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Behaviors, strategies, and interactions in cross training (CrossFit®): A qualitative analysis of competitive dynamics

Comportamientos, estrategias e interacciones en el Cross training (CrossFit®): Un análisis cualitativo de la dinámica competitiva

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Abstract

Cross Training (CrossFit®) has gained popularity as a training modality that combines various sports disciplines, promoting physical development and social interaction. This qualitative study of mixed design (ethnographic and phenomenological) analyzed athletes' behaviors, strategies, and interactions in a CrossFit competition. Seventeen athletes (10 men and 7 women) aged 19 to 28 participated. Data was collected through non-participant observation, focusing on behaviors, facial expressions, and body language in three moments: before, during, and after the competition. In addition, five of them were interviewed through semi-structured interviews. The inductive thematic analysis allowed the identification of patterns and emerging categories. The results revealed that athletes employ preparation and recovery strategies, such as hydration and stretching, and experience significant emotional reactions. In the pre-competition phase, nervousness and anxiety were mitigated by social support and camaraderie. During the competition, athletes who adopted collaborative approaches showed superior performance, highlighting the importance of teamwork. In the post-competition phase, social interactions and the festive atmosphere fostered reflection and emotional recovery. These findings highlight the importance of physical and mental preparation and social support in sports performance. The research provides a comprehensive view of competitive dynamics in CrossFit, with practical applications for coaches and event organizers. It is suggested to structure training programs that include effective recovery practices and promote a supportive environment, contributing to the integral development of athletes.

Keywords: sports psychology; performance; emotions; competition coping; athletes.

Resumen

El Cross Training (CrossFit®) ha ganado popularidad como una modalidad de entrenamiento que combina diversas disciplinas deportivas, promoviendo el desarrollo físico y la interacción social. Este estudio cualitativo de diseño mixto (etnográfico y fenomenológico) analizó los comportamientos, estrategias e interacciones de los atletas en una competición de CrossFit. Participaron 17 deportistas (10 hombres y 7 mujeres) de 19 a 28 años. La recolección de datos se realizó mediante observación no participante, enfocada en comportamientos, expresiones faciales y lenguaje corporal en tres momentos: antes, durante y después de la competencia. Además, cinco de ellos fueron entrevistados mediante entrevistas semiestructuradas. El análisis temático inductivo permitió identificar patrones y categorías emergentes. Los resultados revelaron que los atletas emplean estrategias de preparación y recuperación, como hidratación y estiramientos, y experimentan reacciones emocionales significativas. En la fase precompetitiva, el nerviosismo y la ansiedad fueron mitigados por el apoyo social y la camaradería. Durante la competencia, los atletas que adoptaron enfoques colaborativos mostraron un rendimiento superior, destacando la importancia del trabajo en equipo. En la fase postcompetitiva, las interacciones sociales y el ambiente festivo fomentaron la reflexión y la recuperación emocional. Estos hallazgos resaltan la importancia de la preparación física y mental, así como del apoyo social en el rendimiento deportivo. La investigación proporciona una visión integral de las dinámicas competitivas en el CrossFit, con aplicaciones prácticas para entrenadores y organizadores de eventos. Se

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sugiere estructurar programas de entrenamiento que incluyan prácticas de recuperación efectivas y promuevan un ambiente de apoyo, contribuyendo al desarrollo integral de los deportistas.

Palabras clave: psicología del deporte; rendimiento; emociones; estrategias de afrontamiento; deportistas.

Introduction

Cross Training, known commercially as CrossFit®, has emerged as a multifaceted training approach that combines various physical activities to improve overall athletic performance. This method has gained popularity due to its ability to increase strength, flexibility, and endurance while reducing the risk of injuries associated with repetitive strain caused by the practice of a single sport (Meur et al., 2012; Tønnessen et al., 2014). Its adaptability to different sports disciplines allows athletes to maintain optimal fitness levels during rest or recovery seasons, promoting long-term sports development (Solli et al., 2017). In addition, recent studies highlight that CrossFit® not only improves physical performance and promotes exercise adherence through its community and motivational approach (Feito et al., 2018; Gipson et al., 2021; Lautner et al., 2021).

