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Influence of Traffic Visual Communication on Road Safety amongst Boda-boda Motorcyclists in Kenyan Cities

Influence of Traffic Visual Communication on Road Safety amongst *Boda-boda* Motorcyclists in Kenyan Cities

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Abstract
This study sought to determine the influence of Traffic Visual Communication on Road Safety amongst *Boda–Boda* Motorcyclists in Kenyan Cities. These include road signs, symbols, and also road markings. Roadside advertisements and the presence of police all communicate visually. Road safety has become a major concern worldwide due to the high prevalence of death and injury among road users. This study was anchored on the social cognitive theory, the safety culture theory, and the uses and gratification theory. The study used a pragmatic philosophical paradigm with a convergent parallel design of mixed-method research. Stratified sampling and simple random sampling were used to draw the target population of 399 *Boda-boda* motorcyclists from the four cities in Kenya, namely Nairobi, Mombasa, Kisumu, and Nakuru, a final sample of 399 *Boda-boda* motorcyclists was made. Quantitative data was collected from the motorcyclists by use of semi-structured questionnaires while key informant interviews were used to collect the qualitative data from experts. Descriptive and inferential statistics were used to analyze quantitative data while qualitative data was analyzed using thematic data analysis. The study findings are that visibility and comprehension of traffic signs and markings correlate positively with favourable attitudes toward road safety and self-reported compliance with traffic regulations. The results revealed that traffic visual communication can create synergies, amplify impact, and drive sustainable change in *Boda-boda* riders' road safety practices. In conclusion, there is a need for innovative multifaceted communication intervention to enhance safety amongst *Boda-boda* motorcyclists in Kenyan cities.

Introduction

Despite the tremendous social and economic contribution of *Boda-boda* motorcyclists, Kenya faces a burdensome road safety phenomenon whereby fatalities associated with road accidents keep soaring annually, with 4,323 losing their lives in 2023 (National Traffic Safety Authority, 2024) and an additional 10,769 people getting seriously injured. This is a worldwide concern, as stipulated by the World Health Organization (2021), whereby an estimated 1.3 million people die annually while another 20 to 50 million are injured on the roads. Despite this alarming fact, more pillion passengers prefer to ride motorcycles because of their affordability, manoeuvrability and availability. *Boda-boda* motorcyclists cause death and injury on Kenyan roads through their behaviour, which contributes to

58 per cent of accidents by flouting traffic rules, carrying excess pillion passengers, over-speeding, and the majority do not wear helmets (Nyachieo, 2020). The former government of Kenya spokesman, Retired Col. Oguna, amplified this in a road safety sensitisation meeting in Nakuru in 2021 by observing that failure to wear reflective jackets to boost visibility, ignoring traffic signs, speeding, late night travel, drunk driving, driving while fatigued, untrained and inexperienced motorbike riders all contributed to an increase of 17.5 per cent of road accidents. This study was conducted in Kenya's four cities: Nairobi, Kisumu, Mombasa, and Nakuru. These cities have very busy road networks, a high population of over one million and a high number of *Boda-boda* motorcyclists compared to other towns and urban centres across the country.

According to Melkote (2018), communication is a crucial driver of social change; it involves sending and receiving messages between people and groups through different channels or mediums. Communication occurs in every setting of our daily lives, and we need to adopt the right skills, attitudes and traits for effective communication (Kapur 2018). In Kenya and around the world, road users have been found to present negative behaviours like jaywalking, not wearing helmets, tailgating, and even speeding (Bonnet et al., 2018; Esse, 2021). These behaviours are addressed through research and interventions. Fisa et al. (2022) posit that behaviour-based interventions reduce traffic crashes. Kenya's national transport and safety authority and its partners have addressed road safety concerns by rolling out several interventions, including visual communication regarding traffic. Several platforms and mediums have enhanced knowledge and understanding of traffic visual communication. The ability to recognise and interpret visual traffic communication like road signs, symbols and road markings aids in reducing injuries and fatalities on the roads. Police presence equally has a role in compliance with traffic rules and regulations; hence, the motorcyclists' attitude towards the traffic police is of great concern.

