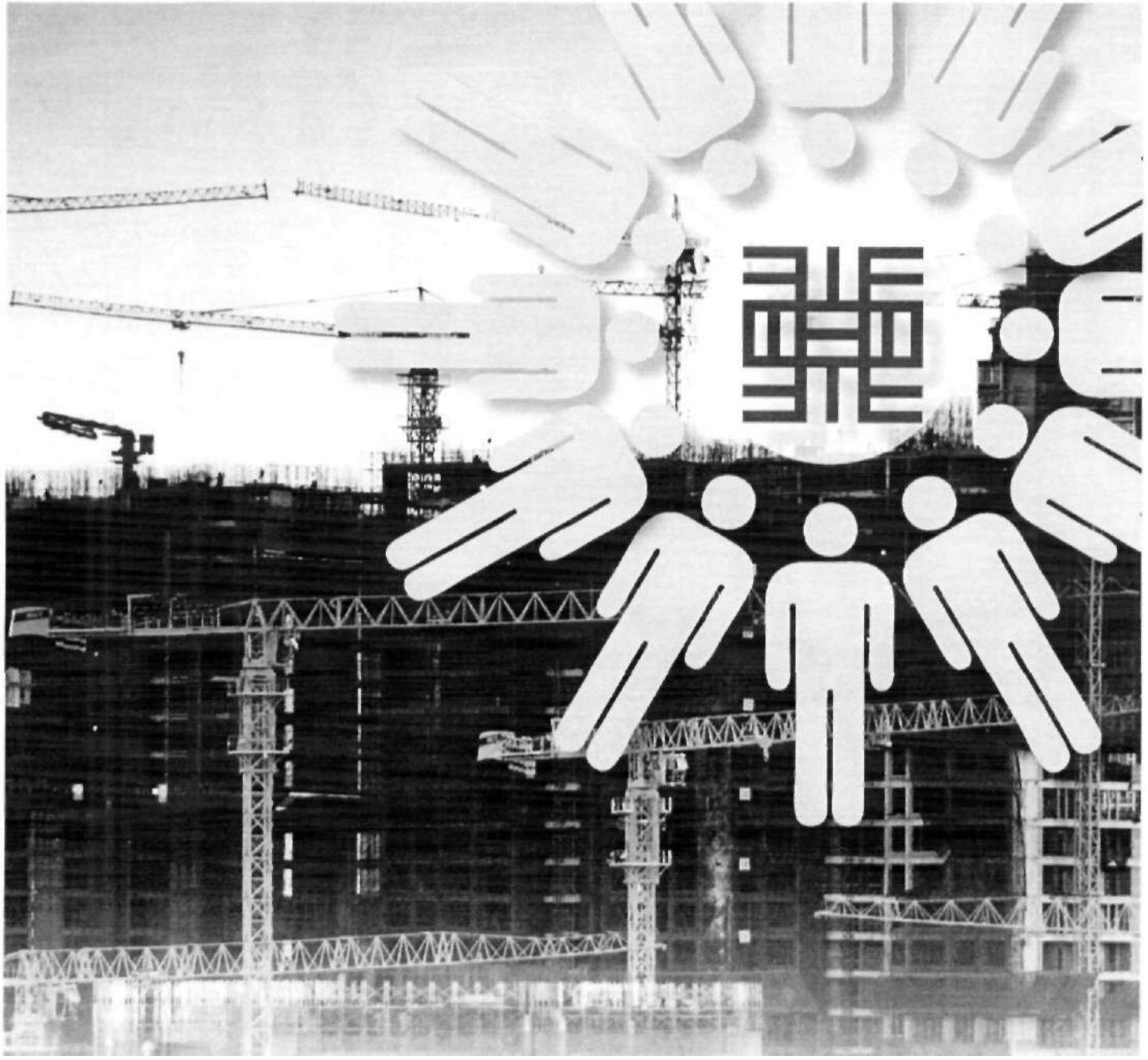

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THE ROLE OF SAFETY ATTITUDE IN CHANGING SAFETY BEHAVIOUR AND HAZARD RECOGNITION CAPABILITY OF CONSTRUCTION WORKERS

