examining changes in affect and work outcomes has focused on differences in positive and negative affect (e.g., Bledow et al., 2011; Yang et al., 2016) and was unable to compare, for example, potential differences that exist between individuals with stable positive affect and individuals that experience an upshift in positive affect. The person-centered approach used in this study identified profiles with these characteristics (e.g., Judy Hopps, Mary Poppins in Sample 2 adaptation), allowing for an examination of whether performance differences exist. Although Judy Hopps and Mary Poppins had the highest performance scores in adaptation, the difference between them was not statistically significant. This suggests maintaining greater positive emotions than negative emotions may be beneficial for complex task performance, however, there may not be a specific degree of positive emotions or threshold required to be related to increased performance. This may suggest that emotion-performance relationships depend on which emotions are most salient (i.e., which emotions are experienced most strongly) over time, such that experiencing higher positive emotions on average matters more than the level at which individuals experience those emotions. Indeed, profiles whose highest emotion scores were positive (averaging PA and PD; Judy Hopps, Mary Poppins) had higher performance. Additionally, profiles whose highest emotion scores were negative (averaging NA and ND; Scar, Beast in acquisition) had lower performance, whereas profiles whose highest emotion scores were deactivating (averaging PD and ND; Eeyore, Bagheera, Duchess, Beast in adaptation) had moderate performance outcomes. None of the profiles highest average emotion scores were activating (averaging PA and NA).

Theoretical Implications for Adaptive Performance

At a surface level, skill acquisition and adaptive performance may seem qualitatively similar, as both involve acquiring skills and knowledge required to complete a task. Indeed, growth modeling demonstrates trajectories of initial performance gains that level off over time for both processes (Lang & Bliese, 2009). However, adaptation requires additional processes for successful performance. Specifically, individuals must detect change, understand its nature, and determine how to respond to the change (Jundt & Shoss, 2023). Affect is thought to play an important role in adaptive performance processes due to change evoking emotions that affect individuals' ability to engage in these processes (Jundt et al., 2015; Jundt & Shoss, 2023; Kiefer, 2002). Although I did not examine specific adaptive performance processes, my findings indicate there were affective differences between acquisition and adaptation. Additional emotion profiles with distinct trajectories were identified in adaptation, and more profiles emerged overall (e.g., three in acquisition versus five in adaptation in Sample 2). Most notably, adaptation profiles were marked by the experience of greater deactivating emotions, aligning with research that indicates change is viewed as threatening and can evoke emotions (e.g., discouragement, disappointment) detrimental for performance (Jundt & Shoss, 2023; Niessen & Jimmieson, 2016).

Some individuals were identified in a different profile following the change, indicating their emotion experiences in adaptation differed from those in acquisition which may have helped or hindered their ability to meet new task demands. In Sample 1, very few individuals remained in the top performing profile characterized by greater positive emotions (i.e., Mary Poppins). Instead, many exhibited emotion trajectories that were more deactivated or negative in nature and were identified in profiles that had lower performance scores. Similarly, in Sample 2, the majority of participants belonged to profiles that experienced greater deactivating emotions, further supporting that emotion arousal is critical for adaptation. Another difference found between acquisition and adaptation emotion profiles was the role of antecedent variables. Antecedents related to emotion trajectories or the probability of profile membership assignment in acquisition were not as relevant in adaptation. Such a finding ostensibly suggests change itself was more important for participants' emotional response and performance in adaptation than cognitive and noncognitive traits. However, findings also showed profile membership in adaptation was related to membership in acquisition, indicating emotions and performance in acquisition likely played a role in adaptation membership. In this way, the present findings support previous conclusions made in the literature regarding how acquisition and adaptation are related yet distinct phenomena (Arthur & Day, 2013).

Limitations and Future Research

There are several limitations that should be considered when interpreting and generalizing the results of this study. First, although it is a strength this study used person-centered approaches to identify unobserved subgroups, one common criticism of these methods is the extent to which findings generalize beyond the study sample due to unique attributes that may exist within the sample (Howard & Hoffman, 2018). To combat this weakness, this study leveraged two samples to assess whether the findings would be replicated. Indeed, several profiles were identified that shared similar antecedents and performance outcomes in both samples. However, other profiles were not replicated, indicating caution should be used when generalizing findings to a broader population. Future research should explore what profiles emerge across diverse samples and complex task environments to further understand the robustness of the profiles, their antecedents, and performance outcomes.

Second, the performance task used in this study was selected because it reflects the demands of a complex and fast-paced environment. Due to the type of task, the emotion trajectories and profiles identified may be most applicable to complex, fast-paced performance contexts. Integral emotions experienced during complex task performance environments may differ from those experienced in everyday settings or when engaged with other task types (e.g., procedural tasks). As such, future research should assess whether different profiles emerge when examining emotions experienced broadly versus integral emotions experienced during complex task performance, as well as during other performance contexts.

Third, although I found support that profile membership was related to performance, the mechanism underlying this relationship remains unclear. Generally, profiles characterized by higher positive emotions performed best, whereas profiles characterized for greater negative emotions performed worst. Variable-centered approaches have suggested positive emotions are related to problem solving (Isen, 2001), whereas negative emotions may increase task mistakes (Lester et al., 2022). Although it was a strength of this study to examine different cognitive and noncognitive traits and their relationship with profile membership, future studies should examine whether profiles differ in their use of emotion regulation strategies, task engagement, effort, and attention. It may also be beneficial to consider how an intervention could be leveraged to alter emotion trajectories (e.g., greater PA emotions) to align with profiles that tend to perform better. Based on my findings, interventions that promote PA emotions while reducing negative emotions may enhance performance. Meta-analytic evidence shows certain strategies (e.g., reappraising the stimulus) are particularly effective for regulating one's emotion response and experience (Webb et al., 2012), and may thus be leveraged to facilitate positive emotions following change. Additionally, by having a better understanding of individuals' different emotion trajectories, it may be possible to develop or leverage emotion regulation strategies more effectively to suit the experience of the individual, rather than rely on broad suggestions (e.g., encourage positive emotions, suppress negative emotions).

Fourth, it should be noted participants were tasked with self-reporting their experienced emotions. Participants may have struggled to accurately monitor their emotions and may have over- or underestimated the degree of their PA, PD, NA, or ND emotions. Some participants may have also been hesitant to report they experienced high boredom or anger. Future research could integrate physiological or behavioral measures of emotion (e.g., facial expressions, heart rate) in addition to self-report data to more comprehensively assess emotions.

Conclusion

Researchers' understanding of emotions continues to evolve. Emotions are complex; they change, are context-dependent, vary in valence and activation potential, co-occur, and relate to behavior. This study employed a novel, person-centered approach that embraces these complexities to provide a more nuanced understanding of how emotions relate to performance, specifically in skill acquisition and adaptive performance within a complex task environment.

Participants reported distinct yet shared patterns of emotion experiences in acquisition and adaptation, such that the person-centered approach successfully identified meaningfully distinct emotion profiles. Additionally, profiles had different antecedents and performance outcomes. Like with previous, variable-centered research, profiles characterized by greater positive and negative emotions were generally associated with greater and lesser levels of performance, respectively. However, several novel findings emerged when examining the emotion profiles. First, emotion experiences (i.e., profiles) were identified that variable-centered approaches are not sensitive to (e.g., higher deactivating emotions, Duchess, Eeyore; rapid shifts in affect, Beast). Second, the experience of higher deactivating emotions is a common and integral component of emotion profiles, particularly following unexpected change. Third, the person-centered approach revealed meaningful heterogeneity between profiles with similar valence or arousal distinctions (e.g., Mary Poppins versus Judy Hopps and Eeyore versus Duchess). In other words, it takes the full complement of PA, PD, NA, and ND levels relative to each other along with the differences in their trajectories to understand how the emotion experiences of individuals differ.

By identifying patterns in emotion experiences variable-centered methods often overlook, this study challenges simple positive-versus-negative emotion distinctions in the emotions literature and demonstrates emotion trajectories differ across periods of acquisition and adaptation in important ways. The identification of previously unobserved emotion profiles highlights the importance of emotional arousal in complex performance contexts. Altogether, my findings indicate that traditional theories of emotion may lack the specificity needed to fully capture the dynamic interplay between emotions and behavioral outcomes. By using a person-centered approach and identifying subgroups of individuals based on their emotion experiences—considering how emotions change, co-occur, and vary in valence and arousal—this study provides a foundation for more nuanced models of emotion in complex performance contexts where change is commonplace. I hope my findings spur more use of person-centered approaches in future research to advance theory on the experience of emotions in complex and dynamic performance contexts.

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Table 1

Sample 1: Means, Standard Deviations, and Correlations

Variable	*M*	*SD*	1	2	3	4	5	6	7	8	9	10
1.ACT	26.20	4.08										
2.Vid. game exp.	0.004	0.84	0.07	(.69)								
3.Extraversion	5.60	1.12	−0.06	−0.04	(.90)							
4.Agreeableness	6.85	0.92	−0.11	0.05	0.38***	(.90)						
5.Conscientiousness	6.16	0.95	0.01	0.04	0.32***	0.45***	(.88)					
6.Emotional stability	5.30	0.88	0.14*	0.08	0.17**	0.19**	0.35***	(.81)				
7.Openness	6.47	0.93	0.07	0.08	0.42***	0.33***	0.39***	−0.05	(.87)			
8.Perf. Avoid	2.58	0.83	−0.08	−0.04	−0.37***	−0.21***	−0.28***	−0.29***	−0.30***	(.85)		
9.Perf. Approach	3.67	0.66	0.04	0.11	0.13*	−0.08	−0.02	−0.15*	0.07	0.15**	(.72)	
10.Mastery Approach	3.93	0.56	0.14*	0.05	0.41***	0.19**	0.35***	0.27***	0.42***	−0.55***	0.02	(.80)
11.Trait PA	5.96	1.49	−0.13*	−0.01	0.56***	0.37***	0.20***	0.09	0.30***	−0.25***	−0.02	0.29***
12.Trait PD	5.78	1.43	−0.04	0.04	0.22***	0.22***	0.25***	0.43***	0.09	−0.25***	−0.11*	0.24***
13.Trait NA	3.41	1.37	−0.06	−0.08	−0.12*	−0.19**	−0.27***	−0.57***	0.04	0.22***	0.17**	−0.15**
14.Trait ND	3.77	1.35	−0.10	−0.07	−0.15**	−0.23***	−0.24***	−0.37***	−0.13*	0.22***	0.14*	−0.21***
15.Performance	20.64	8.44	0.20***	0.48***	−0.16**	0.09	0.08	0.10	0.09	−0.11	−0.03	0.09

Variable	11	12	13	14	15
11.Trait PA	(.86)				
12.Trait PD	0.46***	(.84)			
13.Trait NA	−0.06	−0.39***	(.86)		
14.Trait ND	−0.08	−0.16**	0.69***	(.69)	
15.Performance	−0.05	0.01	−0.22***	−0.12*	(.94)

Note. $N = 303$. Diagonal values are coefficient alpha reliabilities. Video game experience was a standardized composite. Mean alpha across 14 sessions for performance. $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$, two-tailed.

Table 2

Sample 1: Fit Statistics for Growth Mixture Models (GMM) in Skill Acquisition and Adaptive Performance

No. of Profiles	AIC	BIC	Entropy	LMR
Skill Acquisition				
1	24903.713	25171.101	-	-
2	24839.512	25140.325	0.878	80.632
3	**24802.790**	**25137.026**	**0.909**	**18.565**
4	24784.235	25151.894	0.868	35.858†
5	24761.059	25162.142	0.886	40.391
6	24756.672	25191.179	0.892	19.720
7	24740.124	25208.054	0.870	21.014
8	24779.321	25280.675	0.864	−43.201
Adaptive Performance				
1	24092.529	24359.918	-	-
2	24008.134	24308.946	0.910	100.442*
3	23958.614	24292.850	0.887	66.232
4	**23913.802**	**24281.461**	**0.898**	**59.187**
5	23889.582	24290.665	0.887	36.645
6	23876.106	24310.613	0.919	22.084
7	23866.902	24334.832	0.896	6.857
8	23896.034	24397.388	0.959	−52.439

Note. Bold font indicates the best fitting model. † < 0.10, *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$. The best loglikelihood value was not replicated for the 6-profile, 7-profile, and 8-profile models in acquisition and adaptation.

Table 3

Sample 1: Significant Mean Intercept and Slope Values by Profile in Skill Acquisition

Profile		PA	PD	NA	ND
Beast	Intercept	2.66	1.81	5.92	4.67
(*n* = 12)	Slope	0.00	0.78	−0.57	0.00
Scar	Intercept	4.51	3.29	5.29	3.91
(*n* = 72)	Slope	−0.21	0.00	0.12	0.32
Mary Poppins	Intercept	4.73	3.88	3.07	2.67
(*n* = 219)	Slope	−0.15	0.05	−0.13	0.07

Note. *N* = 303. PA = positive activating. PD = positive deactivating. NA = negative activating. ND = negative deactivating.

Table 4

Sample 1: Significant Mean Intercept and Slope Values by Profile in Adaptive Performance

Profile		PA	PD	NA	ND
Judy Hopps	Intercept	6.72	4.40	2.22	2.37
(*n* = 29)	Slope	−0.09	0.16	−0.09	0.07
Eeyore	Intercept	2.86	4.08	2.95	3.94
(*n* = 204)	Slope	−0.07	0.05	−0.09	0.06
Beast	Intercept	2.74	2.36	4.88	4.83
(*n* = 24)	Slope	0.00	0.70	−0.42	0.00
Scar	Intercept	3.06	3.52	4.95	5.48
(*n* = 46)	Slope	−0.11	−0.14	0.22	0.23

Note. *N* = 303. PA = positive activating. PD = positive deactivating. NA = negative activating. ND = negative deactivating.