The *Boda-boda* motorcyclists are a popular mode of transport in Kenya; flouting traffic guidelines is a common practice despite the authority's spirited effort to maintain compliance with traffic signs and symbols. During the licensing process, the NTSA sensitises all motorists and riders on traffic signs and symbols. However, lack of comprehension and poor attitude are still prevalent and have contributed to road accidents. Motorcyclists are key recipients of Behaviour Change Communication (BCC) interventions. Foroutan et al. (2019) state that short periods of interventions positively increase motorcyclists' safety. Traffic visual communication aims to ensure efficient and safe movement of motor vehicles, pedestrians and cyclists on the road networks. Hence, it alleviates road accidents, death and injury.

Road signs and symbols are found in traffic visual communication. They play a critical role in ensuring safe and efficient traffic flow. Understanding these signs and symbols is essential for *Boda-boda* motorcyclists' safety. These traffic signs and symbols include warning signs like school zones, Zebra crossings, speed limits and railway crossings. Other regulatory signs are stop, speed limit, and no parking signs. Guide signs include signs showing bridges, hospital signs and exit signs. Accurate interpretation can prevent accidents, reduce risks, and enhance road safety. Effective traffic visual communication is crucial. However, existing road safety communication interventions rolled out by the government and its partners in Kenya may not adequately address motorcyclists' needs. Specifically, there is a need to enhance traffic visual communication strategies amongst *Boda-boda* motorcyclists, considering their demographics and experiences to promote safe behaviours and reduce collisions. Motorcycle-specific traffic signs and symbols, including hand signals, are essential for motorcyclists to understand. Comprehension and effective usage enhance road safety. Consistent, deliberate, increased interaction with visual traffic communication is critical to enhance road safety. This can be done through awareness, training, refresher courses and firmer enforcement of traffic rules.

This study was anchored on three theories. The social cognitive theory (SCT) by Albert Bandura in 1986 posits that social interaction shapes behaviour and that collective efficacy improves performance Stajkovic & Stajkovic (2019); SCT focuses on the importance of self-regulation as a source of behaviour change; this understanding can aid in the design of road safety intervention. The second theory used in this study is the safety culture, a construct that emerged in 1984 after the Bhopal disaster. James Reason was among the first proponents of this theory. It highlights the importance of knowledge, reporting lines and a positive attitude (Devi 2022) about road safety. Well-informed communication interventions can be used to address specific areas of intervention. The third theory used in this study is the uses and gratification theory by Katz and Bloomer in 1974. It highlights how audiences choose and use media platforms; this theory informs on the importance of identifying the platforms preferred by motorcyclists to disseminate road safety intervention information and campaigns. The researcher intends to propose using planned traffic visual communication interventions to elicit better behaviour on the road and, in turn, enhance road safety amongst *Boda-boda* motorcyclists. It is hoped that fatalities and injuries on the roads will be reduced.

Consequently, visual communication is one of the tools used in Behaviour Change Communication to enhance road safety. According to Utoyo et al. (2021), ninety per cent of the traffic communication for drivers is received visually, and it is between authorities and road users. Traffic visual communication was the area of interest in the 1968 Vienna International Convention on Road Signs and Signals hosted by the United Nations; the aim was to create worldwide uniformity in road signage for increased road safety outcomes Babić et al. (2022). The convection was identified and discussed, and guidance on traffic signs was provided.

Traffic signs are one of the most common and recognisable forms of visual communication for road safety. They provide essential information to road users, including regulatory signs (such as stop signs, speed limits, and no-entry signs), warning signs (such as curve ahead and pedestrian crossing), and informational signs, such as direction signs and service signs (Fernandez et al., 2020). Traffic signs use standardised shapes, colours, and symbols to convey messages quickly and universally (Utoyo et al., 2020). Another type of visual communication is roadside advertising signs, which draw the driver's attention, sometimes causing distraction (Oviedo-Trespalacious et al., 2019). Road markings are visual traffic elements painted or marked on road surfaces to guide and direct vehicles (Adedejin et al., 2019). They include lane markings, centerlines, crosswalks, arrows, and symbols. Road markings help drivers maintain lane discipline, indicate permitted manoeuvers and identify designated parking areas. They also aid road users at night and during challenging weather conditions to ensure road safety (Chengula, 2018).