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Worker's safety has been a major concern in the successful execution of various construction activities. Workers that are unable to recognise the active, emerging, or latent hazards, in the work environment are often exposed to safety risks, leading to catastrophic accidents and injuries. Despite research efforts on strategies to improve the safety of workers on construction sites, recent studies have reported the apparent disregard for human-related factors in the formulation of safety strategies which limits their effectiveness. In this regard, this study provides insight on the specific role worker's safety attitude plays on safety behaviour towards improving Hazard Recognition Capability (HRC) of the worker. A quantitative research approach was adopted for the study, using a structured questionnaire to collect both ordinal and nominal data. Both descriptive and inferential statistical tools were used to analyse the data. Spearman's correlational analysis technique was used to ascertain the monotonic relationship between worker's safety attitude, safety behaviour, and hazard recognition capability. Findings of the study show that worker's safety attitude has an influence on worker's safety behaviour on the job site, although no relationship was established between worker's safety behaviour and respective hazard recognition capability. This finding provides an empirical evidence on the fractional relationship between safety behaviour and HRC. Thus, it is recommended that other human-related factors be studied in relation to the area of safety management with a view to find a sustainable solution to the abysmal safety performance of the global construction industry.

Keywords: attitude, behaviour, construction industry, hazard recognition, safety

INTRODUCTION

The construction industry has been identified as one of the most dangerous industries, recording high rate of accidents and fatality (Tam & Fung, 2012; Törner & Pousette, 2009). According to International Labour Organisation (ILO, 2005), about 16% of fatal accidents recorded at work occurs on construction sites.

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Relatedly, census data from the Bureau of Labour Statistics showed that 774 recorded fatality cases were from construction site injuries in the year 2010. This fretting data emphasises the urgent need to device safety management strategies, and hazard control mechanisms that will improve the safety performance of the industry. In this regard, Zhou, Goh and Li (2015) noted the increasing number of academic studies around the globe, focused on devising novel approaches and techniques to key safety related issues such as safety climate, accident statistics, design for safety, and safety culture.

Despite this surge in academic and professional efforts towards curbing the safety issues in the construction industry, there has been very little improvement on the safety performance of the industry (Namian et al., 2016b). A major deficiency of these efforts has been noted to be the almost complete overlook of human-related factors in the design of safety management systems (Abubakar et al., 2020). Due to the dynamic and unique nature of construction operations, the design of generic safety management systems and techniques are ineffective in addressing safety challenges in all contexts (Dekker, 2012). Choudhry, Fang and Ahmed (2008) argued that workplace safety is a complex phenomenon, and the management of the human element in construction industry is even more complex. Moreover, safety cannot be guaranteed by legislation or regulations alone, as there is apparent need for workers and employees to also commit themselves to safety practices (Baig, 2001).

In line with the aforementioned deficiencies, recent studies in construction safety management have begun to look at the inherent factors that limit the safety performance of construction workers (Abubakar et al., 2020; Namian et al., 2016b). Hazard recognition capability of workers has been identified as a fundamental requirement for addressing the health and safety challenges encountered on construction sites (Abubakar et al., 2020; Albert et al., 2014). Construction site accidents have been found to be mainly caused by worker's unsafe behaviours, largely due to nonchalant attitude towards safety hazards (Fang & Wu, 2013; Feng, 2015). Workers often tend to underestimate safety risks on construction site, which limits their ability to identify hazardous situations (Pandit et al., 2019). Chen, Golparvar-Fard and Kleiner (2014) defined the concept of Hazard recognition as the ability of managers and workers to sense, analyse, and extract physical or mental stimuli that indicates the existence of a hazardous situation in a complex and dynamic scenario of construction environments. These hazardous situations often when not recognised and managed lead to unsavoury safety incidences and fatalities in construction.