Table 5

Sample 1: Analysis of Profile Antecedents in Skill Acquisition

	Beast vs. Scar				Beast vs. Mary Poppins				Scar vs. Mary Poppins			
Antecedent	Coef.	*OR*	*SE*	*p*	Coef.	*OR*	*SE*	*p*	Coef.	*OR*	*SE*	*p*
General Mental Ability	0.19	0.83	0.07	0.02	0.10	0.90	0.07	0.19	−0.09	1.09	0.04	0.03
Video Game Experience	−0.40	1.49	0.85	0.48	−1.00	2.72	1.48	0.07	−0.60	1.82	0.46	0.02
Extraversion	0.12	0.89	0.38	0.78	0.47	0.63	0.27	0.28	0.35	0.71	0.11	0.03
Agreeableness	−0.84	2.32	0.69	0.00	−0.94	2.56	0.66	0.00	−0.10	1.10	0.23	0.64
Conscientiousness	0.54	0.59	0.18	0.08	0.45	0.64	0.17	0.09	−0.09	1.09	0.22	0.67
Emotional Stability	0.89	0.41	0.28	0.19	0.02	0.98	0.64	0.97	−0.87	2.39	0.55	0.00
Openness	−0.60	1.82	0.76	0.15	−0.99	2.69	1.09	0.01	−0.39	1.48	0.31	0.06
Performance Avoidance	1.04	0.35	0.15	0.02	1.10	0.33	0.13	0.01	0.06	0.94	0.21	0.79
Performance Approach	−1.10	3.00	1.76	0.06	−0.52	1.69	0.94	0.35	0.57	0.56	0.14	0.02
Mastery Approach	1.11	0.33	0.18	0.04	0.51	0.60	0.30	0.31	−0.60	1.81	0.57	0.06
Trait PA	−0.66	1.93	0.55	0.02	−0.64	1.90	0.55	0.03	0.02	0.99	0.14	0.91
Trait PD	−0.00	1.00	0.36	0.99	0.17	0.84	0.30	0.63	0.17	0.84	0.14	0.30
Trait NA	−0.38	1.46	0.61	0.37	0.43	0.65	0.30	0.35	0.81	0.45	0.11	0.00
Trait ND	−0.15	1.16	0.44	0.69	−0.07	1.08	0.43	0.85	0.08	0.93	0.17	0.68

Note. Beast $n = 12$. Scar $n = 72$. Mary Poppins $n = 219$. Positive (negative) coefficients indicate a person is more (less) likely to belong to the first latent profile in the comparison. *OR* = odds ratio, indicating the change in likelihood of membership in the second latent profile relative to the first latent profile in the comparison associated with a unit increase in the antecedent. Coef. = coefficients. *SE* = standard error. PA = positive activating. PD = positive deactivating. NA = negative activating. ND = negative deactivating. The dashed line denotes separate antecedent categories. Separate R3STEP analyses were run for each antecedent category in line with previous research (Bigelow et al., 2024; Klotz et al., 2018).

Table 6

Sample 1: Analysis of Profile Antecedents in Adaptive Performance

	Judy Hopps vs. Eeyore				Judy Hopps vs. Beast				Judy Hopps vs. Scar			
Antecedent	Coef.	*OR*	*SE*	*p*	Coef.	*OR*	*SE*	*p*	Coef.	*OR*	*SE*	*p*
General Mental Ability	0.06	1.06	0.06	0.28	0.00	1.00	0.07	0.98	0.10	1.11	0.07	0.09
Video Game Experience	0.32	1.37	0.29	0.14	0.46	1.58	0.56	0.19	0.46	1.58	0.45	0.11
Extraversion	0.13	1.14	0.30	0.62	0.19	1.20	0.41	0.59	−0.26	0.77	0.22	0.36
Agreeableness	0.21	1.23	0.34	0.45	0.17	1.18	0.52	0.70	0.24	1.28	0.41	0.45
Conscientiousness	−0.67	0.51	0.18	0.06	−0.57	0.56	0.32	0.32	−0.22	0.80	0.32	0.58
Emotional Stability	0.76	2.14	0.70	0.02	0.98	2.67	1.40	0.06	1.53	4.61	1.69	0.00
Openness	0.78	2.18	0.81	0.04	−0.06	0.94	0.52	0.92	0.78	2.19	0.86	0.05
Performance Avoidance	−0.66	0.52	0.25	0.17	−0.42	0.66	0.42	0.51	−0.90	0.41	0.21	0.08
Performance Approach	−0.09	0.91	0.27	0.76	−0.59	0.56	0.25	0.20	−0.59	0.56	0.25	0.19
Mastery Approach	1.08	2.94	1.73	0.07	0.93	2.53	2.08	0.26	0.87	2.39	1.53	0.17
Trait PA	0.70	2.01	0.75	0.06	0.78	2.18	0.87	0.05	0.58	1.79	0.67	0.12
Trait PD	−0.03	0.97	0.29	0.91	−0.20	0.82	0.28	0.57	0.16	1.18	0.38	0.61
Trait NA	−0.04	0.96	0.36	0.91	−0.73	0.48	0.23	0.12	−0.58	0.56	0.22	0.15
Trait ND	−0.07	0.93	0.30	0.83	0.45	1.57	0.70	0.31	0.14	1.16	0.40	0.68

Table 6 Continued

	Eeyore vs. Beast				Eeyore vs. Scar				Beast vs. Scar			
Antecedent	Coef.	*OR*	*SE*	*p*	Coef.	*OR*	*SE*	*p*	Coef.	*OR*	*SE*	*p*
General Mental Ability	−0.06	0.94	0.06	0.32	0.05	1.05	0.04	0.28	0.11	1.11	0.07	0.11
Video Game Experience	0.15	1.16	0.37	0.65	0.14	1.15	0.27	0.54	−0.01	1.00	0.36	0.99
Extraversion	0.05	1.06	0.27	0.83	−0.39	0.68	0.12	0.03	−0.45	0.64	0.18	0.12
Agreeableness	−0.41	0.96	0.40	0.92	0.03	1.03	0.24	0.88	0.08	1.08	0.46	0.86
Conscientiousness	0.09	1.10	0.52	0.85	0.45	1.56	0.41	0.09	0.36	1.43	0.68	0.46
Emotional Stability	0.22	1.25	0.58	0.63	0.77	2.16	0.52	0.00	0.55	1.73	0.79	0.23
Openness	−0.84	0.43	0.20	0.07	0.00	1.00	0.21	0.99	0.84	2.32	1.07	0.07
Performance Avoidance	0.24	1.27	0.63	0.62	−0.23	0.79	0.20	0.36	−0.48	0.62	0.32	0.36
Performance Approach	−0.50	0.61	0.26	0.24	−0.50	0.61	0.23	0.19	0.00	1.00	0.52	1.00
Mastery Approach	−0.15	0.86	0.57	0.82	−0.21	0.81	0.30	0.58	−0.06	0.95	0.67	0.94
Trait PA	0.08	1.09	0.21	0.66	−0.12	0.89	0.15	0.50	−0.20	0.82	0.17	0.33
Trait PD	−0.17	0.85	0.20	0.48	0.20	1.22	0.23	0.29	0.36	1.44	0.33	0.12
Trait NA	−0.69	0.50	0.18	0.06	−0.54	0.58	0.13	0.01	0.15	1.16	0.34	0.62
Trait ND	0.52	1.68	0.59	0.14	0.22	1.24	0.25	0.28	−0.31	0.74	0.23	0.33

Note. Judy Hopps n = 29. Eeyore n = 204. Beast n = 24. Scar n = 46. Positive (negative) coefficients indicate a person is more (less) likely to belong to the first latent profile in the comparison. *OR* = odds ratio, indicating the change in likelihood of membership in the second latent profile relative to the first latent profile in the comparison associated with a unit increase in the antecedent. Coef. = coefficients. *SE* = standard error. PA = positive activating. PD = positive deactivating. NA = negative activating. ND = negative deactivating. The dashed line denotes separate antecedent categories. Separate R3STEP analyses were run for each antecedent category in line with previous research (Bigelow et al., 2024; Klotz et al., 2018).

Table 7

Sample 1: Contingency Table of Profile Membership in Skill Acquisition and Adaptive Performance

	Adaptive Performance Profiles				
Skill Acquisition Profiles	Judy Hopps	Eeyore	Beast	Scar	Total
Beast	0 (0%)	8 (66.7%)	2 (16.7%)	2 (16.7%)	12
Scar	1 (1.4%)	33 (45.8%)	9 (12.5%)	29 (40.3%)	72
Mary Poppins	28 (12.%)	163 (74.4%)	13 (5.9%)	15 (6.8%)	219
Total	29	204	24	46	303

Note. Percentages reflect the percentage of participants from the skill acquisition profile who were identified in the adaptive performance profile.

Table 8

Sample 1: Overview of Latent Profiles of Emotion Trajectories in Skill Acquisition

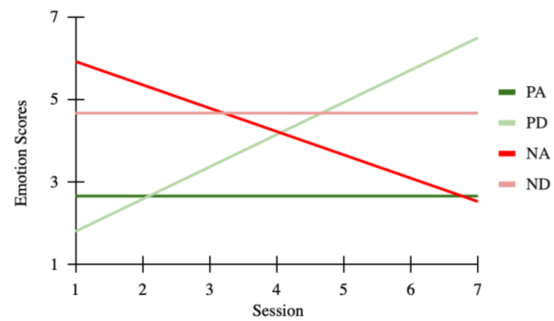
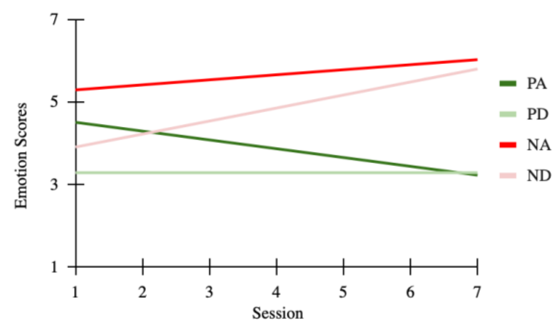
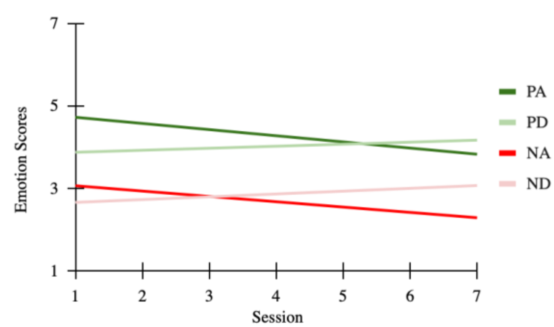
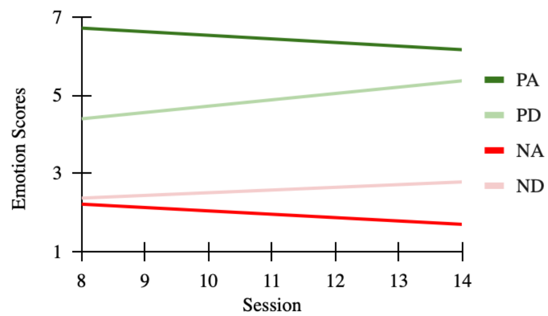
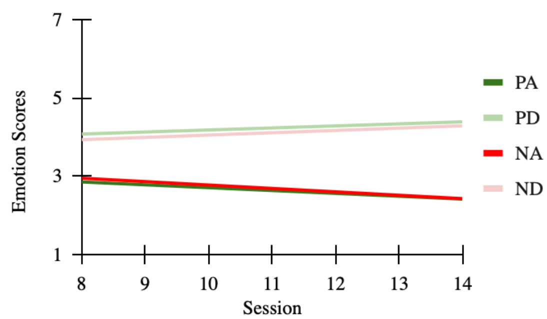
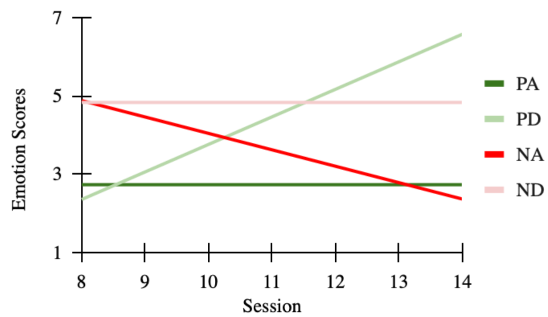
<table>
<tr><th>Profile Information</th><th>Emotion Trajectory Graph of Profile</th></tr>
<tr><td><u>Profile Label</u>
Beast (4% of Sample)
<u>Distinguishing Characteristics</u>
Exemplified by low, stable PA emotions, low PD emotions that sharply increased over time, moderate NA emotions that sharply decreased over time, and moderate, stable ND emotions
<u>Relevant Antecedents</u>
Lower agreeableness, higher performance avoidance orientation, higher mastery approach orientation, lower trait PA
<u>Performance</u>
Lower performance scores than Mary Poppins in all sessions and Scar in Sessions 6 and 7</td><td></td></tr>
<tr><td><u>Profile Label</u>
Scar (24% of Sample)
<u>Distinguishing Characteristics</u>
Exemplified by moderate PA emotions that decreased over time, low, stable PD emotions, moderate NA emotions that slightly increased over time, and moderate ND emotions that increased over time
<u>Relevant Antecedents</u>
Lower general cognitive ability, higher extraversion, higher performance approach orientation, higher trait NA
<u>Performance</u>
Lower performance scores than Mary Poppins in all sessions and higher performance scores than Beast in Sessions 6 and 7</td><td></td></tr>
<tr><td><u>Profile Label</u>
Mary Poppins (72% of Sample)
<u>Distinguishing Characteristics</u>
Exemplified by moderate PA emotions that slightly decreased over time, moderate PD emotions that slightly increased over time, low NA emotions that slightly decreased over time, and low ND emotions that slightly increased over time
<u>Relevant Antecedents</u>
Higher video game experience, higher emotional stability, higher openness
<u>Performance</u>
Higher performance scores than Beast and Scar across all sessions</td><td></td></tr>
</table>

Table 9

Sample 1: Overview of Latent Profiles of Emotion Trajectories in Adaptive Performance

Profile Information	Emotion Trajectory Graph of Profile
Profile Label *Judy Hopps (10% of Sample)* **Distinguishing Characteristics** Exemplified by high PA emotions that slightly decreased over time, moderate PD emotions that slightly increased over time, low NA emotions that slightly decreased over time, and low ND emotions that slightly increased over time **Relevant Antecedents** Higher emotional stability, higher openness **Performance** Higher performance scores on average than Eeyore, Beast, and Scar	
Profile Label *Eeyore (67% of Sample)* **Distinguishing Characteristics** Exemplified by low PA emotions that slightly decreased over time, moderate PD emotions that slightly increased over time, low NA emotions that slightly decreased over time, and moderate ND emotions that slightly increased over time **Relevant Antecedents** Higher emotional stability **Performance** Lower performance scores than Judy Hopps, no significant performance differences than Beast, higher performance scores than Scar	
Profile Label *Beast (8% of Sample)* **Distinguishing Characteristics** Exemplified by low, stable PA emotions, low PD emotions that sharply increased over time, moderate NA emotions that decreased over time, and moderate, stable ND emotions **Relevant Antecedents** Lower trait PA **Performance** Lower performance scores than Judy Hopps, no significant performance differences than Eeyore, higher performance scores than Scar	

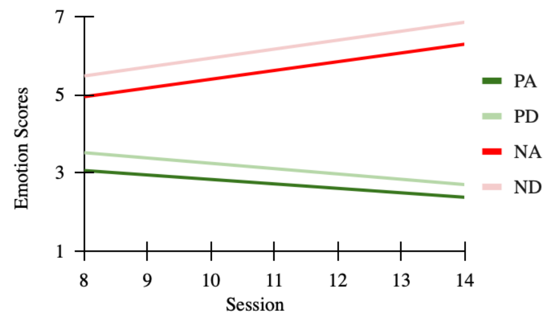
<u>Profile Label</u> *Scar (15% of Sample)* **<u>Distinguishing Characteristics</u>** Exemplified by low PA emotions that slightly decreased over time, low PD emotions that slightly decreased over time, moderate NA emotions that increased over time, and moderate ND emotions that increased over time **<u>Relevant Antecedents</u>** Higher extraversion, higher trait NA **<u>Performance</u>** Lower performance scores performance scores on average than Judy Hopps, Eeyore, and Beast	