From a psychological perspective, studying competition in CrossFit is crucial, as it addresses the mental resilience and coping strategies that athletes employ in competitive scenarios. Factors such as anxiety management, self-efficacy, and mental toughness are determinants of performance under pressure (Iwuagwu et al., 2021; Kuan & Kueh, 2015; Silva et al., 2021). Recent research has shown that athletes who train psychological skills are better equipped to handle competitive stress, leading to better performance (Cheng, 2023). This aspect is especially relevant in CrossFit, where athletes face diverse challenges that require rapid adaptability and mental toughness, as has been evidenced in previous studies (Benítez-Sillero et al., 2021; Brandt et al., 2023).

Unlike other sports, CrossFit incorporates a variety of competitive dynamics that influence athletes' interactions and behaviors. Integrating different training modalities fosters a unique environment where athletes can learn from each other, share techniques, and develop a broader skill set (Cano et al., 2021; Sobko et al., 2023). This collaborative aspect is less pronounced in traditional sports, where competition tends to be more individualized. The community environment characteristic of CrossFit **not only** motivates

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participants to initiate its practice but is also decisive for its long-term permanence (Heinrich et al., 2017; Whiteman-Sandland et al., 2018). In fact, the CrossFit® brand emphasizes that community is an essential component of the CrossFit experience (CrossFitV®, 2020). This aspect has been highlighted in qualitative studies where it is emphasized that team spirit and solidarity have been fundamental aspects to understanding the growth and development of this sport (Sarıçam et al., 2022).

Several psychological theories and concepts are relevant to understanding competitive interactions in CrossFit. The inverted U hypothesis, which postulates an optimal level of arousal to achieve peak performance, is particularly relevant (Jia-Jun et al., 2019). This theory suggests that athletes must find a balance between anxiety and performance, which is crucial in

CrossFit's diverse and often unpredictable environment. In addition, the Basic Psychological Needs Theory proposed by Ryan and Deci (2000), suggests that satisfaction of autonomy, competence, and social relatedness needs are related to motivation to engage in physical exercise (Chen & Zhang, 2022; Sibley & Bergman, 2018). Recent studies have shown that frequency of CrossFit is associated with significantly higher satisfaction levels of these needs (Lautner et al., 2021).

Previous research has shown that CrossFit programs, such as CrossFit Kids, can have positive impacts on the physical, emotional, and social development of youth. For example, studies have found that children who participate in CrossFit programs improve their academic performance, fitness levels, strength, confidence, and competence (Garst et al., 2020; Sibley, 2012). In addition, these programs have been especially beneficial for at-risk populations, such as children from low-income or single-parent households, by providing them with extracurricular opportunities and transferable skills such as resilience and goal-setting (Gipson et al., 2018, 2021). These findings highlight the importance of exploring social and psychological dynamics in CrossFit settings, not only in adults but also in younger populations.

Despite the growing interest in CrossFit, there are notable gaps in the current literature regarding behavioral and psychological dynamics. Much of the research focuses on traditional sports, leaving a gap in understanding how the multifaceted nature of CrossFit affects adult athlete interactions and competitive strategies (Sklett et al., 2018).

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Furthermore, there is a limited exploration of how different training modalities influence psychological factors such as motivation, anxiety, and self-efficacy (Li, 2024). This lack of comprehensive studies hinders the development of effective training methodologies that could improve athletes' performance in competition.

The present study seeks to contribute to understanding competitive dynamics and athlete behavior in CrossFit by addressing these gaps. The objective is to identify and analyze athletes' behaviors, strategies, and interactions during a CrossFit competition and how these dynamics influence their competitive performance. To this end, a qualitative non-participant observation methodology will be employed, capturing the nuanced and dynamic nature of interactions in real time (Clancy et al., 2016; Huebner & Perperoglou, 2020). This approach is particularly suited to explore the complex interplay of psychological and social factors that influence performance.