Abubakar et al. (2020) classified the key factors influencing hazard recognition capability of construction workers into four distinct taxonomies (personal, organisational, social, and project), towards developing context-based strategies for improving the safety performance of the construction industry. The study established a significant influence of workers personal attributes on respective hazard recognition capability. However, with a view to fill the gap in literature on human-related safety studies and strategies for improving safety performance of construction workers, this study builds on the findings of Abubakar et al. (2020) by providing insight into the dynamics of worker's safety attitude which is an antecedent of personal factors, influencing safety behaviour and hazard

recognition capability of workers. Notably, Choudhry, Fang and Ahmed (2008) noted that the subject of worker's attitudes and its relation to safety performance in construction industry is complex. However, as attitude is a core manifestation of inherent individual traits which reflects on characteristics and behaviour (Beus et al., 2015), this study provides an answer to this research question "Does worker's safety attitude have influence on safety behaviour and hazard recognition capability of the worker?".

LITERATURE REVIEW

Safety attitude, behaviour and HRC

The definition of Attitude in literature is quite vague and dynamic. Sawacha (1993) observed that the definition often depends on the context of the discourse, and the observables selected as the basis for inference. Despite the concept of attitude being seen as an abstraction or a hypothetical construct rather than an actual principle, Sartain et al. (1974) defined it as the tendency of an individual to react positively or negatively towards an object or a person. Katz (1960) has described attitude as the predisposition of the individual to evaluate some symbol or object, or aspect of the world in a favourable or unfavourable manner". The concept of Safety Attitude could then be seen as complex and multidimensional with deep roots in fields such as safety science, psychology and management science.

More so, as human behaviour is a clear manifestation of attitudes and beliefs, social and psychological dynamics of workers may have a strong influence on their safety behaviour on construction sites (Choudhry, 2014; Krech & Crutchfield, 1948). Lingard and Turner (2017) found that embracing of healthy behaviours by workers is influenced by factors playing around the individual. Leung, Chan and Yuen (2010) showed that safety cases and risky behaviours can be affected by the safety attitudes of construction workers.

More often, workplace accidents comprise the failure of workers to identify a hazardous condition. Studies have reported that more than 42% of injuries in construction occur because of inadequate hazard recognition and evaluation (Haslam et al., 2005; Sacks et al., 2013). Zhou and Ding (2017) observed that workers found themselves in a position of risk either due to their ignorance or inability to behave safely. Although their ignorance may be linked to limited knowledge and experience, their attitude towards safety may inform their unsafe behaviour.

Based on the forgone, it can be hypothesised that worker's safety attitude as a corresponding effect on the worker's behaviour towards safety, and the respective ability to recognise hazards on job site. This assumption is driven on the psychological theoretical base of the planned behaviour theory which links human beliefs to respective behaviour. Ajzen & Fishbein (1975) noted that an individual's belief and attitude towards a certain phenomenon commensurate with the individual's tendency to behave positively or negatively. Pandit et al. (2019) noted that worker's nonchalant belief towards safety risk often result in risk-taking behaviour and the normalisation of deviance from safe-work operations. For instance, Perlman et al. (2014) observed the behaviour of worker's that are commonly used to using ladders as a job routine to become increasingly insensitive to the risk of falls even in circumstances where the potential of fall is

recognised as a relevant hazard. This is also common amongst workers working in other distinct job trades (Bohm & Harris, 2010; Choudhry & Fang, 2008)

Measuring attitude and behaviour

Several methods and techniques have been adopted across various literatures for the measurement of individual attitude in diverse contexts (Johnson & Scott, 1965). Green, (1954) classified these methods into six major categories namely Judgement Method, the Summated Ratings methods, the Scalogram Analysis method, the Rating Method, the Unfolding Technique and the Latent Structure Analysis method. The structure of the safety behaviour scale designed by Hayes et al. (1998) was adapted to fit the context of this study in measuring the safety behaviour of construction workers on site, sourcing the measurement items from specific construction related literature. Table 1 highlights the respective measurement items for both constructs.