Table 10

Sample 2: Means, Standard Deviations, and Correlations

Variable	*M*	*SD*	1	2	3	4	5	6	7	8	9
1.ACT	24.23	7.08									
2.Vid. game exp.	−0.11	0.85	0.11**	(.73)							
3.Extraversion	5.54	1.11	−0.12**	−0.12**	(.88)						
4.Agreeableness	6.94	0.92	−0.05	−0.10*	0.26***	(.90)					
5.Conscientiousness	6.35	0.95	−0.00	−0.12**	0.21***	0.50***	(.88)				
6.Emotional stability	5.09	1.06	0.06	0.14***	0.05	0.16***	0.09*	(.86)			
7.Openness	6.51	0.89	0.09*	−0.02	0.32***	0.43***	0.42***	−0.07	(.85)		
8.Perf. Avoid	2.82	0.87	−0.03	−0.13***	−0.20***	−0.07	−0.09*	−0.33**	−0.16***	(.85)	
9.Perf. Approach	3.58	0.73	0.08*	0.01	0.14***	−0.03	0.09*	−0.16***	0.13**	0.21**	(.77)
10.Mastery Approach	3.78	0.67	0.12**	0.13**	0.23***	0.12**	0.21***	0.22***	0.33***	−0.49***	0.11**
11.Trait PA	5.89	1.51	−0.06	−0.04	0.44***	0.33***	0.20***	0.06	0.14***	−0.11**	0.12**
12.Trait PD	5.56	1.49	0.03	0.14**	0.03	0.11**	0.07	0.43***	−0.07	−0.18***	0.00
13.Trait NA	3.61	1.49	0.02	−0.05	−0.12**	−0.16***	−0.07	−0.58***	0.05	0.29***	0.19***
14.Trait ND	3.96	1.41	0.02	−0.03	−0.18***	−0.12**	−0.16***	−0.36***	−0.02	0.19***	0.09*
15.Performance	17.68	11.19	0.24***	0.61***	−0.16***	−0.10*	−0.18***	0.23***	−0.03	−0.20***	−0.02
16.Sex[1]	-	-	−0.18***	−0.51***	0.06	0.16***	0.17***	−0.32***	0.08*	0.29***	−0.01

Variable	10	11	12	13	14	15
10.Mastery Approach	(.84)					
11.Trait PA	0.20***	(.86)				
12.Trait PD	0.14***	0.42***	(.87)			
13.Trait NA	−0.09*	−0.04	−0.30***	(.86)		
14.Trait ND	−0.13***	−0.07	−0.14***	0.64***	(.68)	
15.Performance	0.15***	−0.14***	0.13***	−0.13**	0.00	(.97)
16.Sex[1]	−0.17***	0.04	−0.22***	0.21***	0.09*	−0.65***

Note. N = 615. Diagonal values are coefficient alpha reliabilities. Video game experience was a standardized composite. Mean alpha across 14 sessions for performance. [1]Sex is a dichotomous variable: 0 = male, 1 = female. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$, two-tailed.

Table 11

Sample 2: Fit Statistics for Growth Mixture Models (GMM) in Skill Acquisition and Adaptive Performance

No. of Profiles	AIC	BIC	Entropy	LMR
Skill Acquisition				
1	50172.000	50490.357	-	-
2	50065.564	50423.716	0.830	122.319***
3	**50009.005**	**50406.951**	**0.789**	**73.291**
4	49961.200	50398.940	0.790	64.687
5	49911.472	50389.007	0.806	62.926
6	49898.500	50415.829	0.818	25.121
7	49842.309	50399.433	0.831	55.679
8	49935.045	50531.964	0.849	88.856
Adaptive Performance				
1	49434.418	49752.775	-	-
2	49273.616	49631.767	0.875	175.761**
3	49196.969	49594.915	0.826	93.037
4	49121.891	49559.632	0.876	91.494
5	**49049.192**	**49526.727**	**0.837**	**89.157**
6	49015.492	49532.822	0.856	50.820
7	49008.303	49565.428	0.858	0.317
8	49002.116	49599.035	0.866	8.539

Note. Bold font indicates the best fitting model. † < 0.10, *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$. The best loglikelihood value was not replicated for the 5-profile, 6-profile, 7-profile, and 8-profile models in acquisition or for the 6-profile, 7-profile, and 8-profile models in adaptation.

Table 12

Sample 2: Significant Mean Intercept and Slope Values by Profile in Skill Acquisition

Profile		PA	PD	NA	ND
Judy Hopps	Intercept	5.57	4.70	3.52	3.31
(*n* = 147)	Slope	0.00	0.00	−0.07	0.05
Scar	Intercept	3.42	2.85	5.45	4.57
(*n* = 94)	Slope	−0.22	0.00	0.17	0.20
Bagheera	Intercept	3.55	3.50	3.47	3.27
(*n* = 374)	Slope	−0.26	0.00	−0.14	0.15

Note. *N* = 615. PA = positive activating. PD = positive deactivating. NA = negative activating. ND = negative deactivating.

Table 13

Sample 1: Significant Mean Intercept and Slope Values by Profile in Adaptive Performance

Profile		PA	PD	NA	ND
Scar	Intercept	2.18	2.70	5.69	5.84
(*n* = 67)	Slope	−0.12	0.00	0.00	0.15
Duchess	Intercept	1.99	6.52	2.08	3.88
(*n* = 43)	Slope	−0.10	0.00	0.00	0.17
Judy Hopps	Intercept	5.23	5.06	2.87	3.24
(*n* = 30)	Slope	0.31	0.16	0.00	0.00
Mary Poppins	Intercept	4.50	4.51	3.43	3.93
(*n* = 142)	Slope	0.00	0.10	−0.06	0.05
Eeyore	Intercept	2.22	3.05	3.04	4.19
(*n* = 333)	Slope	−0.11	0.00	−0.11	0.04

Note. *N* = 615. PA = positive activating. PD = positive deactivating. NA = negative activating. ND = negative deactivating.

Table 14

Sample 2: Analysis of Profile Antecedents in Skill Acquisition

	Judy Hopps vs. Scar				Judy Hopps vs. Bagheera				Scar vs. Bagheera			
Antecedent	Coef.	*OR*	*SE*	*p*	Coef.	*OR*	*SE*	*p*	Coef.	*OR*	*SE*	*p*
General Mental Ability	0.00	1.00	0.02	0.98	0.00	1.00	0.02	0.92	0.00	1.00	0.02	0.96
Video Game Experience	0.64	1.89	0.38	0.00	0.53	1.70	0.22	0.00	−0.11	0.90	0.18	0.61
Extraversion	−0.21	0.81	0.13	0.20	0.08	1.09	0.12	0.44	0.29	1.34	0.21	0.06
Agreeableness	0.11	1.11	0.26	0.64	0.34	1.40	0.23	0.04	0.23	1.26	0.26	0.25
Conscientiousness	−0.15	0.86	0.18	0.47	−0.24	0.79	0.12	0.10	−0.10	0.91	0.16	0.59
Emotional Stability	0.85	2.33	0.41	0.00	0.14	1.15	0.14	0.25	−0.71	0.49	0.08	0.00
Openness	0.07	1.07	0.22	0.74	−0.20	0.82	0.13	0.20	−0.26	0.77	0.14	0.15
Performance Avoidance	−0.27	0.76	0.18	0.25	−0.27	0.77	0.12	0.09	0.01	1.01	0.21	0.98
Performance Approach	−0.80	0.45	0.11	0.00	0.14	1.15	0.20	0.42	0.94	2.56	0.58	0.00
Mastery Approach	0.84	2.32	0.67	0.00	0.20	1.22	0.26	0.35	−0.64	0.53	0.13	0.01
Trait PA	−0.12	0.88	0.11	0.30	0.22	1.24	0.11	0.02	0.34	1.41	0.15	0.00
Trait PD	0.28	1.32	0.17	0.02	0.21	1.24	0.12	0.03	−0.07	0.94	0.10	0.54
Trait NA	−0.34	0.71	0.09	0.01	0.10	1.11	0.13	0.37	0.45	1.56	0.19	0.00
Trait ND	−0.07	0.93	0.14	0.63	−0.03	0.97	0.10	0.79	0.04	1.04	0.15	0.76
Sex[1]	−1.90	0.15	0.05	0.00	−1.29	0.28	0.07	0.00	0.61	1.85	0.56	0.04

Note. Judy Hopps n = 147. Scar n = 94. Bagheera n = 374. Positive (negative) coefficients indicate a person is more (less) likely to belong to the first latent profile in the comparison. *OR* = odds ratio, indicating the change in likelihood of membership associated with a unit increase in the antecedent. Coef. = coefficients. *SE* = standard error. PA = positive activating. PD = positive deactivating. NA = negative activating. ND = negative deactivating. [1]Sex is a dichotomous variable: 0 = male, 1 = female. The dashed line denotes separate antecedent categories. Separate R3STEP analyses were run for each antecedent category in line with previous research (Bigelow et al., 2024; Klotz et al., 2018).

Table 15

Sample 2: Analysis of Profile Antecedents in Adaptive Performance

	Scar vs. Duchess				Scar vs. Judy Hopps				Scar vs. Mary Poppins			
Antecedent	Coef.	*OR*	*SE*	*p*	Coef.	*OR*	*SE*	*p*	Coef.	*OR*	*SE*	*p*
General Mental Ability	0.01	1.01	0.04	0.83	0.01	1.01	0.03	0.79	0.00	1.00	0.03	0.84
Video Game Experience	−0.14	0.87	0.25	0.64	−0.53	0.59	0.13	0.02	−0.34	0.71	0.15	0.09
Extraversion	0.15	1.16	0.26	0.51	−0.08	0.93	0.23	0.75	0.23	1.26	0.21	0.18
Agreeableness	−0.04	0.97	0.34	0.92	−0.12	0.89	0.34	0.76	−0.11	0.89	0.23	0.66
Conscientiousness	−0.02	0.98	0.34	0.95	0.38	1.46	0.43	0.20	0.19	1.21	0.25	0.36
Emotional Stability	−1.06	0.35	0.10	0.00	−1.03	0.36	0.09	0.00	−0.73	0.48	0.09	0.00
Openness	0.05	1.05	0.35	0.87	−0.68	0.51	0.16	0.03	−0.31	0.73	0.17	0.17
Performance Avoidance	0.51	1.66	0.51	0.10	0.28	1.33	0.50	0.45	−0.04	0.96	0.22	0.85
Performance Approach	0.56	1.75	0.59	0.10	0.51	1.66	0.65	0.20	0.43	1.54	0.38	0.08
Mastery Approach	−0.33	0.72	0.24	0.33	−0.97	0.38	0.20	0.06	−1.00	0.37	0.10	0.00
Trait PA	0.49	1.64	0.25	0.00	−0.14	0.87	0.21	0.55	0.08	1.08	0.14	0.54
Trait PD	−0.76	0.47	0.10	0.00	−0.12	0.88	0.19	0.56	−0.23	0.80	0.11	0.09
Trait NA	0.41	1.51	0.34	0.07	0.74	2.10	0.52	0.00	0.10	1.10	0.15	0.50
Trait ND	−0.07	0.93	0.14	0.63	−0.03	0.97	0.10	0.79	0.04	1.04	0.15	0.76
Sex[1]	0.85	2.34	1.06	0.06	1.41	4.10	2.12	0.01	1.49	4.42	1.61	0.00

Table 15 Continued

	Scar vs. Eeyore				Duchess vs. Judy Hopps				Duchess vs. Mary Poppins			
Antecedent	Coef.	*OR*	*SE*	*p*	Coef.	*OR*	*SE*	*p*	Coef.	*OR*	*SE*	*p*
General Mental Ability	0.01	1.01	0.02	0.66	0.00	1.00	0.04	0.97	−0.01	0.99	0.03	0.70
Video Game Experience	−0.04	0.97	0.21	0.88	−0.39	0.68	0.17	0.13	−0.21	0.81	0.19	0.39
Extraversion	0.15	1.16	0.20	0.39	−0.23	0.80	0.20	0.38	0.08	1.08	0.20	0.67
Agreeableness	0.10	1.11	0.28	0.69	−0.08	0.92	0.38	0.84	−0.08	0.93	0.27	0.80
Conscientiousness	0.07	1.07	0.21	0.72	0.40	1.50	0.56	0.28	0.21	1.24	0.38	0.49
Emotional Stability	−0.61	0.55	0.09	0.00	0.03	1.03	0.32	0.92	0.34	1.40	0.37	0.20
Openness	−0.08	0.92	0.20	0.71	−0.74	0.48	0.17	0.04	−0.37	0.69	0.20	0.21
Performance Avoidance	−0.15	0.86	0.19	0.50	−0.23	0.80	0.32	0.58	−0.55	0.58	0.16	0.04
Performance Approach	0.43	1.54	0.37	0.07	−0.05	0.95	0.39	0.90	−0.13	0.88	0.26	0.66
Mastery Approach	−0.61	0.54	0.14	0.02	−0.64	0.53	0.28	0.23	−0.68	0.51	0.16	0.04
Trait PA	0.24	1.28	0.15	0.04	−0.63	0.53	0.12	0.01	−0.41	0.66	0.09	0.00
Trait PD	0.10	1.10	0.14	0.44	0.63	1.89	0.49	0.01	0.53	1.70	0.34	0.01
Trait NA	0.42	1.53	0.23	0.00	0.33	1.39	0.42	0.27	−0.32	0.73	0.15	0.13
Trait ND	0.08	1.09	0.18	0.62	0.10	1.11	0.29	0.69	0.30	1.35	0.27	0.13
Sex[1]	0.37	1.45	0.48	0.27	0.56	1.75	0.97	0.31	0.64	1.89	0.77	0.12

Table 15 Continued

	Duchess vs. Eeyore				Judy Hopps vs. Mary Poppins				Judy Hopps vs. Eeyore			
Antecedent	Coef.	*OR*	*SE*	*p*	Coef.	*OR*	*SE*	*p*	Coef.	*OR*	*SE*	*p*
General Mental Ability	0.00	1.00	0.03	0.96	−0.01	0.99	0.02	0.58	0.00	1.00	0.02	0.85
Video Game Experience	0.10	1.11	0.29	0.70	0.18	1.20	0.19	0.24	0.49	1.63	0.27	0.00
Extraversion	0.00	1.00	0.19	0.99	0.31	1.36	0.29	0.16	0.22	1.25	0.25	0.27
Agreeableness	0.14	1.15	0.33	0.63	−0.01	1.01	0.35	0.98	0.22	1.25	0.40	0.50
Conscientiousness	0.09	1.10	0.35	0.77	−0.19	0.83	0.22	0.48	−0.31	0.73	0.18	0.22
Emotional Stability	0.46	1.58	0.42	0.08	0.30	1.35	0.31	0.18	0.43	1.53	0.32	0.04
Openness	−0.14	0.87	0.26	0.65	0.37	1.45	0.38	0.16	0.60	1.82	0.46	0.02
Performance Avoidance	−0.66	0.52	0.14	0.02	−0.33	0.72	0.26	0.36	−0.43	0.65	0.22	0.20
Performance Approach	−0.13	0.88	0.26	0.67	−0.08	0.93	0.33	0.83	−0.07	0.93	0.31	0.83
Mastery Approach	−0.28	0.75	0.22	0.34	−0.04	0.97	0.48	0.94	0.36	1.43	0.68	0.45
Trait PA	−0.25	0.78	0.10	0.06	0.22	1.25	0.29	0.35	0.39	1.47	0.32	0.08
Trait PD	0.85	2.35	0.48	0.00	−0.10	0.90	0.19	0.63	0.22	1.25	0.24	0.26
Trait NA	0.01	1.01	0.23	0.96	−0.65	0.52	0.13	0.01	−0.32	0.73	0.17	0.16
Trait ND	0.19	1.21	0.25	0.36	0.20	1.22	0.25	0.33	0.09	1.09	0.21	0.65
Sex[1]	−0.48	0.62	0.24	0.21	0.07	1.08	0.53	0.88	−1.04	0.35	0.16	0.02