Comprehension of road signs and signals is paramount. Maulina et al. (2022) point out the significance of understanding traffic signs quickly and accurately through familiarising and comprehension of the road signs. Another very important form of traffic communication is traffic signals, also called traffic lights. These devices are used to control the movement of traffic, especially at intersections. These traffic lights are in three colours: red, yellow, and green. They signal when drivers should stop, proceed cautiously, or give way. Traffic signals provide clear and standardised visual cues to regulate traffic movements and minimise conflicts between traffic streams, enhancing road safety (Maulina et al., 2022). Visual communication elements help promote awareness and compliance with traffic rules, positive behaviour and road safety among road users.

Several studies have been conducted in traffic visual communication across the world. Choocharukul and Sriroongvikrai (2017) conducted a study on road safety awareness and comprehension of road signs. The study found that the respondents could only comprehend road signs to a certain extent. It was noted that international travellers were neglected in road safety considerations, and the development of guidelines was desirable. Oviedo–Trespalacious et al. (2019) studied the impact of

road advertising signs on driver behaviour and its implication on road safety. The findings were that roadside advertising signs are considered environmental clutter, which gives the driver additional tasks; their impact on driving behaviour depends on individual drivers. However, it was not concluded if this was a direct relationship between driving behaviour changes attributed to roadside activity and road accidents. However, the researchers pointed out that emerging studies suggest roadside advertisements like billboards can increase accidents. In Jakarta, Utoyo et al. (2020) wrote a paper on visual communication analysis of the effect of signs and colours on traffic safety in Jakarta. This study evaluated the perception of implied danger and language among drivers. It was concluded that the shape of signs and colour carried a psychological meaning that can make people comfortable or otherwise; the research also concluded that traffic signs were handy and represented the authorities.

In Nigeria, Imoh et al. (2021) conducted a study to determine the challenges or the exposition of traffic signs and symbols to Lagos state road users. The study recommended more training and sensitisation on traffic signs and symbols; this could be conducted by the body that issues licenses to the drivers. The study concluded that safety knowledge and comprehension of traffic signs and symbols were poor. In Ghana, Sakyiama (2021) researched the effectiveness of visual communication by the National Road Safety Authority for behaviour change. The study findings were that knowledge of informatory signs was high. However, knowledge on warning and regulatory signs and their meaning was poor. The study recommended that education on road signs and safety should be done at the school level and integrated into the basic school curricula. McOpiyo et al. (2019) conducted a study that examined traffic information and road safety in Kisumu. The study aimed to assess the influence of traffic signage and the significance of traffic guidelines on road safety in Kenya. In Kisumu, rural traffic signages were inadequate, while in the urban area, they were fairly sufficient. There were inconsistencies in traffic guidelines. The study concluded that there was a significant correlation between road safety traffic signage and consistency of traffic road use. The researchers recommended that all key state departments bolster traffic information per the road safety policy.

Method

This study was anchored on the pragmatic philosophical underpinning and used a mixed-method approach. The mixed method approach gives the study a broad scope. The study area included four cities in Kenya, namely Nairobi, Kisumu, Mombasa and Nakuru. The study had a population of 399 motorcyclists drawn out of the 280,078 riders in the four cities using the Yamane 1967 formulae with a 95% confidence level. Qualitative data was collected through key informant interviews with nine experts from the NTSA communication office, senior traffic police and *Boda-boda* association officials. Qualitative data was analysed through thematic analysis, while descriptive and inferential statistics were used to analyse the quantitative data.

A multivariate regression model was applied to determine the relative importance of each variable concerning road safety practices. A pilot study was undertaken in Machakos, which has characteristics similar to Kenyan cities, to test the consistency of the research instruments (Creswell & Creswell 2018).

Results

Qualitative and quantitative findings gave insight into the lived experiences and perceptions of *Boda-boda* riders regarding traffic visual communication initiatives. Through in-depth interviews and thematic analysis, the study uncovers themes related to road signs and symbols, road markings, road advertising and police presence. The findings also amplify the importance of localised interventions in promoting road safety awareness. Below are the findings.