Table 1: Measurement items

SN	Measurement Items (Safety Attitude)	Source
1	Provision of PPE and other safety tools on construction site is an unnecessary effort.	(Abubakar et al., 2020; Gao et al., 2020)
2	Pressure from other workers and supervisors on site makes me behave unsafely.	(Gao et al., 2020; Wu et al., 2017)
3	I can never be involved in an accident because of my vast experience on the job.	(Abubakar et al., 2020; Pandit et al., 2019; Sacks et al., 2013; Sawacha, 1993)
4	My workmate's safety on site is not very much important to me.	(Sawacha, 1993)
5	Safety Training prior to commencement of work is unnecessary.	(Namian et al., 2016b; Sawacha, 1993)
6	I am safety conscious on site only when I know management is strict on it.	(Sawacha, 1993)
7	I will rather finish my work early discarding safety, than follow safety protocols that takes longer time to finish.	(Pandit et al., 2019)
8	I do not follow safety rules that I feel are unnecessary.	(Gao et al., 2020)
SN	Measurement Items (Safety Behavior)	Source
1	I take drugs while on site to enable me work harder.	(Abubakar et al., 2020)
2	While working, I get overwhelmed that i become unaware of my environment.	(Abubakar et al., 2020; Hayes et al., 1998)
3	I barely wear PPE or use other safety tools while on site.	(Gao et al., 2020; Hayes et al., 1998)
4	I sometimes breach safety protocols in order to finish my work on time.	(Abubakar et al., 2020; Gao et al., 2020; Hayes et al., 1998; Pandit et al., 2019)
5	I hardly check the conditions of my tools and site equipment before I use them.	(Gao et al., 2020; Hayes et al., 1998)
6	I sometimes engage in hazardous works even when I know my safety is not guaranteed.	(Sawacha, 1993)
7	I do not always stick to my workstation as I like to wander around the site.	(Sawacha, 1993)
8	I do engage in works on site that I had no prior training on because I feel they are easy to do.	(Gao et al., 2020; Sawacha, 1993)

METHODOLOGY

A Quantitative research approach was adopted for the study, using a questionnaire as research instrument. The population of the study included workers on 3 selected construction sites in Kaduna state, Nigeria. The choice of the city and construction sites where at the convenience of the researcher as Burnett and Holton (1997) noted one of the advantages of quantitative research methods is their ability to use relatively smaller convenient sample size to make inferences about larger populations that would be prohibitively overwhelming to study. The demography of the workers involved in carpentry, masonry, plumbing and electrical works were purposively selected due to the hazardous nature of such tasks (Davies & Tomasin, 1996). Overall, a total of 30 workers that fit the study demography were identified, and all agreed to participate in the study. However, 3 responses were discarded due to errors in filling the research instrument.

The summated ratings method developed by Likert (1932)was used to measure respondent's safety attitude and behaviour on site. The scale used in this study was initially subjected to both academic and professional scrutiny to ascertain its validity and reliability. Adaptations were made from the initial scale based on the outcome of the validity exercise, and the resulting scale recorded a reliability value (α=0.90) which shows strong of reliability (Cronbach, 1951). Respondents were then asked to respond with their respective level of agreement to each item using a scale of 1-5 (1= strongly disagree, 2= disagree, 3= somewhat agree, 4= agree, 5=strongly agree). Subsequently, an average score across all measurement items for individual worker was calculated using Eq. (1) and Eq. (2). This gives an aggregated safety attitude and safety behaviour scores for each worker ranging from 1-5, with positive score and negative score at both extremes (1= Positive, 5= Negative) considering the negative structure of the measurement items.

$$\text{SAworker} = \frac{\sum_1^8 SA}{8} \quad \text{.....(1)}$$

$$\text{SBworker} = \frac{\sum_1^8 SB}{8} \quad \text{.....(2)}$$

where SAworker is a measure of the safety attitude of an individual worker, SBworker is a measure of behaviour of individual worker, SA and SB are the responses of individual workers to each of the survey statement items for safety attitude and safety behaviour respectively.