Table 15 Continued

	Mary Poppins vs. Eeyore			
Antecedent	Coef.	*OR*	*SE*	*p*
General Mental Ability	0.02	1.02	0.02	0.40
Video Game Experience	0.31	1.36	0.20	0.03
Extraversion	−0.08	0.92	0.10	0.47
Agreeableness	0.21	1.24	0.20	0.18
Conscientiousness	−0.12	0.89	0.13	0.41
Emotional Stability	0.12	1.13	0.14	0.30
Openness	0.23	1.26	0.20	0.15
Performance Avoidance	−0.10	0.90	0.15	0.52
Performance Approach	0.00	1.00	0.16	0.99
Mastery Approach	0.39	1.48	0.31	0.06
Trait PA	0.17	1.18	0.12	0.10
Trait PD	0.32	1.38	0.16	0.01
Trait NA	0.33	1.39	0.18	0.01
Trait ND	−0.11	0.89	0.11	0.34
Sex[1]	−1.12	0.33	0.09	0.00

Note. Scar n = 67. Duchess n = 43. Judy Hopps n = 30. Mary Poppins n = 142. Eeyore n = 333. Positive (negative) coefficients indicate a person is more (less) likely to belong to the first latent profile in the comparison. *OR* = odds ratio, indicating the change in likelihood of associated with a unit increase in the antecedent. Coef. = coefficients. *SE* = standard error. PA = positive activating. PD = positive deactivating. NA = negative activating. ND = negative deactivating. [1]Sex is a dichotomous variable: 0 = male, 1 = female. The gray line denotes separate antecedent categories. Separate R3STEP analyses were run for each antecedent category in line with previous research (Bigelow et al., 2024; Klotz et al., 2018).

Table 16

Sample 2: Contingency Table of Profile Membership in Skill Acquisition and Adaptive Performance

	Adaptive Performance Profiles					
Skill Acquisition Profiles	Scar	Duchess	Judy Hopps	Mary Poppins	Eeyore	Total
Judy Hopps	3 (2%)	2 (1.4%)	22 (15%)	85 (57.8%)	35 (23.8%)	147
Scar	36 (38.3%)	2 (2.1%)	2 (2.1%)	15 (16%)	39 (41.5%)	94
Bagheera	28 (7.5%)	39 (10.4%)	6 (1.6%)	42 (11.2%)	259 (69.3%)	374
Total	67	43	30	142	333	615

Note. Percentages reflect the percentage of participants from the skill acquisition profile who were identified in the adaptive performance profile.

Table 17

Sample 2: Overview of Latent Profiles of Emotion Trajectories in Skill Acquisition

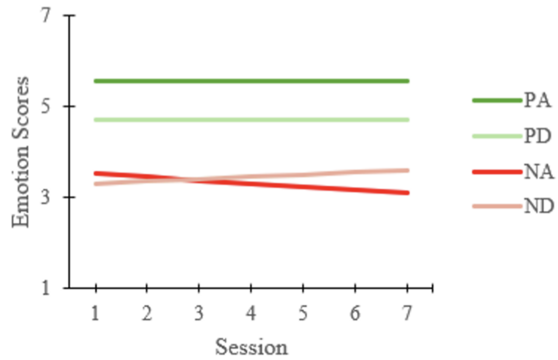
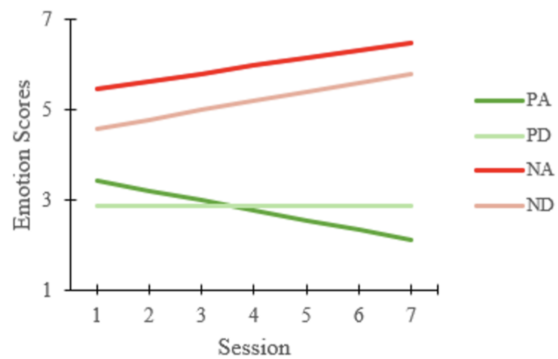
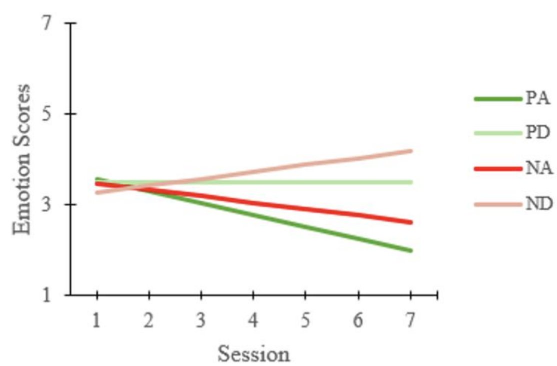
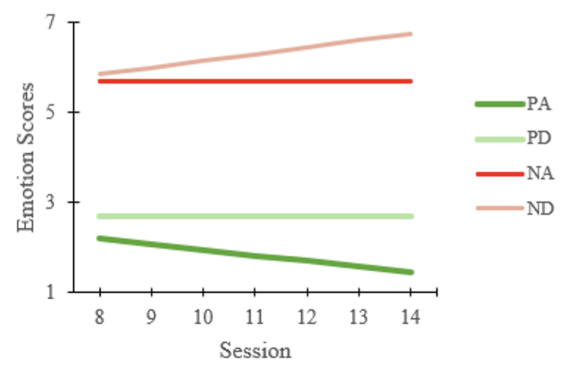
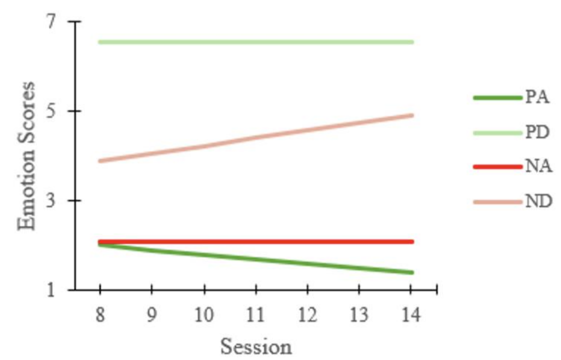
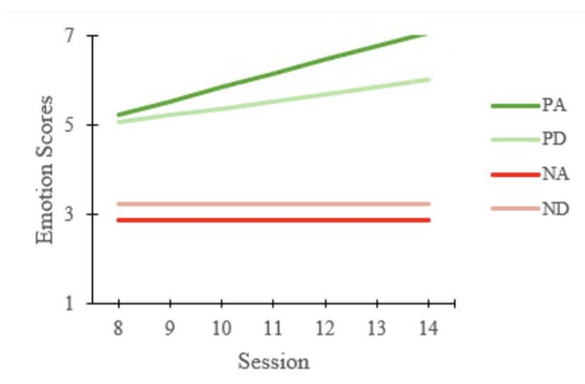
Profile Information	Emotion Trajectory Graph of Profile
<u>Profile Label</u> *Judy Hopps (24% of Sample)* **<u>Distinguishing Characteristics</u>** Exemplified by high, stable PA emotions, moderate, stable PD emotions, moderate NA emotions that slightly decreased over time, and moderate ND emotions that slightly increased over time **<u>Relevant Antecedents</u>** Higher video game experience, higher agreeableness, higher trait PD **<u>Performance</u>** Higher performance scores than Scar and Bagheera	
<u>Profile Label</u> *Scar (15% of Sample)* **<u>Distinguishing Characteristics</u>** Exemplified by moderate PA emotions that decreased over time, low, stable PD emotions, high NA emotions that slightly increased over time, and moderate ND emotions that increased over time **<u>Relevant Antecedents</u>** Lower emotional stability, higher performance approach orientation, lower mastery approach orientation, higher trait NA **<u>Performance</u>** Lower performance scores than Judy Hopps and Bagheera	
<u>Profile Label</u> *Bagheera (61% of Sample)* **<u>Distinguishing Characteristics</u>** Exemplified by moderate PA emotions that decreased over time, moderate, stable PD emotions, moderate NA emotions that slightly decreased over time, and moderate ND emotions that slightly increased over time **<u>Relevant Antecedents</u>** Lower trait PA **<u>Performance</u>** Lower performance scores than Judy Hopps and higher performance scores than Scar	

Table 18

Sample 2: Overview of Latent Profiles of Emotion Trajectories in Adaptive Performance

Profile Information	Emotion Trajectory Graph of Profile
Profile Label *Scar (11% of Sample)* **Distinguishing Characteristics** Exemplified by low PA emotions that slightly decreased over time, low, stable PD emotions, high, stable NA emotions, and high ND emotions that slightly increased over time **Relevant Antecedents** Lower emotional stability, lower mastery approach orientation **Performance** Lower performance scores than Judy Hopps, Mary Poppins, and Eeyore, no significant performance differences with Duchess	
Profile Label *Duchess (7% of Sample)* **Distinguishing Characteristics** Exemplified by low PA emotions that slightly decreased over time, high, stable PD emotions, low, stable NA emotions, and moderate ND emotions that slightly increased over time **Relevant Antecedents** Lower performance avoidance orientation, lower trait PA, higher trait PD **Performance** No significant performance differences with Scar, Judy Hopps, Mary Poppins, and Eeyore	
Profile Label *Judy Hopps (5% of Sample)* **Distinguishing Characteristics** Exemplified by high PA emotions that increased over time, high PD emotions that increased over time, low, stable NA emotions, and moderate, stable ND emotions **Relevant Antecedents** Higher video game experience, higher emotional stability, higher openness, lower trait NA **Performance** Higher performance scores than Scar, no significant performance differences with Duchess, Mary Poppins, or Eeyore	

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Profile Label
Mary Poppins (23% of Sample)
Distinguishing Characteristics
Exemplified by moderate, stable PA emotions, moderate PD emotions that slightly increased over time, moderate NA emotions that slightly decreased over time, and moderate ND emotions that slightly increased over time
Relevant Antecedents
Higher video game experience, higher mastery approach orientation
Performance
Higher performance scores than Scar and Eeyore, no significant performance differences with Duchess and Judy Hopps

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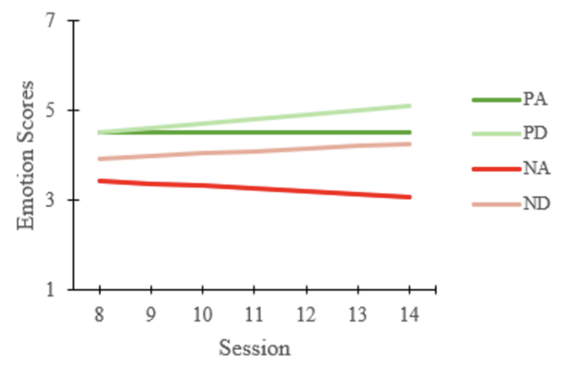

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<tr>
<td>

Profile Label
Eeyore (54% of Sample)
Distinguishing Characteristics
Exemplified by low PA emotions that slightly decreased over time, moderate, stable PD emotions, moderate NA emotions that slightly decreased over time, and moderate ND emotions that slightly increased over time
Relevant Antecedents
Lower trait PA, lower trait PD, lower trait NA
Performance
Lower performance scores than Mary Poppins, higher performance scores than Scar, no significant performance differences with Duchess or Judy Hopps

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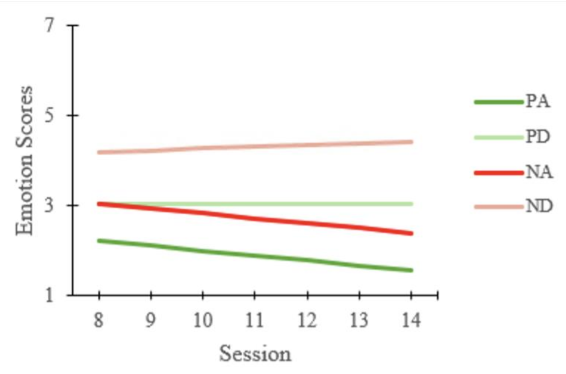

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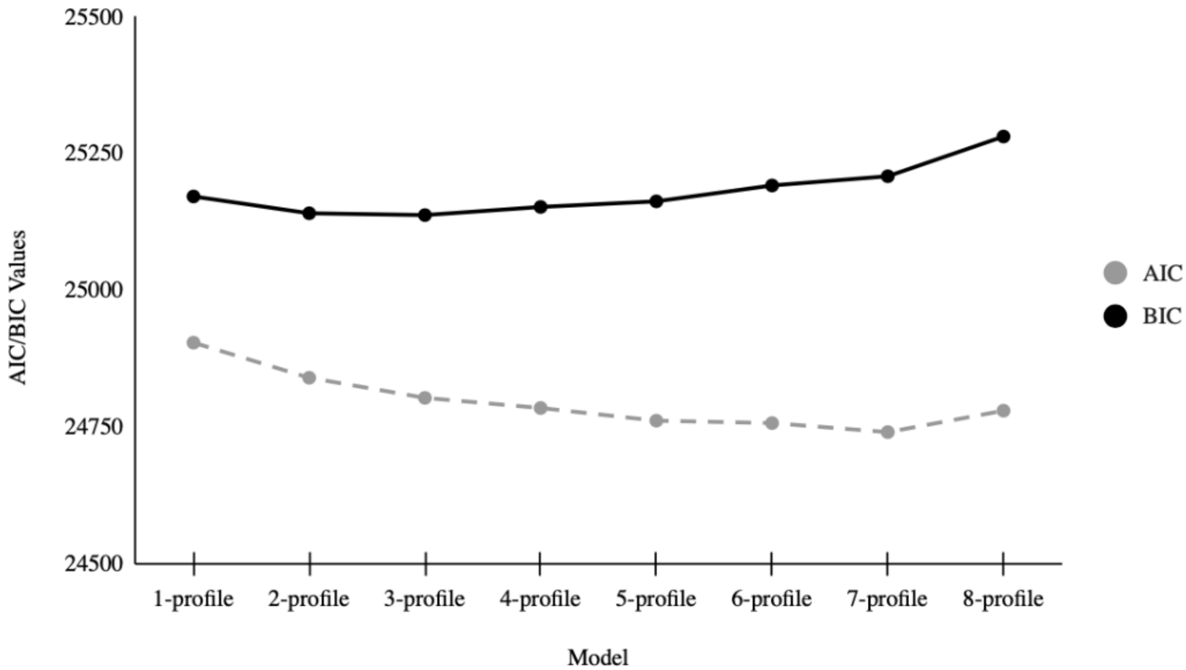
Figure 1