Table 1: Level of Agreement on Aspects Describing Traffic Visual Communication

Statement	Distribution of Responses (%)					Mean	Std. Deviation	Skewness	Kurtosis
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Statistic	Statistic	Statistic	Statistic
Road Signs and Symbols:									
I effectively understand and interpret road signs and symbols.	29.5	21.2	18.6	14.2	16.5	2.672	1.446	0.328	-1.243
Road signs and symbols provide clear information about road safety.	28.4	16.5	26.4	16.5	12.1	2.674	1.361	0.215	-1.143
Knowledge of road signs and symbols influences my road safety behaviour.	26.6	18.3	24.0	12.1	18.9	2.783	1.443	0.228	-1.243
Aggregate	***28.2***	***18.7***	***23.0***	***14.3***	***15.8***	***2.710***	***1.417***	***0.257***	***-1.210***
Road Markings:									
Road markings guide traffic and enhance road safety.	3.6	6.7	16.8	36.4	36.4	3.954	1.062	-0.977	0.427
Clear road markings positively influence road safety awareness.	4.4	6.7	18.3	39.3	31.3	3.863	1.070	-0.924	0.386
Road markings are essential for promoting safe road behaviour among *Boda-boda* riders.	4.4	5.9	24.0	35.4	30.2	3.811	1.069	-0.781	0.166
Aggregate	***4.1***	***6.5***	***19.7***	***37.0***	***32.6***	***3.876***	***1.067***	***-0.894***	***0.326***
Roadside Advertisements and Police Presence:									
Roadside advertisements catch my	5.4	6.7	25.6	35.9	26.4	3.711	1.094	-0.721	0.039

Statement	Distribution of Responses (%)					Mean	Std. Deviation	Skewness	Kurtosis
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Statistic	Statistic	Statistic	Statistic
attention and provide valuable information.									
Police presence on the roads enhances road safety behaviour.	4.9	9.0	27.1	37.5	21.4	3.615	1.070	-0.602	-0.109
Roadside advertisements and police control contribute to increased road safety awareness among *Boda-boda* riders.	7.0	7.2	25.1	33.9	26.9	3.664	1.152	-0.707	-0.146
Aggregate	***5.8***	***7.7***	***25.9***	***35.7***	***24.9***	***3.663***	***1.105***	***-0.677***	***-0.072***

Source: Author 2024

Table 1 presents the level of agreement on various aspects describing traffic visual communication among *Boda-boda* motorcyclists. The respondents expressed mixed understanding and interpretation of road signs and symbols. Only 30.7 per cent of participants agreed or strongly agreed that they effectively understand and interpret road signs and symbols, leading to a mean score of 2.672 and a standard deviation of 1.446. Similarly, 28.6 per cent felt that road signs and symbols provide clear information about road safety, with a mean score of 2.674 and a standard deviation of 1.361. The knowledge of road signs and symbols was perceived to influence road safety behaviour by 31.0 per cent of respondents, resulting in a mean score of 2.783 and a standard deviation of 1.443. The aggregate mean for this category was 2.710, with a standard deviation of 1.417, indicating a generally low level of agreement on the effectiveness of road signs and symbols in promoting road safety among *Boda-boda* riders.

In contrast, the respondents viewed road markings more favourably. A significant 72.8 per cent agreed or strongly agreed that road markings guide traffic and enhance road safety, with a mean score of 3.954 and a standard deviation of 1.062. Clear road markings were also seen as positively influencing road safety awareness by 70.6 per cent of respondents, leading to a mean score of 3.863 and a standard deviation of 1.070. Additionally, 65.6 per cent of participants agreed or strongly agreed that road markings are essential for promoting safe road behaviour among *Boda-boda* riders, resulting in a mean score of 3.811 and a standard deviation of 1.069. The aggregate mean for road markings was 3.876, with a standard deviation of 1.067, reflecting a strong consensus on their importance for road safety.

The impact of roadside advertisements and police presence on road safety behaviour elicited moderate agreement among respondents. Roadside advertisements caught the attention of and provided valuable information to 62.3 per cent of participants, yielding a mean score of 3.711 and a

standard deviation of 1.094. Police presence enhanced road safety behaviour by 58.9 per cent of respondents, with a mean score of 3.615 and a standard deviation of 1.070. Additionally, 60.8 per cent agreed or strongly agreed that roadside advertisements and police control contribute to increased road safety awareness, resulting in a mean score of 3.664 and a standard deviation of 1.152. The aggregate mean for this category was 3.663 with a standard deviation of 1.105, indicating a generally positive perception of the role of advertisements and police presence in promoting road safety among *Boda-boda* riders.