Methodology

Study design

This study employed a mixed qualitative design, combining ethnographic and phenomenological elements to explore athletes' competitive dynamics and interactions in their natural environment. The ethnography allowed documenting and analyzing the underlying behaviors, strategies, and meanings that emerge in a CrossFit championship, while the phenomenological approach focused on understanding the subjective experiences of athletes in a context of high physical and psychological pressure (Angrosino, 2012; Packer, 2017). This mixed design ensures a holistic and in-depth view of athletes' experiences, integrating objective observations with subjective perceptions.

Participants

Seventeen athletes (10 men and 7 women) between 19 and 28 years old, participants in a CrossFit district championship in Bogota, Colombia, were included. The participants were selected using a purposive sampling based on the following criteria:

Inclusion criteria: to be older than 18 years, to actively participate in the district CrossFit championship, availability to be observed and interviewed during the event, and to fill out the informed consent to participate in the study.

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Exclusion criteria: Athletes who did not complete all the tests of the championship and unavailability to participate in the semi-structured interviews.

The athletes represented different performance levels (beginner, intermediate, and advanced), which allowed us to analyze variations in their behaviors and strategies. In addition, additional demographic data, such as years of CrossFit experience, frequency of training, and previous participation in competitions, were collected to enrich the specificity of the data (Table 1).

Table n.º1. Characteristics of the participants

Characteristic	Description
Age	19-28 years
Sex	10 males (58.8%), 7 females (41.2%)
Performance level	Beginner: 5 (29.4%), Intermediate: 7 (41.2%), Advanced: 5 (29.4%)
Years of experience	1-3 years: 8 (47.1%), 4-6 years: 6 (35.3%), >6 years: 3 (17.6%)
Frequency of training	3-4 times/week: 10 (58.8%), 5-6 times/week: 7 (41.2%)
Previous participation in competitions	Yes: 12 (70.6%), No: 5 (29.4%)

Instruments

The research used two main instruments for data collection:

Observation card: This card was specifically designed to document key categories such as behaviors, facial expressions, body language, and other relevant aspects at three moments: before, during, and after the competition. This instrument was based on Angrosino (2012) theory on ethnographic observation and previous studies on competitive dynamics in high-performance sports (Clancy et al., 2016; Lautner et al., 2021). The card included predefined categories and indicators, as detailed in Table 2.

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Table n.º2. Categories of analysis and indicators

Categories	Indicators	Examples of Details	Additional Dimensions
Before the Competition	Arrival of athletes	Mood (e.g. nervousness, confidence).	Interactions with other athletes or staff.
	Athlete preparation	Pre-routines, stretching, use of equipment.	Peer support or isolation gestures.
	General environment	Tension in the environment, music, cheerleading.	External factors that may influence the emotional state of the athletes.
During the Competition	Athlete performance	Technique in WOD, level of effort, signs of fatigue.	Moments of greatest difficulty and how to deal with them.
	Athlete strategies	Planning before the WOD, adaptations.	Communication strategies with peers or individualists.
	Interactions between athletes	Support, encouragement, and competitive feedback.	Tone and content of interactions.
	Audience reactions	Applause, shouting, comments	Influence of audience reaction on performance
	General atmosphere	The climate of tension or excitement	Sense of community or rivalry
After the competition	Athlete recovery	Methods of rehydration, stretching	Comparisons between different athletes
	Athlete reactions	Satisfaction, frustration, fatigue	Body language or verbal codes
	Interactions with others	Congratulation, peer support	Changes in interactions before and after the event
	General atmosphere	A feeling of camaraderie and a festive atmosphere	Reflections of reflection or celebration

Semi-structured interviews: Five randomly selected athletes were interviewed before and after the competition in a space close to the competition area. Each interview lasted a maximum of 15 minutes and was guided by eight general questions aligned with the categories and indicators of the observation sheet (Annex 1—Supplementary file). The questions explored mental preparation, anticipated strategies, and expectations for the competition, providing a deeper context for interpreting the observations.