Sample 1: GMM - AIC and BIC Elbow Plots

(A) Skill Acquisition



(B) Adaptive Performance

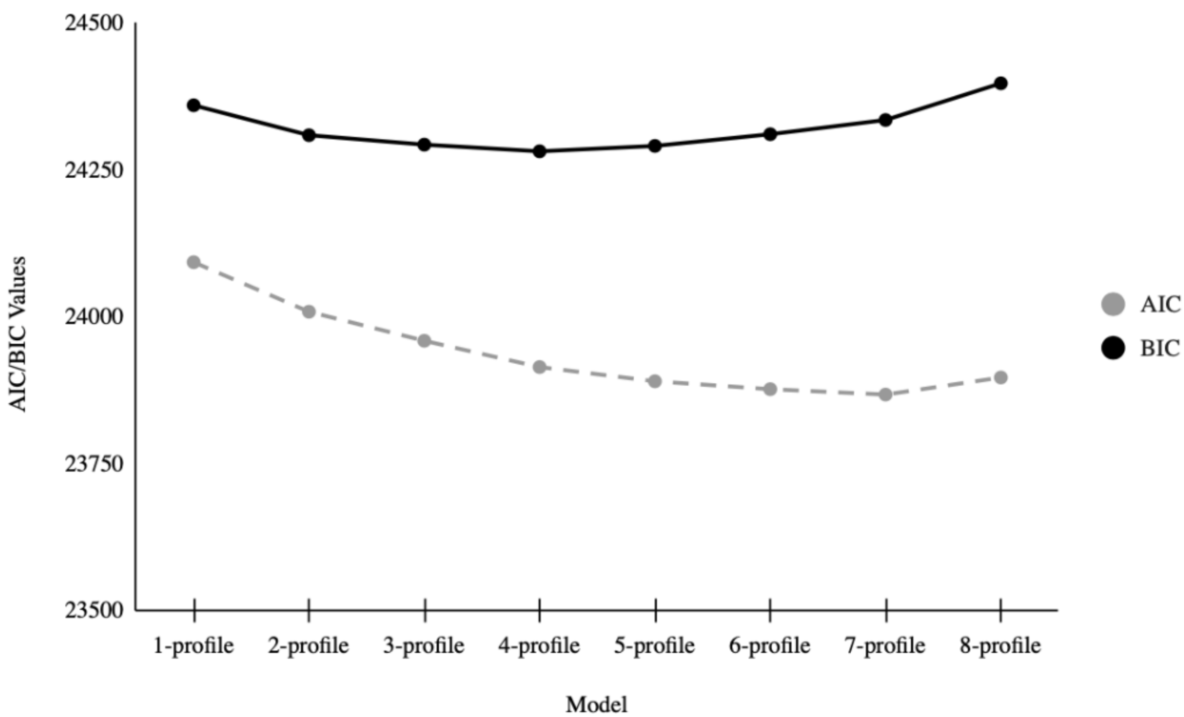
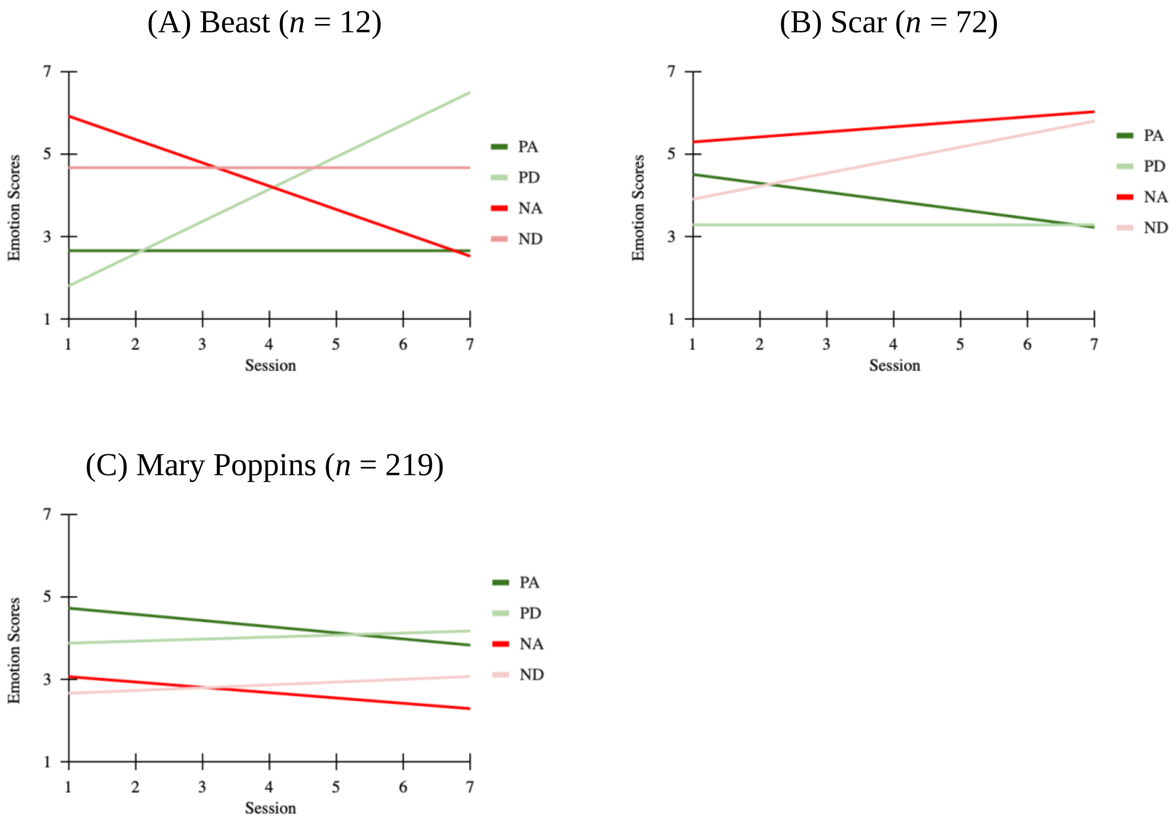


Figure 2

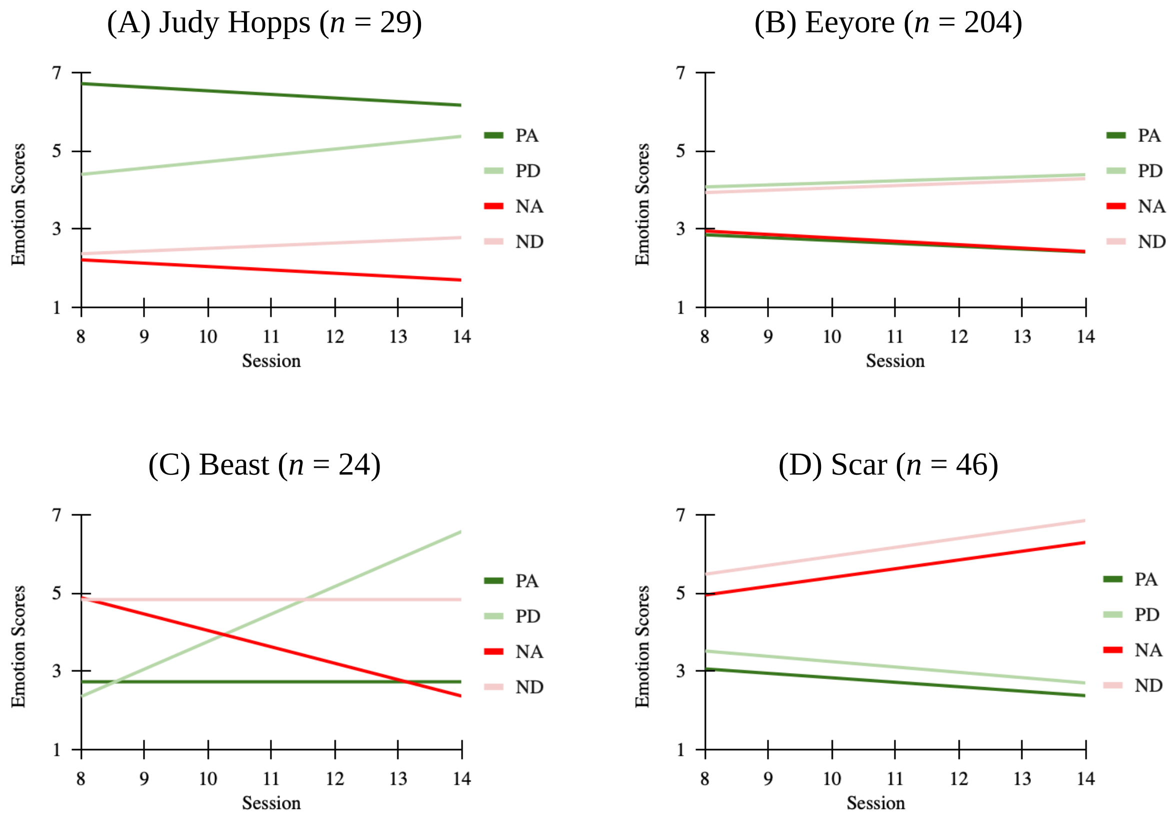
Sample 1: GMM - Latent Profiles of Emotions in Skill Acquisition Parsed by Profile



Note. PA = positive activating. PD = positive deactivating. NA = negative activating. ND = negative deactivating.

Figure 3

Sample 1: GMM - Latent Profiles of Emotions in Adaptive Performance Parsed by Profile



Note. PA = positive activating. PD = positive deactivating. NA = negative activating. ND = negative deactivating.

Figure 4

Sample 1: Profile Transitions from Skill Acquisition to Adaptive Performance

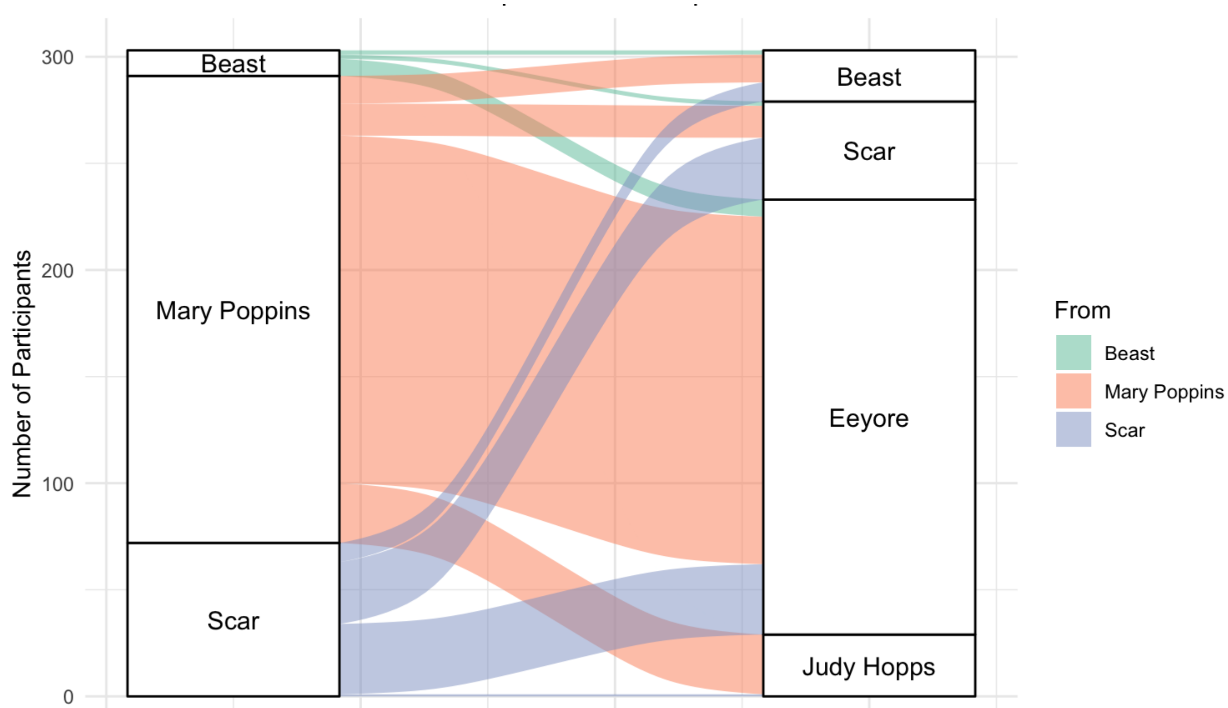
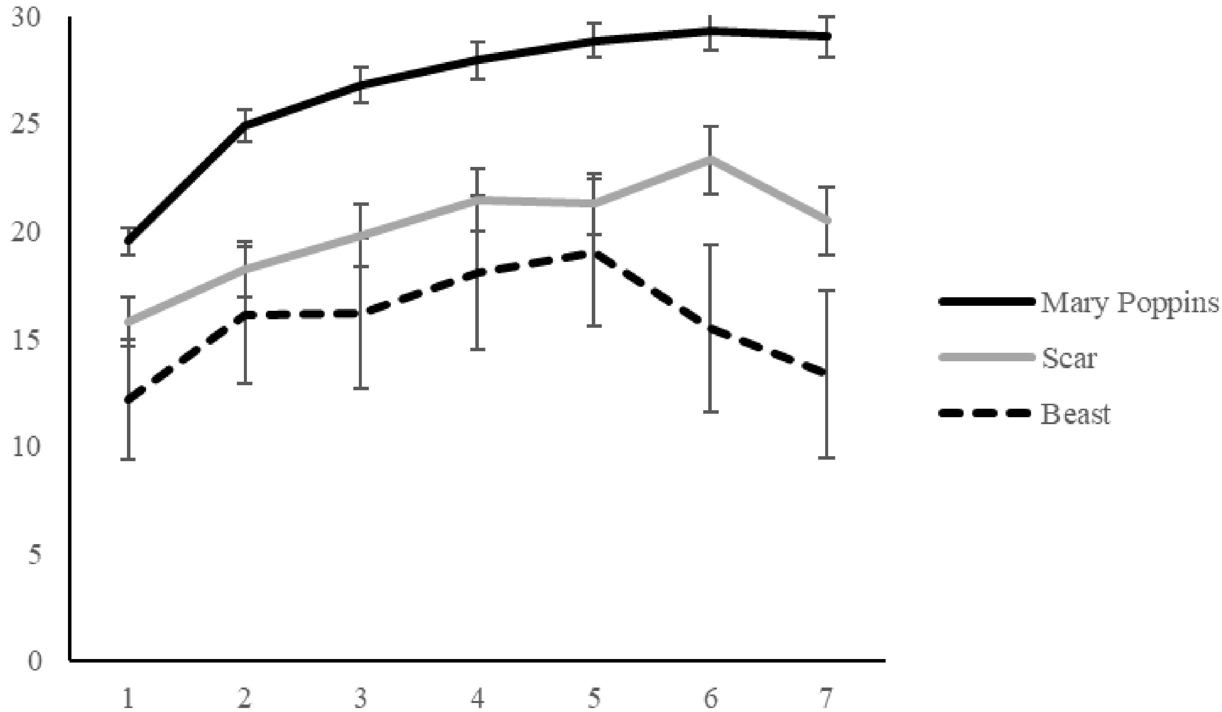