Detailed statistical analysis uncovered insights into the relationship between visual communication strategies and road safety outcomes within this demographic. Key statistical metrics and model coefficients are examined to assess the effectiveness of traffic visual communication in enhancing road safety awareness and behaviour among *Boda-boda* motorcyclists.

Statistical techniques

This section explores the statistical relationships between these variables, shedding light on the effectiveness of education and communication initiatives in enhancing road safety practices within this demographic. Key metrics such as R-squared values, ANOVA results, and model coefficients are examined to discern how traffic visual Communication influences Road Safety outcomes among *Boda-boda* motorcyclists.

Table 2: R^2 for Traffic Visual Communication and Road Safety amongst Boda-boda Motorcyclists

R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
.780a	0.608	0.607	0.487	1.522
a Predictors: (Constant), Traffic Visual Communication on Road Safety				
b Dependent Variable: Road Safety				

Source: Author 2024

Table 2 presents the inferential findings regarding the relationship between traffic visual communication and road safety among *Boda-boda* motorcyclists. The coefficient of determination (R-squared) indicates that approximately 60.8 per cent of the variance in road safety can be explained by traffic visual communication, suggesting a strong association between these two variables. The adjusted R-squared value remains consistent, further supporting the robustness of the model. Additionally, the standard error of the estimate and the Durbin-Watson statistic provide insights into the accuracy of the model's predictions and the presence of autocorrelation, respectively. The statistically significant values underscore the importance of traffic visual communication in influencing road safety outcomes for *Boda-boda* motorcyclists.

Table 3: ANOVA for Traffic Visual Communication and Road Safety amongst Boda-boda Motorcyclist

	Sum of Squares	df	Mean Square	F	Sig.
Regression	141.755	1	141.755	596.816	.000b
Residual	91.445	385	0.238		
Total	233.2	386			
a Dependent Variable: Road Safety					
b Predictors: (Constant), Traffic Visual Communication					

Source: Author 2024

Table 3 presents the analysis of variance (ANOVA) for traffic visual communication and road safety among *Boda-boda* motorcyclists. The ANOVA table evaluates whether the regression model containing

traffic visual communication variables significantly predicts road safety. The results reveal a statistically significant F-statistic (F = 596.816) with a corresponding p-value of .000, indicating that the regression model fits the data well. This suggests that traffic visual communication variables collectively contribute to predicting road safety outcomes among *Boda-boda* motorcyclists, reinforcing the importance of visual communication strategies in enhancing road safety awareness and behaviour.

Table 4: Model Coefficients for Traffic Visual Communication and Road Safety amongst Boda-boda Motorcyclists

	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	0.637	0.133		4.783	0.000
Traffic Visual Communication	0.789	0.032	0.780	24.430	0.000
a Dependent Variable: Road Safety					

Source: Author 2024

Table 4 provides the model coefficients for traffic visual communication and road safety among *Boda-boda* motorcyclists. Unstandardised coefficients show the effect of each predictor variable on the dependent variable (road safety). In contrast, the standardised coefficients (Beta) represent the relative importance of each predictor in the model. The constant term indicates the expected road safety score when all predictor variables are zero. The coefficient for traffic visual communication is statistically significant ($p < .001$), with a positive value of 0.789. This suggests that increased in traffic visual communication is associated with higher levels of road safety among *Boda-boda* motorcyclists.

In qualitative findings concerning traffic visual communication and road safety, several themes emerge, shedding light on the effectiveness of visual communication strategies in promoting road safety among *Boda-boda* motorcyclists in Kenyan cities. One prominent theme is the importance of clear and universally understandable visual cues. Participants emphasised the significance of using simple and intuitive visual communication tools, such as road signs and symbols, to convey critical safety messages to *Boda-boda* riders. These visual cues must be easily understandable to riders of varying literacy levels and cultural backgrounds to ensure their effectiveness in promoting safe road behaviours.