Procedure

Data collection took place during a university district cross-training championship at a private university in Bogota (Figure 1). Before the competition, the researchers

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received prior preparation through observation of CrossFit competitions available on online platforms, which allowed them to become familiar with the dynamics, rules, and behaviors typical of this type of event. This preparation ensured the researchers were trained to identify and document key aspects during the field observation.

Observations were carried out in two time slots (9:00-13:00 and 18:00-21:00), and the researchers, with experience in fieldwork, were strategically located around the competition area to ensure a comprehensive perspective. To increase the study's reliability, two researchers observed each athlete independently. Subsequently, the information collected was contrasted to identify patterns and reduce possible individual biases, following an observer triangulation approach.

The interviews, conducted before the competition, were conducted in a quiet space close to the main area, ensuring the confidentiality and comfort of the athletes.

Figure n.º1. Sports arena, competition judges, and observers.



Ethical Considerations

To preserve participant confidentiality, a coding system was implemented in which athletes were identified as male participant athletes (MPA) and female participant athletes (FPA).

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The study complied with international and national ethical standards. Informed consent was obtained from all participants, ensuring the confidentiality of their data and their right to withdraw at any time. The researchers received training in research ethics and qualitative methodologies to guarantee the rigor of the process. The study complied with the ethical guidelines established in Resolution 8430 of 1993 of the Colombian Ministry of Health and the Declaration of Helsinki (2003). The research project was approved by the Research Ethics Committee of the University Institution (Act 04 of 2023).

Information analysis

To integrate the data obtained through the observation sheet and the semi-structured interviews, an inductive thematic analysis was followed (Braun & Clarke, 2006), which made it possible to identify patterns and emerging themes from the data (Figure 2). The procedure included the following phases:

Initial systematization: The data from both instruments were organized in an analysis matrix in Excel and classified according to the categories predefined in the observation sheet.

Coding: Field notes and interview transcripts were coded using an inductive approach, identifying keywords and patterns that reflected the behaviors, perceptions, and strategies mentioned by the athletes.

Data triangulation: codes obtained from observation were compared with emerging interview themes, corroborating and enriching the findings.

Category grouping: Emerging categories were refined to reflect an integrative perspective of observed behaviors and verbalized perceptions.

Contextual interpretation: The combined results were synthesized, highlighting how internal (emotions and mental preparation) and external (competitive environment and social support) factors influence competitive strategies and dynamics.

Figure n.º2. Phases of the data analysis procedure.



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Results

Pre-competitive preparation: behaviors and social dynamics

During the pre-competition phase, behaviors and social dynamics reflected nervousness and mutual support among athletes. The data were organized into two main categories: 'Emotions and support between competitors' and 'Differences in preparation and approach'.

Emotions and support between competitors. Athletes displayed a wide range of emotions upon arrival at the event. Through observation, it was identified that many competitors expressed nervousness and anxiety, especially those with less experience in CrossFit competitions. This nervousness was evidenced in gestures such as rubbing their hands together, constantly fidgeting, or having rapid conversations about the events. For example, it was observed that:

“Upon the two athletes' arrival at the event, they show interest in competing, although with a little nervousness [...], they take pictures with the other teammates from the same university.”

However, this tense atmosphere contrasted with the participants' remarkable camaraderie. Throughout the interviews, athletes emphasized the importance of social support. FPA6 (Intermediate, 1-3 years of experience) mentioned, “My teammates helped me relax before I started; that was key for me.” This finding is consistent with observations where positive interactions, such as encouraging words, jokes, and supportive gestures, were recorded.

Differences in preparation and approach. Significant differences were identified in the physical and mental preparation of the athletes. Observing showed that some competitors performed a thorough warm-up, using tools such as elastic bands and discs to mobilize their joints. These athletes showed a clear awareness of the importance of previous physical preparation. For example, it was noted that:

“Some athletes show adequate physical and mental preparation, while others seem distracted or poorly focused on the competition.”

In contrast, other athletes performed limited preparation, which reflected a lack of focus. MPA1 (Beginner, 1-3 years of experience) admitted in his interview, “I didn't do

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much warming up; I was more focused on socializing.” This variability in preparation suggests differences in experience level and goal prioritization among participants.