Relatedly, the Hazard recognition capability of the workers was assessed using pictures capturing a total of 8 common hazards often encountered on construction sites. These hazards included Using ladder horizontally, working at height without harness, scattered tools on the floor, working close to electric lines without harness, misuse of PPE, hanging out of a window to work, working in extreme weather condition, and working in confined spaces. Respondents were required to look through, and identify the hazards from respective pictures. This technique according to Han et al. (2020) is an effective method in accessing hazard recognition capability of individuals in diverse work contexts. The hazard recognition capability of each worker was calculated using Eq. (3).

$$HRC = \frac{HazardRecognized}{TotalHazard} x100 \quad \text{.....(3)}$$

DATA ANALYSIS AND RESULTS

Demography of respondents

The characteristic nature of the study respondents, which puts the findings of the study into relative context was defined using questions that inquired about the respective demography of the respondents. Table 2 shows that Masons and Carpenters formed 74% of the total respondents with 37% representation respectively. Whereas, 26% of the respondents were involved in mechanical and electrical works. More so, with regards to the years of experience in respective jobs, majority of the workers representing 57% of the respondents reported having work experience ranging from 6 to 15 years, 30% having over 16 years of experience, whilst only 15% reported having 1 to 5 years of experience.

Table 2: Job demography

Nature of Job	Frequency	Percentage (%)	Years of Experience	Frequency	Percentage (%)
Carpentry	10	37	1-5years	4	15
Masonry	10	37	6-15years	15	56
M&E	7	26	16years and above	8	30
Total	27	100	Total	27	100

Namian, Albert, Zuluaga and Behm (2016) noted the significant role safety training Programmes play in orienting construction workers on safety. Along this line, this study enquired about the prior engagement of the respondents in related safety trainings on respective job tasks.

Table 3: Accident experience

Prior Accident	Frequency	Percentage (%)	Severity	Frequency	Percentage (%)
Yes	26	96	Not Severe	9	33
No	1	4	Severe	12	44
	27	100	Very Severe	6	22
			Total	27	100

Nature of Accident	Frequency	Prior Training	Frequency	Percentage (%)
Electrocution	2	Yes	20	74
Stepping on Sharp Object	2	No	7	26
Fall from Height	18			
Fall into an Open Pit	1			
Falling Objects	3			
Chainsaw Cut	1			

Findings presented in Table 3 showed that 74% of the respondents have had prior safety training on their respective job tasks, with only 26% responding negatively

to the question. Relatedly, Gharibi et al. (2008) observed that workers who have been previously involved in a job-related accident, or have witnessed the occurrence of an accident, are often more safety cautious when on site. A vast majority of the respondents representing 96% have had an accident experience on job site, with "Fall from Height" being the most frequent nature of accident experienced as shown in Table 3. Other types of accident noted by the respondents include Electrocution, Stepping on Sharp Object, fall into an Open Pit, Falling Objects, and Chainsaw Cut. More so, 22% of these accidents were reported to be fatal, 44% resulted into major injuries, while only 33% resulted into minor injuries.

Safety attitude, behaviour and hazard recognition capability of workers

As discussed in the methodology section, an aggregated score was calculated for workers safety attitude and behaviour respectively, based on responses to the measurement items presented in the questionnaire. Analysis of the data shows workers having a relatively positive attitude towards safety in their respective job tasks, with an aggregated mean value of 2.43 across all the 27 workers. More so, the one sample T-test showed that the mean value is significantly distant from the T-value ($t=3$, $p<0.05$) being the threshold for negative safety attitude. Relatedly, the aggregated score of 2.44 for safety behaviour across all the workers shows a relatively good safety behaviour on job site, which is also significantly different from the T-Value ($t=3$, $p<0.05$).