Another significant theme is the need for consistent and widespread dissemination of visual communication materials. Participants highlighted the importance of ensuring that road signs, symbols, and other visual aids are prominently displayed across road networks in Kenyan cities. Additionally, they stressed the importance of incorporating visual communication elements into broader road safety campaigns, including media initiatives and community engagement efforts, to maximise their reach and impact.

Contextual relevance and cultural sensitivity emerged as crucial considerations in designing and implementing of visual communication strategies. Participants emphasised the need for visual materials to reflect local road conditions, traffic patterns, and cultural norms to resonate with *Boda-boda* riders effectively. By incorporating familiar imagery and language, visual communication materials can better capture riders' attention and facilitate comprehension of safety messages. Accessibility and inclusivity were also highlighted as essential aspects of effective visual communication. Participants underscored the importance of ensuring visual materials are accessible to all road users, including those with disabilities or limited literacy. This includes employing clear

fonts, colours, and symbols and providing alternative formats, such as audio or tactile versions, to accommodate diverse needs and preferences.

Finally, ongoing evaluation and adaptation emerged as critical themes: traffic visual communication and road safety. Participants emphasised the need for continuous monitoring and assessment of visual communication initiatives to gauge their effectiveness and identify areas for improvement. By soliciting feedback from *Boda-boda* riders and other stakeholders, authorities can refine visual communication strategies iteratively, ensuring their relevance and impact over time. In summary, qualitative findings underscore the importance of clear, consistent, culturally relevant, and accessible visual communication strategies in promoting road safety among *Boda-boda* motorcyclists in Kenyan cities. By prioritising these principles and engaging stakeholders in the design, implementation, and evaluation of visual communication initiatives, authorities can enhance the effectiveness of their road safety efforts and contribute to safer road environments for all.

Discussion

The descriptive findings for traffic visual communication revealed mixed perceptions among *Boda-boda* riders. While road markings were regarded as effective in guiding traffic and enhancing road safety, road signs and symbols were perceived as less clear and understandable. Additionally, roadside advertisements and police presence were recognised as valuable contributors to road safety awareness, although opinions varied. Overall, the findings suggest room for improvement in the clarity and effectiveness of visual communication tools for *Boda-boda* riders.

Inferential analysis through regression models and hypothesis testing identifies significant associations between exposure to visual communication stimuli, riders' perceptions of road safety, and their adherence to traffic rules. Key findings suggest increased visibility and comprehension of traffic signs and markings correlate positively with favourable attitudes towards road safety and self-reported compliance with traffic regulations. Furthermore, the study explores moderators and mediators that influence the effectiveness of visual communication interventions, such as rider experience, environmental factors, and socio-economic status. Inferential analysis through regression models and hypothesis testing identifies significant associations between exposure to visual communication stimuli, riders' perceptions of road safety, and their adherence to traffic rules.

Key findings suggest increased visibility and comprehension of traffic signs and markings correlate positively with favourable attitudes towards road safety and self-reported compliance with traffic regulations. Furthermore, the study explores moderators and mediators that influence the effectiveness of visual communication interventions, such as rider experience, environmental factors, and socio-economic status. Qualitative findings explore *Boda-boda* riders' experiences and perceptions regarding traffic visual communication. Through thematic analysis, the study uncovers themes related to the usability, accessibility, and effectiveness of visual communication tools in real-world contexts. Participants discussed their challenges in interpreting complex signage, navigating unfamiliar road layouts, and responding to dynamic traffic conditions. Moreover, the qualitative data shed light on the role of cultural norms, peer influence, and informal communication channels in shaping riders' interactions with visual stimuli and their compliance with traffic regulations. Quantitative findings yielded valuable insights into the prevalence of behaviour change communication interventions targeting *Boda-boda* riders and their attitudes towards road safety among *Boda-boda* motorcyclists in Kenyan cities.

Conclusion

The study concluded that visual communication strategies should include clear, intuitive signage and symbols, such as regulatory, warning, and road markings, which aid in conveying safety messages to *Boda-boda* riders. Police presence in strategic locations aids in enforcement where compliance is poor.

When designed effectively and strategically placed along roadways, visual cues can enhance riders' awareness, comprehension, and adherence to road safety protocols.

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