Figure 5

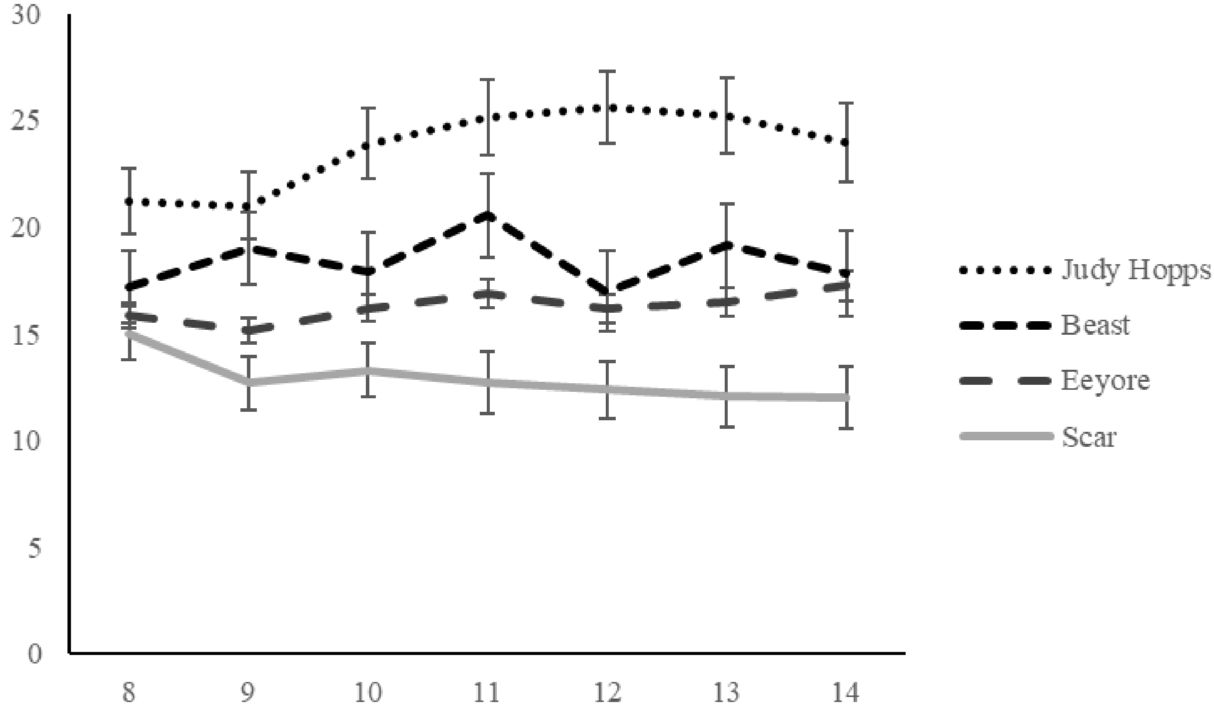
Sample 1: Performance Means by Profile in Acquisition



Note. N = 303. Beast n = 12. Scar n = 72. Mary Poppins n = 219. ±1 standard error.

Figure 6

Sample 1: Performance Means by Profile in Adaptation

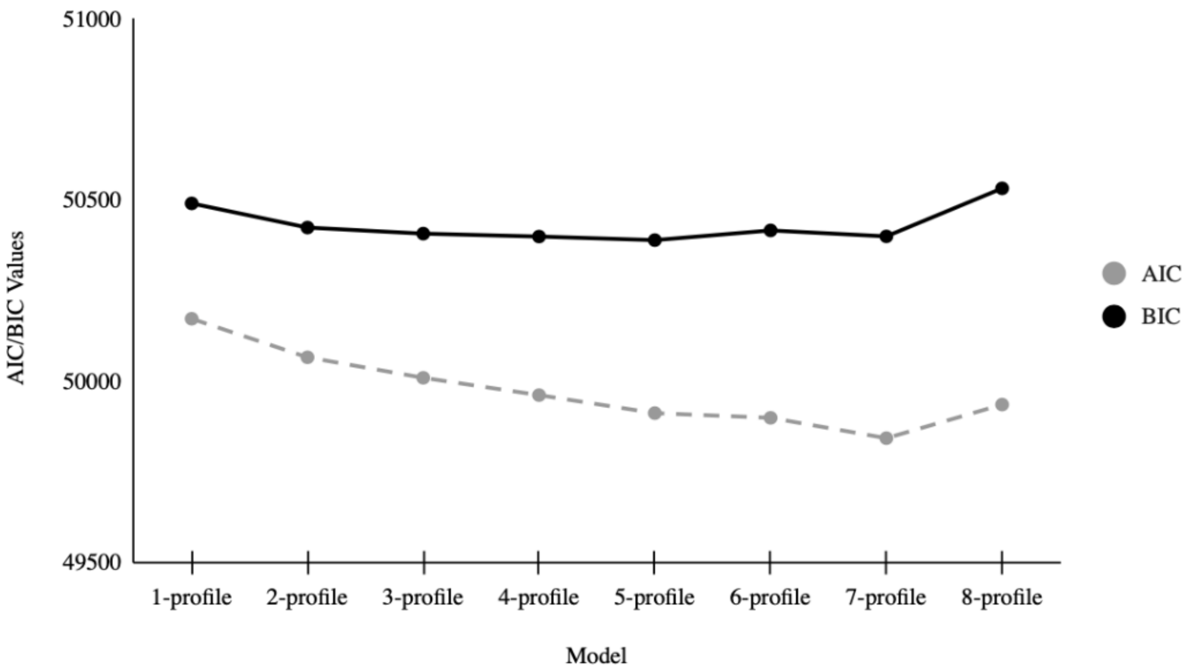


Note. *N* = 303. Judy Hopps *n* = 29. Eeyore *n* = 204. Beast *n* = 24. Scar *n* = 46. ±1 standard error.

Figure 7

Sample 2: GMM - AIC and BIC Elbow Plots

(A) Skill Acquisition



(B) Adaptive Performance

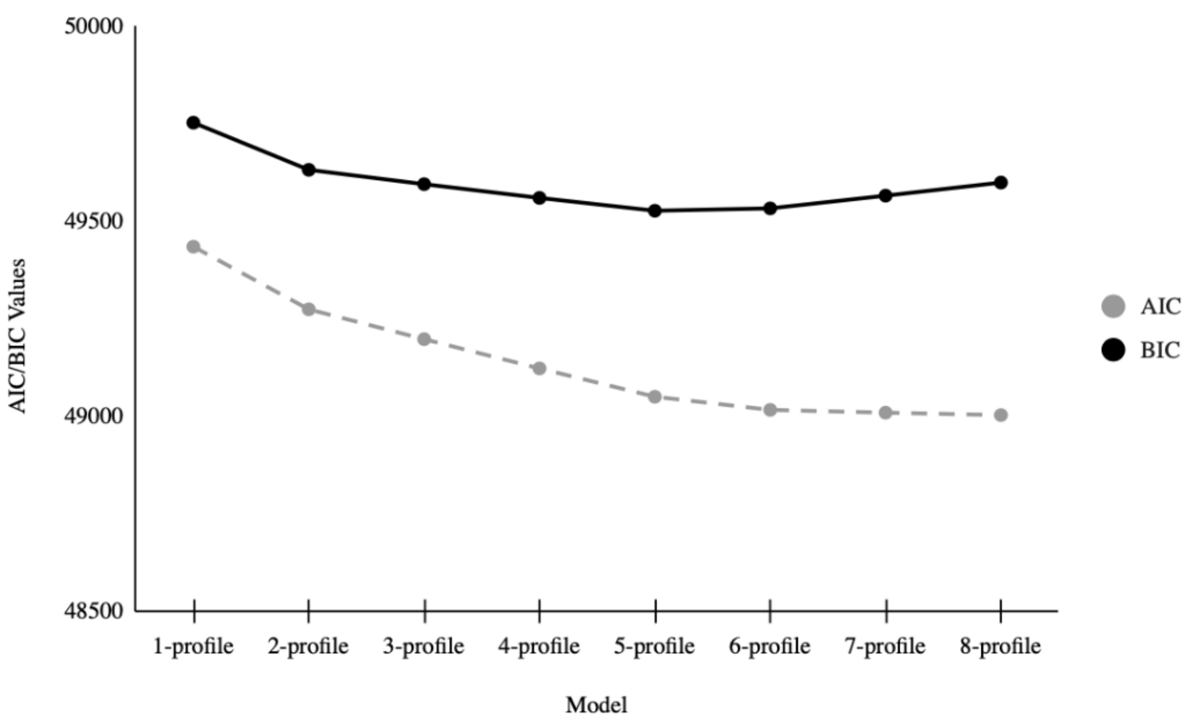
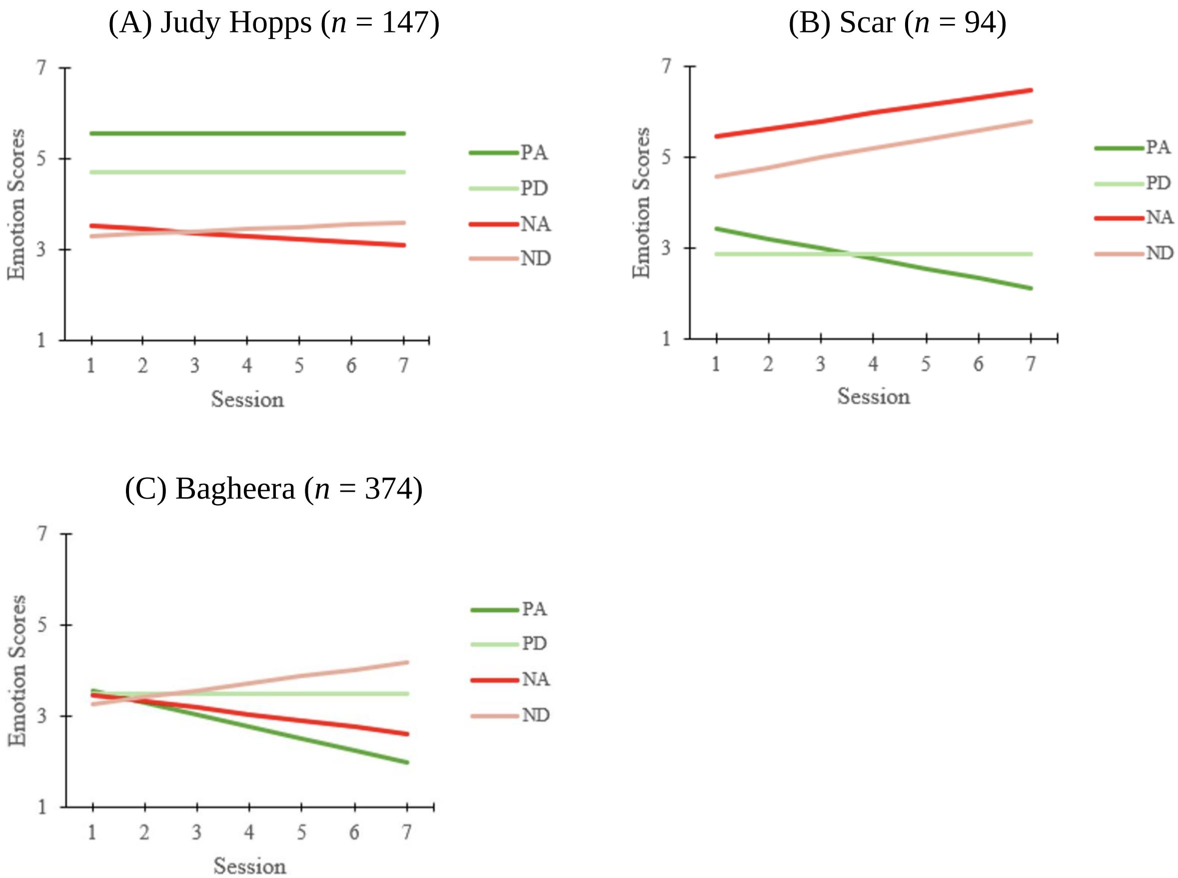


Figure 8

Sample 2: GMM - Latent Profiles of Emotions in Skill Acquisition Parsed by Profile

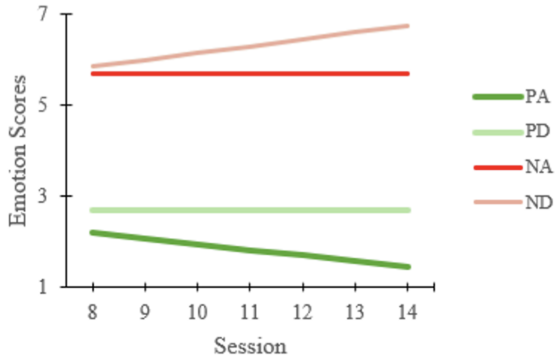


Note. PA = positive activating. PD = positive deactivating. NA = negative activating. ND = negative deactivating.

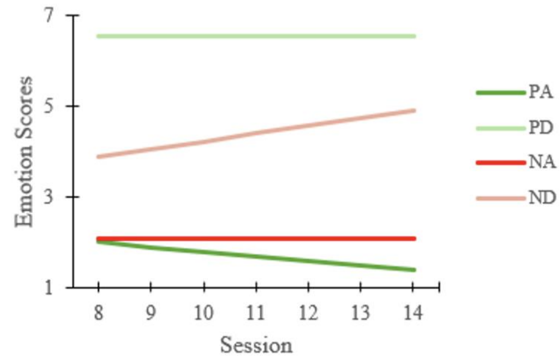
Figure 9

Sample 2: GMM - Latent Profiles of Emotions in Adaptive Performance Parsed by Profile

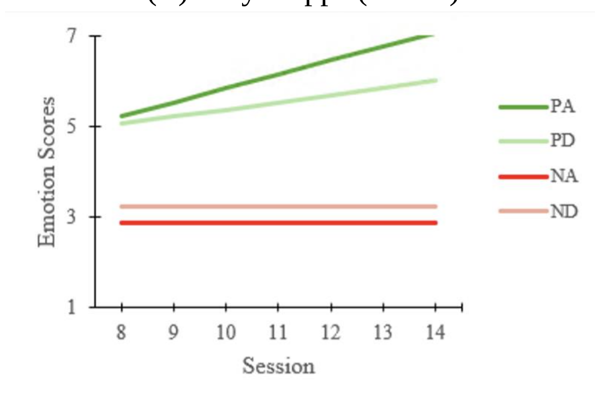
(A) Scar (*n* = 67)



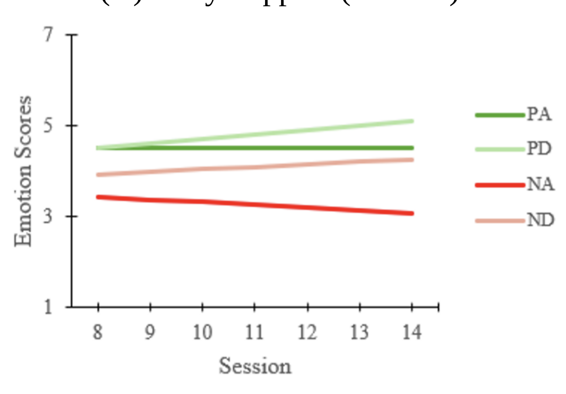
(B) Duchess (*n* = 43)



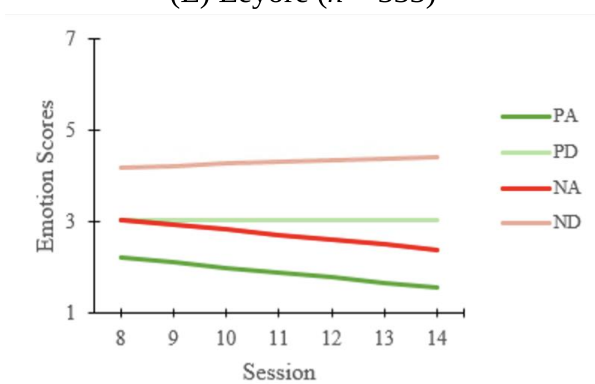
(C) Judy Hopps (*n* = 30)



(D) Mary Poppins (*n* = 142)



(E) Eeyore (*n* = 333)



Note. PA = positive activating. PD = positive deactivating. NA = negative activating. ND = negative deactivating.