Competitive Strategies and WOD Performance

Variable competitive strategies influenced athlete performance during the competition. The data were organized into ‘Collaborative Strategies’ and ‘Audience Impact and Emotions.’

Collaborative strategies. It was observed that some athletes adopted collaborative approaches, working as a team to maximize their performance. For example, it was observed that:

“A strong sense of camaraderie and support is observed between pairs of athletes, with constant encouragement, motivation, and technical correctness between them.”

These strategies allowed the athletes to maintain high motivation and technical efficiency. MPA13 (Advanced, 4-6 years of experience) mentioned in his interview, “My partner and I split the workloads to maintain a consistent pace.” In contrast, other competitors lacked proper planning, resulting in less effective execution. MPA7 (Intermediate, 1-3 years of experience) acknowledged, “We didn't have a clear plan; we just followed the judge's instructions.”

Audience impact and emotions. Audience support played a crucial role in the athletes' performance. Through observation, it was recorded that applause and shouts of encouragement served as an additional stimulus, especially during fatigue. For example, it was observed that:

“The audience plays an active role in the atmosphere of the competition, providing significant emotional support that influences the athletes' mood and determination.”

However, moments of frustration at judges' corrections were also observed, which temporarily affected the focus of some athletes. FPA16 (Advanced, >6 years of experience) expressed, “I felt frustrated when the judge corrected me, but I tried not to let it affect me.”

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Post-competitive recovery and reflection

Athletes prioritized physical and emotional recovery in the post-competitive phase, although their approaches varied. The data were organized into the categories 'Recovery strategies' and 'Social interactions and emotions.'

Recovery strategies. Most athletes resorted to hydration and stretching to counteract physical exhaustion. For example, it was observed that:

“Peer support and reflection on performance are common after competition.”

However, some athletes showed limited recovery, preferring to observe other competitors rather than focus on their recovery. MPA1 (Beginner, 1-3 years of experience) admitted: “I didn't hydrate well; I was more interested in watching others.”

Social interactions and emotions. Social interactions were primarily positive. Through observation, gestures of camaraderie, such as congratulations and hugs among peers, were recorded. FPA6 (Intermediate, 4-6 years of experience) highlighted, “I felt supported by my peers, which helped me overcome frustration.” However, individual tensions were also observed, with some athletes opting not to participate in these dynamics. FPA16 (Advanced, >6 years of experience) commented: “I prefer to be alone after competing; I need time to reflect.”

Discussion

The present research provides a comprehensive view of a CrossFit event's pre-, during, and post-competitive dynamics, highlighting athletes' behaviors, emotions, and strategies. Through a mixed qualitative design, combining ethnographic observation and phenomenological approaches, patterns were identified that reflect the complexity of the competitive experience and the social interaction accompanying it. This mixed approach allowed for capturing both the objective dynamics (through observation) and the subjective experiences of athletes (through interviews), which enriched the understanding of the phenomena studied (Angrosino, 2012; Packer, 2017).

Findings related to precompetitive preparation indicate that, although nervousness and anxiety are common emotions among athletes, camaraderie and social support can mitigate their adverse effects. This phenomenon is consistent with existing literature, which suggests that social support plays a key role in the emotional regulation of

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competitors (Strobel et al., 2014). In the case of CrossFit, this sense of connection with others (relatedness) notably fosters the sense of community that characterizes CrossFit®, strengthening the sense of belonging to the group and stimulating participation in the activity (Whiteman-Sandland et al., 2018). In addition, recent studies have highlighted that social support reduces precompetitive stress and improves athletes' intrinsic motivation (Lautner et al., 2021).

The variability in warm-up practices and physical preparation suggests the need for continued education on the importance of these practices to avoid injury and optimize performance (McHugh et al., 2016). This finding is consistent with the Basic Psychological Needs Theory (Deci & Ryan, 2002; Ryan & Deci, 2000), which posits that satisfying competence, autonomy, and social relatedness needs is key to motivation and performance in sports contexts (Chen & Zhang, 2022).