The hazard recognition capability as a measure of the ability of a worker to identify potential risks and hazards that could result in job site accident was measured as a function of percentage. Collectively, all 27 construction workers were only able to Identify an average 49% of the total hazards presented in the image with over 50% of the hazards unidentified. It is also important to note that the deviation between the scores of respective workers was statistically quite minimal (std=0.18) with only a few workers scoring very high, and very low marks respectively.

Ultimately, to achieve the aim of this study, a correlation analysis was conducted to scientifically ascertain the relationship between worker's safety attitude, safety behaviour, and respective hazard recognition capability on work site. Due to the nature of data collected, the Spearman's non-parametric correlation technique was used to test the relationships at 95% confidence level. Result of the analysis presented in Table 4 shows a non-significant weak association between worker's attitude towards safety, and the respective capability to recognise hazard on job site ($rs=0.10$, $P>0.05$). More so, Although Liao, Sun and Zhang (2021) noted that different types of hazards can induce different cognitive demands which manifests into individual behaviours, no correlation was found between worker's safety behaviour and hazard recognition capability of the worker in respective job site ($rs= -0.147$), with the correlation also being not statistically significant ($P>0.05$).

Table 4: Spearman's Correlation Between HRC, Attitude and Behaviour

	HRC	Safety Attitude	Safety Behavior
HRC	1	0.10 (P=0.77)	-0.147 (P=0.47)
Safety Attitude	0.10 (P=0.77)	1	0.69 (P=0.00)
Safety Behavior	-0.147 (P=0.47)	0.69 (P=0.00)***	1

*** Significant at 95% Confidence Level

The result of the correlation analysis provides a scientific answer to the research question in this study. A significantly strong association was found between worker's safety attitude and safety behaviour on respective job site ($rs=0.69$, $p>0.00$), although the partial association between positive safety attitude and hazard recognition capability was found not to be significant ($rs=0.1$, $p>0.77$). it is paramount to note that the significance level of the spearman's correlation does not mean to disregard the association, but rather limits its reliability and application in a broader context (Schober et al., 2018). Therefore, it can be claimed that a positive change in worker's safety attitude those not influence any significant improvement on the hazard recognition capability of the worker, but rather improves the worker's safety behaviour in dynamic safety climates. As Pandit et al. (2019) observed that providing a positive safety climate improves hazard recognition capability of construction workers, and safety risk perception which is a manifestation of safety attitude, it can be seen that safety attitude is not a stand-alone factor in changing hazard recognition capability of construction workers. This is in line with the views of previous literature focused on understanding the antecedents of worker's hazard recognition capability on respective job sites (Abubakar et al., 2020; Albert et al., 2017; Namian et al., 2016a).

CONCLUSION AND RECOMMENDATION

The fretting nature of the construction industry with regards to safety of workers, and the execution of tasks begs the need for an urgent response. Building on the numerous efforts from studies in this regard, this paper provides a new perspective to the management of construction safety on construction sites by focusing on the human related dynamics of the worker. Understanding the antecedents of worker's safety hazard recognition capability certainly has the potential of minimising the occurrences of avoidable accidents, and improving the overall safety performance of the industry. This study found that although safety attitude was found to influence safety behaviour of workers with slight impact on hazard recognition capability, the behaviour of worker with regards to safety has no direct correlation with the capability of the worker to identify hazardous working circumstances. This finding prompts a different outlook to the relationship on the role of safety attitude in changing behaviour and improving hazard recognition capability. It could be probable that safety behaviour of worker plays a facilitating role between safety attitude and hazard recognition capability. As thus, it is recommended that further studies be carried out in divergent demographic and statistical contexts to put this relationship into clearer perspective.

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