Figure 10

Sample 2: Profile Transitions from Skill Acquisition to Adaptive Performance

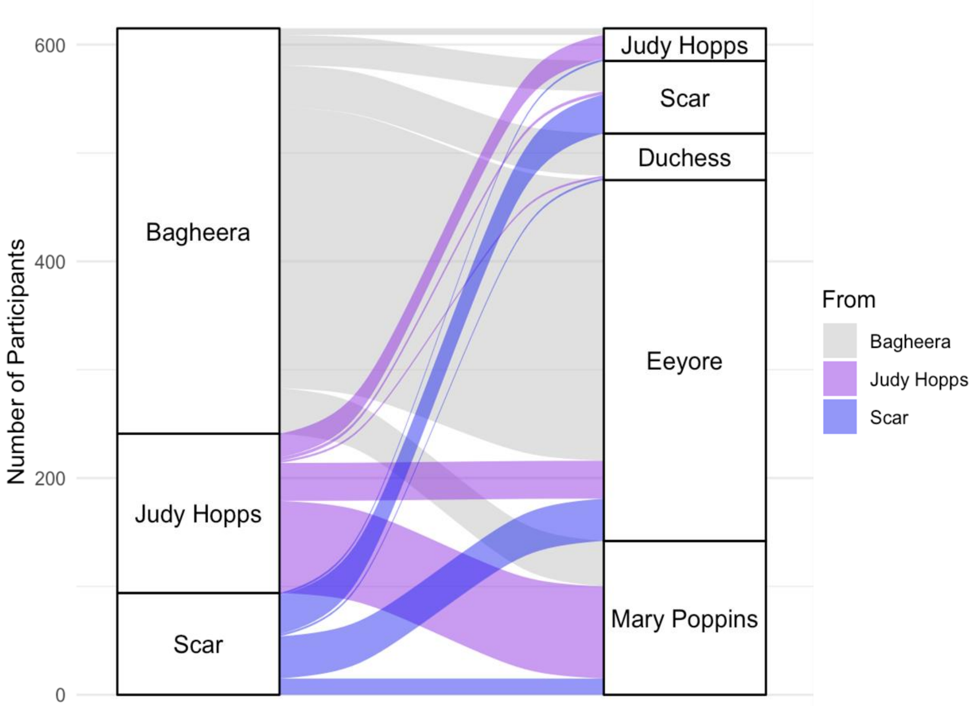
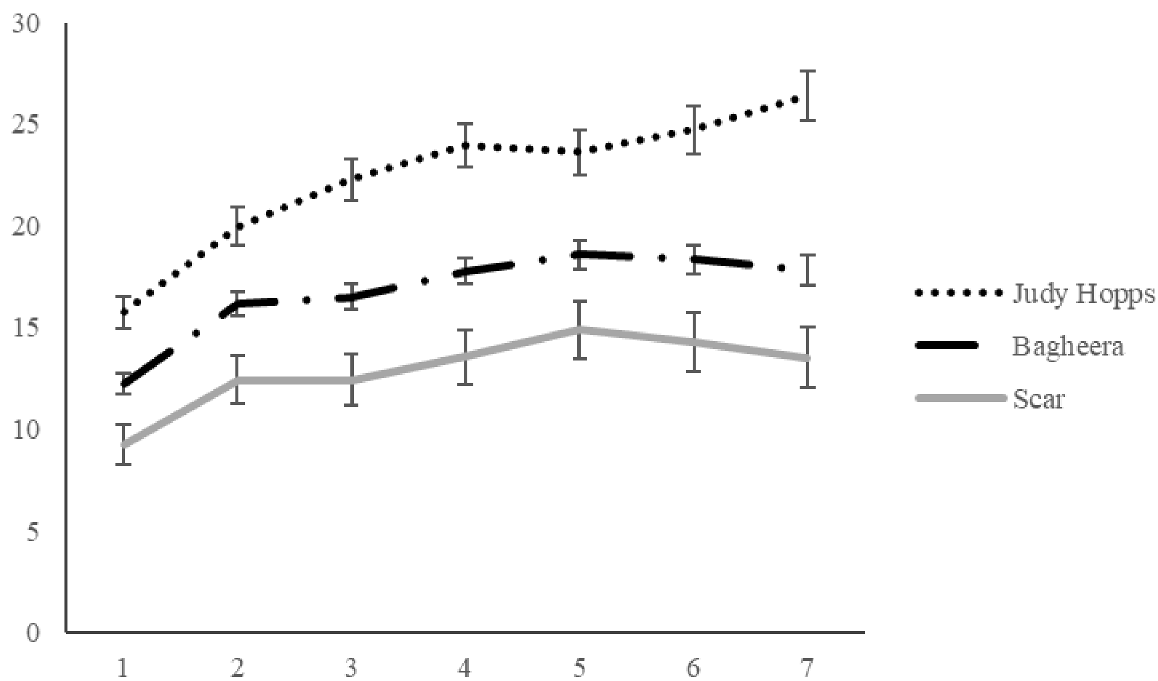


Figure 11

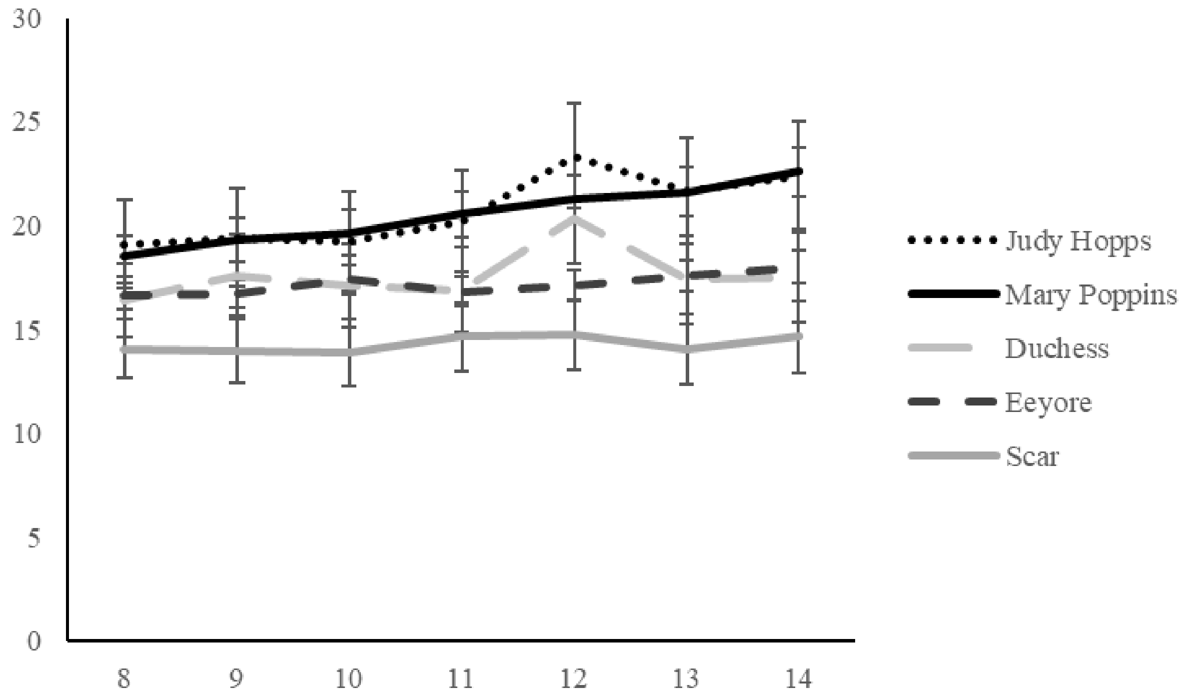
Sample 2: Performance Means by Profile in Acquisition



Note. N = 615. Judy Hopps n = 147. Scar n = 94. Bagheera n = 374. ±1 standard error.

Figure 12

Sample 2: Performance Means by Profile in Adaptation



Note. N = 615. Scar n = 67. Duchess n = 43. Judy Hopps n = 30. Mary Poppins n = 142. Eeyore n = 333. ±1 standard error.

Appendix A

Sample 1 Antecedent Variables Means, Standard Deviations, and Cohen's *d*

Table A1

Sample 1: Means, Standard Deviations, and Cohen's d of Antecedent Variables by Profile in Skill Acquisition

Profile		GMA	VGEXP	Extra	Agree	Consc	EmoSt	Open	PAv	PAp	MAp	Trait PA	Trait PD	Trait NA	Trait ND
Beast (*n* = 12)	*M*	27.85	−0.37	5.50	6.03	6.10	5.54	5.81	3.04	3.50	3.88	4.83	5.36	3.49	3.81
	SD	3.97	0.71	0.96	1.20	0.77	0.98	0.95	0.65	0.89	0.40	1.56	1.52	1.36	1.22
Scar (*n* = 72)	*M*	25.08	−0.25	5.65	6.76	5.94	4.90	6.39	2.72	3.83	3.80	6.06	5.61	4.32	4.46
	SD	3.89	0.84	0.96	0.98	0.88	0.89	0.97	0.80	0.57	0.54	1.32	1.42	1.44	1.37
Mary Poppins (*n* = 219)	*M*	26.48	0.11	5.59	6.92	6.24	5.42	6.53	2.50	3.62	3.97	6.00	5.86	3.10	3.54
	SD	4.09	0.83	1.18	0.86	0.98	0.84	0.90	0.84	0.67	0.56	1.52	1.43	1.21	1.27
Beast vs. Scar	Cohen's *d*	.71†	–.15	–.15	–.67*	.19	.69*	–.60	.44	–.44	.18	–.84*	–.17	–.60†	–.50
Beast vs. Mary Poppins	Cohen's *d*	.34	–.62	–.08	–.85**	–.16	.13	–.78*	.71†	–.16	–.18	–.76*	–.33	.30	.22
Scar vs. Mary Poppins	Cohen's *d*	–.35*	–.43**	.05	–.18	–.32†	–.60**	–.15	.26	.33†	.32†	.04	–.17	.92**	.70**

Note. GMA = General mental ability. VGEXP = Video game experience. Extra = Extraversion. Agree = Agreeableness. Consc = Conscientiousness. EmoSt = Emotional Stability. Open = Openness. PAv = Performance Avoidance. PAp = Performance Approach. MAp = Mastery Approach. PA = Positive Activating. PD = Positive Deactivating. NA = Negative Activating. ND = Negative Deactivating. † < .10, *$p < .05$, **$p < .01$, ***$p < .001$.

Table A2

Sample 1: Means and Standard Deviations of Antecedent Variables by Profile in Adaptive Performance

Profile		GMA	VGEXP	Extra	Agree	Consc	EmoSt	Open	PAv	PAp	MAp	Trait PA	Trait PD	Trait NA	Trait ND
Judy Hopps	*M*	27.03	0.23	5.96	7.08	6.24	5.73	6.82	2.06	3.56	4.28	6.93	6.36	3.04	3.47
(*n* = 29)	*SD*	3.89	0.75	1.08	0.83	1.01	0.90	1.15	0.79	0.59	0.49	1.42	1.35	1.20	1.08
Eeyore	*M*	26.16	0.003	5.52	6.83	6.21	5.36	6.38	2.62	3.63	3.88	5.87	5.82	3.27	3.76
(*n* = 204)	*SD*	4.17	0.86	1.13	0.93	0.92	0.82	0.87	0.80	0.66	0.56	1.47	1.39	1.28	1.35
Beast	*M*	27.01	−0.07	5.74	6.98	6.33	5.22	6.90	2.49	3.80	3.97	5.83	5.76	3.74	3.67
(*n* = 24)	*SD*	4.11	0.84	1.19	0.82	0.97	1.14	1.10	0.95	0.66	0.59	1.49	1.58	1.50	1.44
Scar	*M*	25.43	−0.10	5.68	6.71	5.82	4.81	6.43	2.77	3.83	3.89	5.86	5.24	4.07	4.08
(*n* = 46)	*SD*	3.71	0.84	0.98	0.98	0.99	0.83	0.81	0.86	0.71	0.49	1.46	1.44	1.56	1.39
Judy Hopps vs. Eeyore	Cohen's *d*	.71	.28	.40	.28	.03	.43	.43†	−.70**	−.11	.76**	.73**	.39	−.19	−.24
Judy Hopps vs. Beast	Cohen's *d*	.00	.38	.19	.12	−.09	.50	−.07	−.49	−.38	.57	.76*	.41	−.51	−.16
Judy Hopps vs. Scar	Cohen's *d*	.42	.41	.27	.41	.42	1.06***	.39	−.86**	−.41	.80*	.74*	.80**	−.74**	−.49
Eeyore vs. Beast	Cohen's *d*	−.21	.09	−.19	−.17	−.13	.14	−.52†	.15	−.26	−.16	.03	.04	−.34	.06
Eeyore vs. Scar	Cohen's *d*	.18	.13	−.15	.13	.41†	.67***	−.06	−.18	−.29	−.02	.01	.41†	−.56**	−.23
Beast vs. Scar	Cohen's *d*	.40	.04	.06	.30	.52	.41	.49	−.31	−.04	.15	−.02	.34	−.22	−.29

Note. GMA = General mental ability. VGEXP = Video game experience. Extra = Extraversion. Agree = Agreeableness. Consc = Conscientiousness. EmoSt = Emotional Stability. Open = Openness. PAv = Performance Avoidance. PAp = Performance Approach. MAp = Mastery Approach. PA = Positive Activating. PD = Positive Deactivating. NA = Negative Activating. ND = Negative Deactivating. .† < .10, *p < .05, **p < .01, ***p < .001.

Appendix B
Sample 1 BCH Analyses Results

To determine whether statistically significant mean differences in performance across sessions by profile existed, I used the Mplus automated BCH analysis (Bigelow et al., 2024), which uses weighted multiple-group analysis to test for differences by profile (Asparouhov & Muthén, 2014).

Skill Acquisition

Results of the BCH analysis for profiles in skill acquisition are reported in **Table B1**. In skill acquisition, average performance was significantly higher for participants in Mary Poppins (M = 26.83) than those in Beast (M = 14.73, p < 0.001) or Scar (M = 19.60, p < 0.001). Additionally, average performance was significantly higher for participants in Scar than those in Beast (p = 0.02). Performance scores were significantly higher for participants in Mary Poppins than those in Beast or Scar across all seven sessions of skill acquisition. Generally, there was not a statistically significant difference in performance between participants in Beast and Scar until Sessions 6 and 7, with performance significantly higher for participants in Scar than those in Beast.