The execution of the WODs showed significant differences in the strategies adopted by the competitors. Those who employed collaborative approaches showed superior performance, highlighting the importance of teamwork and communication in competitive situations. This finding is consistent with previous studies indicating that peer support can enhance motivation and performance in team sports (Danioni et al., 2021). Furthermore, this result supports the principles of Self-Determination Theory by highlighting the close link between optimal performance in competition and strong social relationships (Ryan & Deci, 2000). This phenomenon can be explained by a higher frequency of training, driven by high enjoyment (enjoyment), which is the product of a sense of high affinity with peers (Feito et al., 2018).

Athletes' adaptability, both in terms of technical execution and effort management strategies, emerged as a critical factor for success in competition. This flexibility is an indicator of adequate experience and preparation, suggesting that coaches should foster this ability in their training programs. Recent studies have shown that athletes with more experience in previous competitions tend to develop more effective coping strategies, which improves their performance in subsequent events (Meier et al., 2023).

The post-competition phase reveals that recovery strategies are not homogeneous among athletes, which may reflect competitors' knowledge or experience differences. The importance of hydration and stretching in physical recovery is well known; however, the

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observed differences indicate the need for a more systematic approach to educating athletes about these practices (Behm, 2019). In addition, post-competitive emotions and perceptions of personal performance are areas that require further research, especially in relation to how social interactions and peer support may influence emotional recovery.

Moments of frustration in the face of judges' corrections highlight the need for a constructive feedback system that allows competitors to improve their approach during competition. This finding is consistent with studies suggesting immediate and specific feedback can improve athletes' performance and satisfaction (Cazayoux & DeBeliso, 2019).

This study brings a novel perspective by integrating ethnographic and phenomenological approaches to explore competitive dynamics in CrossFit. Unlike previous studies that have focused on quantitative aspects of performance, this research delves into the subjective experiences of athletes, providing a more holistic understanding of the factors that influence their performance. In addition, the use of triangulation techniques (non-participant observation and semi-structured interviews) strengthened the validity and reliability of the findings, allowing for a more robust interpretation of the data (Clancy et al., 2016).

This study has limitations that should be considered when interpreting the findings. First, the research was conducted with a small number of athletes (17 athletes), which restricts the generalizability of the results to a larger population. To address this limitation, future studies could increase the sample size, allowing for more representative results. In addition, the observation was conducted in a specific event in a particular context (a district championship in Bogota), which may affect the applicability of the results to other national or international contexts.

As for future lines of research, it is suggested to carry out comparative studies between different sports modalities to understand how social and emotional dynamics vary. Likewise, further research on how previous competition experience affects athletes' preparation and emotional performance, as well as the effectiveness of interventions designed to improve social support, may provide valuable insights for CrossFit. Finally, it would be relevant to explore the recovery strategies adopted by athletes' post-competition and their relationship to performance in future events.

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Conclusions

The findings of this research evidenced significant patterns in recovery strategies and social dynamics among athletes in the context of CrossFit. Hydration and stretching practices emerged as crucial strategies for post-competitive recovery, highlighting their importance in athletes' performance and well-being. Likewise, the emotional reactions observed post-competition, along with supportive interactions and camaraderie, underscore the critical role of the social environment in both the emotional and physical recovery of athletes. Finally, this research fulfills the expectations raised by recognizing the different emotions athletes express and their relationship with performance at varying levels of competition.

Practical applications

The findings of this research offer valuable practical implications for coaches, sports event managers, and athletes in the field of CrossFit. First, it is critical to incorporate structured recovery routines, such as adequate hydration and stretching, into training programs. Also, fostering a supportive social environment among athletes through activities promoting camaraderie and post-competition reflection can improve team cohesion and emotional well-being, translating into optimal performance in future competitions. In addition, it allows addressing a line of research on competitive sport and the emotional states of the athlete to consider the importance of sport in terms of training in the management of emotions, which is a determining and necessary factor for the approach of the athlete as a human being.

Supplementary Materials

This can be seen in the following link:

<https://figshare.com/s/408702b15c389a541f38>

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