Adaptive Performance

Table B2 reports the results of the BCH analysis for profiles in adaptive performance. In adaptive performance, average performance was significantly higher for participants in Judy Hopps (M = 24.41) than those in Eeyore (M = 16.22, p < 0.001), Beast (M = 18.58, p = 0.02), or Scar (M = 12.67, p < 0.001). Additionally, average performance was significantly higher for participants in Eeyore and Beast than those in Scar (both p < 0.01). Participants in Judy Hopps typically had significantly higher performance than participants in the other profiles across all seven sessions of adaptive performance. There were some sessions where participants in Eeyore

(Sessions 10-14) and Beast (Sessions 9, 11-14) had significantly higher performance than participants in Scar.

Table B1

Sample 1: BCH Analysis of Skill Acquisition Emotion Profile Correlates

Correlate	Beast (A)	Scar (B)	Mary Poppins (C)	Omnibus χ^2 test
Session 1	11.47_{C}	15.52_{C}	19.65_{AB}	18.32***
Session 2	15.27_{C}	17.79_{C}	25.12_{AB}	29.32***
Session 3	15.14_{C}	19.33_{C}	26.99_{AB}	44.12***
Session 4	17.15_{C}	21.01_{C}	28.13_{AB}	21.57***
Session 5	18.13_{C}	20.74_{C}	29.07_{AB}	34.70***
Session 6	14.15_{BC}	22.91_{AC}	29.52_{AB}	30.13***
Session 7	11.84_{BC}	19.90_{AC}	29.31_{AB}	52.61***
Skill Acquisition	14.73_{BC}	19.60_{AC}	26.83_{AB}	54.59***

Note. N = 303. Beast n = 12. Scar n = 72. Mary Poppins n = 219. Profile comparisons were examined using BCH analysis in Mplus (Version 8.4). Values are distal outcome means for each profile. Each profile is indicated by a letter (A for Beast, B for Scar, C for Mary Poppins). Subscripts indicate the comparison profiles from which the focal profile is significantly different at $p < .05$. *$p < .05$, **$p < .01$, ***$p < .001$.

Table B2

Sample 1: BCH Analysis of Adaptive Performance Emotion Profile Correlates

Correlate	Judy Hopps (A)	Eeyore (B)	Beast (C)	Scar (D)	Omnibus χ^2 test
Session 8	21.72_{BD}	15.78_{A}	17.37	14.98_{A}	9.03*
Session 9	21.53_{BD}	15.07_{A}	19.38_{D}	12.54_{AC}	20.13***
Session 10	24.62_{BCD}	16.11_{AD}	18.09_{A}	13.13_{AB}	24.58***
Session 11	25.89_{BD}	16.81_{AD}	20.92_{D}	12.45_{ABC}	28.57***
Session 12	26.50_{BCD}	16.09_{AD}	17.06_{AD}	12.16_{ABC}	31.77***
Session 13	26.02_{BCD}	16.43_{AD}	19.37_{AD}	11.78_{ABC}	40.71***
Session 14	24.57_{BCD}	17.24_{AD}	17.87_{AD}	11.65_{ABC}	30.06***
Adaptive Performance	24.41_{BCD}	16.22_{AD}	18.58_{AD}	12.67_{ABC}	40.07***

Note. N = 303. Judy Hopps n = 29. Eeyore n = 204. Beast n = 24. Scar n = 46. Profile comparisons were examined using BCH analysis in Mplus (Version 8.4). Values are distal outcome means for each profile. Each profile is indicated by a letter (A for Judy Hopps, B for Eeyore, C for Beast, D for Scar). Subscripts indicate the comparison profiles from which the focal profile is significantly different at $p < .05$. *$p < .05$, **$p < .01$, ***$p < .001$.

Appendix C
Sample 2 Antecedent Variables Means, Standard Deviations, and Cohen's *d*

Table C1

Sample 2: Means, Standard Deviations, and Cohen's d of Antecedent Variables by Profile in Skill Acquisition

Profile		GMA	VGEXP	Extra	Agree	Consc	EmoSt	Open	PAv	PAp	MAp	Trait PA	Trait PD	Trait NA	Trait ND
Judy Hopps (n = 147)	*M*	24.54	0.17	5.55	7.04	6.30	5.30	6.44	2.63	3.56	3.91	6.22	5.95	3.47	3.86
	SD	6.44	0.91	1.11	0.97	0.97	0.99	0.89	0.91	0.80	0.63	1.45	1.46	1.51	1.32
Scar (n = 94)	*M*	24.09	−0.25	5.69	6.95	6.35	4.56	6.52	3.06	3.85	3.58	6.17	5.36	4.33	4.41
	SD	6.58	0.74	1.07	0.96	0.98	1.06	0.89	0.85	0.59	0.72	1.27	1.33	1.50	1.52
Bagheera (n = 374)	*M*	24.14	–0.20	5.49	6.90	6.38	5.13	6.53	2.83	3.51	3.77	5.68	5.46	3.48	3.89
	SD	7.46	0.83	1.12	0.90	0.93	1.04	0.89	0.85	0.73	0.65	1.55	1.51	1.42	1.39
Judy Hopps vs. Scar	Cohen's *d*	.06	.51***	−.13	−.09	−.05	.72***	−.09	−.49***	−.41**	.49***	.04	.42**	−.57***	−.39**
Judy Hopps vs. Bagheera	Cohen's *d*	.05	.42***	.05	−.15	−.08	.17	−.10	−.23*	.07	.22†	.36***	.33**	−.01	−.02
Scar vs. Bagheera	Cohen's *d*	−.01	−.06	.17	.05	−.03	−.54***	−.01	.27†	.51***	−.28*	.35*	−.07	.58***	.36**

Note. GMA = General mental ability. VGEXP = Video game experience. Extra = Extraversion. Agree = Agreeableness. Consc = Conscientiousness. EmoSt = Emotional Stability. Open = Openness. PAv = Performance Avoidance. PAp = Performance Approach. MAp = Mastery Approach. PA = Positive Activating. PD = Positive Deactivating. NA = Negative Activating. ND = Negative Deactivating. † < .10, *p < .05, **p < .01, ***p < .001.

Table C2

Sample 2: Means and Standard Deviations of Antecedent Variables by Profile in Adaptive Performance

Profile		GMA	VGEXP	Extra	Agree	Consc	EmoSt	Open	PAv	PAp	MAp	Trait PA	Trait PD	Trait NA	Trait ND
Scar (*n* = 67)	*M*	24.35	−0.21	5.63	6.90	6.39	4.51	6.52	3.00	3.72	3.55	6.13	5.36	4.32	4.46
	SD	6.51	0.74	1.14	1.05	1.04	1.14	0.95	0.85	0.66	0.75	1.30	1.26	1.58	1.66
Duchess (*n* = 43)	*M*	24.06	−0.14	5.54	7.01	6.46	5.49	6.41	2.52	3.42	3.79	5.64	6.46	3.25	4.01
	SD	8.85	0.84	1.14	1.00	0.96	1.26	0.85	0.97	0.85	0.70	1.44	1.52	1.50	1.48
Judy Hopps (*n* = 30)	*M*	24.43	0.21	5.94	7.21	6.42	5.47	6.89	2.49	3.50	3.99	6.58	6.11	2.91	3.59
	SD	3.94	0.71	1.08	1.08	1.14	0.93	0.69	0.98	0.83	0.72	1.87	1.63	1.28	1.39
Mary Poppins (*n* = 142)	*M*	24.76	0.02	5.49	7.04	6.37	5.19	6.60	2.73	3.58	3.92	6.21	5.82	3.75	3.94
	SD	6.55	0.83	1.11	0.85	0.89	1.02	0.86	0.86	0.70	0.59	1.39	1.48	1.56	1.37
Eeyore (*n* = 333)	*M*	23.98	−0.18	5.49	6.87	6.33	5.07	6.44	2.89	3.57	3.74	5.67	5.32	3.51	3.90
	SD	7.41	0.88	1.10	0.90	0.94	0.99	0.91	0.84	0.73	0.65	1.52	1.45	1.39	1.34
Scar vs. Duchess	Cohen’s *d*	.04	−.09	.08	−.11	−.07	−.82***	.12	.53*	.39	−.33	.36	−.79**	.69**	.29
Scar vs. Judy Hopps	Cohen’s *d*	−.01	−.58	−.28	−.29	−.03	−.92***	−.45	.56†	.29	−.60*	−.28	−.51	.98***	.57*
Scar vs. Mary Poppins	Cohen’s *d*	−.06	−.29	.12	−.17	.02	−.63***	−.09	.32	.21	−.55**	−.06	−.33	.36†	.34†
Scar vs. Eeyore	Cohen’s *d*	.05	−.04	.12	.03	.06	−.52***	.09	.13	.22	−.27	.33	.03	.54***	.37*
Duchess vs. Judy Hopps	Cohen’s *d*	−.05	−.45	−.36	−.19	.04	.02	−.62	.03	−.10	−.28	−.56†	.22	.24	.29
Duchess vs. Mary Poppins	Cohen’s *d*	−.09	−.19	.04	−.03	.10	.26	−.22	−.23	−.21	−.20	−.40	.43	−.33	.05
Duchess vs. Eeyore	Cohen’s *d*	.01	.05	.04	.15	.14	.37†	−.03	−.41†	−.19	.07	−.02	.77***	−.18	.08
Judy Hopps vs. Mary Poppins	Cohen’s *d*	−.06	.25	.41	.17	.05	.29	.37	−.26	−.10	.11	.22	.19	−.59*	−.25
Judy Hopps vs. Eeyore	Cohen’s *d*	.08	.49	.41	.34	.09	.42	.56†	−.44	−.09	.36	.53*	.51*	−.45	−.23
Mary Poppins vs. Eeyore	Cohen’s *d*	.11	.23	.00	.19	.04	.12	.18	−.19	.01	.29†	.37**	.34**	.16	.03

Note. GMA = General mental ability. VGEXP = Video game experience. Extra = Extraversion. Agree = Agreeableness. Consc = Conscientiousness. EmoSt = Emotional Stability. Open = Openness. PAv = Performance Avoidance. PAp = Performance Approach. MAp = Mastery Approach. PA = Positive Activating. PD = Positive Deactivating. NA = Negative Activating. ND = Negative Deactivating. .† < .10, *p < .05, **p < .01, ***p < .001.

Appendix D
Sample 2 BCH Analyses Results

Skill Acquisition

Results of the BCH analysis for profiles in skill acquisition are reported in **Table D1**. In skill acquisition, average performance was significantly higher for participants in the Judy Hopps (M = 23.13) than those in the Scar (M = 142.09, $p < 0.001$) or Bagheera (M = 16.77, $p < 0.001$) profiles. Additionally, average performance was significantly higher for participants in Bagheera than those in Scar ($p < 0.001$). Performance was significantly higher for participants in Judy Hopps than in Scar or Bagheera across all seven sessions of acquisition, and performance was higher for participants in Bagheera than in Scar across all seven sessions.

Adaptive Performance

Table D2 reports the results of the BCH analysis for profiles in adaptive performance. In adaptive performance, average performance was significantly higher for Mary Poppins (M = 20.92, $p < 0.001$), Judy Hopps (M = 20.81, $p < 0.01$), and Eeyore (M = 17.20, $p = 0.03$) than Scar (M = 13.83). Additionally, average performance was significantly higher for participants in Mary Poppins than those in Eeyore ($p < 0.01$). Participants in Mary Poppins had significantly higher performance than participants in the Scar profile across all seven sessions of adaptive performance. Judy Hopps had significantly higher performance than Scar across all sessions aside from Session 11. Mary Poppins had higher performance than Eeyore in Sessions 9, 11-14, and Judy Hopps had higher performance than Eeyore in Session 12. There were some sessions where Eeyore had higher performance scores than Scar (Sessions 10, 13-14).

Table D1

Sample 2: BCH Analysis of Skill Acquisition Emotion Profile Correlates

Correlate	Judy Hopps (A)	Scar (B)	Bagheera (C)	Omnibus χ^2 test
Session 1	16.24_{BC}	8.57_{AC}	12.26_{AB}	33.33***
Session 2	20.50_{BC}	11.59_{AC}	16.24_{AB}	29.90***
Session 3	23.01_{BC}	12.41_{AC}	16.59_{AB}	37.29***
Session 4	24.75_{BC}	12.51_{AC}	17.78_{AB}	45.21***
Session 5	24.28_{BC}	13.99_{AC}	18.61_{AB}	26.60***
Session 6	25.54_{BC}	13.25_{AC}	18.34_{AB}	33.75***
Session 7	27.47_{BC}	12.38_{AC}	17.80_{AB}	55.82***
Skill Acquisition	23.13_{BC}	12.09_{AC}	16.77_{AB}	52.95***

Note. $N = 615$. Judy Hopps $n = 147$. Scar $n = 94$. Bagheera $n = 374$. Profile comparisons were examined using BCH analysis in Mplus (Version 8.4). Values are distal outcome means for each profile. Each profile is indicated by a letter (A for Judy Hopps, B for Scar, C for Bagheera). Subscripts indicate the comparison profiles from which the focal profile is significantly different at $p < .05$. *$p < .05$, **$p < .01$, ***$p < .001$.

Table D2

Sample 2: BCH Analysis of Adaptive Performance Emotion Profile Correlates

Correlate	Scar (A)	Duchess (B)	Judy Hopps (C)	Mary Poppins (D)	Eeyore (E)	Omnibus χ^2 test
Session 8	13.74_{CD}	16.43	19.14_{A}	18.75_{A}	16.68	9.50*
Session 9	13.61_{CD}	17.74	19.40_{A}	19.62_{AE}	16.74_{D}	12.21*
Session 10	13.43_{CDE}	17.09	19.20_{A}	19.97_{A}	17.49_{A}	11.68*
Session 11	14.37_{D}	16.91	20.16	20.97_{AE}	16.80_{D}	15.06**
Session 12	14.49_{CD}	20.71	23.49_{AE}	21.72_{AE}	16.92_{CD}	22.78***
Session 13	13.56_{CDE}	17.39	21.67_{A}	22.08_{AE}	17.62_{AD}	21.01***
Session 14	14.20_{CDE}	17.46	22.37_{A}	23.10_{AE}	18.01_{AD}	24.51***
Adaptive Performance	13.83_{CDE}	17.67	20.81_{A}	20.92_{AE}	17.20_{AD}	21.88***

Note. $N = 615$. Scar $n = 67$. Duchess $n = 43$. Judy Hopps $n = 30$. Mary Poppins $n = 142$. Eeyore $n = 333$. Profile comparisons were examined using BCH analysis in Mplus (Version 8.4). Values are distal outcome means for each profile. Each profile is indicated by a letter (A for Scar, B for Duchess, C for Judy Hopps, D for Mary Poppins, E for Eeyore). Subscripts indicate the comparison profiles from which the focal profile is significantly different at $p < .05$. *$p < .05$, **$p < .01$, ***$p < .001$.