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Original Research Article

The impact of video-game on aggressive behaviors among adolescents in Saudi Arabia: a national study

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ABSTRACT

Background: Children and teenagers frequently use video games as a form of entertainment. Although the middle east has one of the fastest-growing video game user populations, most studies need more national data to demonstrate the prevalence of playing video games and its effects on aggressive and mental health behaviours. Therefore, this study aimed to assess the prevalence of video game use and its association with aggressive behaviours among adolescents in Saudi Arabia.
Methods: This was a community-based cross-sectional study involving males and females, aged 15-18 years, in both private and public secondary schools in the five main regions of Saudi Arabia. A modified aggression questionnaire comprised 29 items and scored on a 5-point Likert scale was electronically self-administered for each participant. This survey measured hostility, verbal aggression, physical aggression, and anger.
Results: A total of 4,840 students participated in the study with an average age of 16.15±3.98 years. Males frequently played video games compared with females ($p<0.0001$). The average playing time per day was significant across males ($p<0.0001$). Females were more likely to show anger and hostility ($p<0.0001$ for both). However, males were more likely to show physical aggression ($p<0.0001$).
Conclusions: Our study suggests that playing video games might associate with violent behaviours among adolescents in Saudi Arabia. This conclusion is supported by previous international studies. Increasing families' awareness about video games and their impact on mental health and behaviours would help them identify their benefits and drawbacks.

Keywords: Adolescence, Aggression, Saudi Arabia, Video gaming

INTRODUCTION

Video games have become a major source of entertainment among children and adolescents across the world.[1,2] Globally, the average time spent on gaming among adolescents has increased over the last three decades.[3] For instance, in the United States, adolescents' average daily gaming usage has increased from 24 to 73

minutes between 2004 and 2009.[4] Such popularity has driven concerns about the potential negative effect. Moreover, the World Health Organization (WHO) spurred debate over the possibility of video games' negative effects when it decided to add "gaming disorder" and "hazardous gaming" to its international classification of diseases in 2018.[5] One subject that draws many researchers' attention is the relationship between violent video games and aggressive behavior.[6-8] A study concluded that males who are 16-21 years old are more likely to develop a problematic video game-related behavior.[9] Another study reported that the longer children are exposed to violent video games, the more likely they are to adopt aggressive behaviours and thoughts.[8]

Based on the general aggression model (GAM), Anderson et al suggested that there is a positive correlation between the amount of exposure to violent video games and aggressive behavior.[2,6,7] Furthermore, the American psychological association (APA) affirms a reliable association between violent video game playing and aggressive outcomes.[10] However, some studies suggest the opposite and do not support the conclusion that media violence leads to aggressive behavior.[11,12] Furthermore, the increments of aggressive behaviour among the young players who are exposed to violent video games might be explained by the vicarious learning process described by the social learning theory, and/or an increase in the accessibility of aggressive thoughts and cognitive schemas to the player as proposed in the general aggression model.[13,14]

The middle east nowadays is one of the fastest growing communities in the video game industry. Nevertheless, there is a lack of national data or documentation to show the prevalence of playing video games and its impact on mental health and aggressive behaviours.

Therefore, this study aimed to assess the prevalence of video game use and its association with aggressive behaviours among adolescents in Saudi Arabia.

METHODS

A community-based, cross-sectional study was conducted between October 2020 and June 2021 to identify the prevalence of video game use and its association with aggressive behaviors among adolescents in the five main regions of the Kingdom of Saudi Arabia, with no exclusion criteria applied.

Participants and recruitment

Participants were students, males and females aged between 15 and 18 years old. Students who can read and understand Arabic, have access to an internet connection, and are registered in a private or public secondary school were invited to participate. With a 5% margin of error and a 99% degree of confidence, the sample size is computed to be 663 using the Raosoft sample size calculator website. The sample size was 4,840.

Measures

The survey consisted of the participant and parental consent, sociodemographic information, and Buss and Perry aggression questionnaire. Buss and Perry aggression is a self-administered questionnaire developed to investigate aggressiveness in various populations.[15] A validated Arabic version of the scale was retested in the pilot study.[16] The questionnaire included questions about the drawbacks of video games, the types of video games, the frequency of using video games and exposure time to video games. In addition, there were 29 items scored with a 5-point Likert scale (1= extremely uncharacteristic of me, 2= somewhat uncharacteristic of me, 3= neither uncharacteristic nor characteristic of me, 4= somewhat characteristic of me and 5= extremely characteristic of me) and composed of four categories: physical aggression, anger, hostility, and verbal aggression.

Procedure

The questionnaire was converted into electronic format using Lime Survey (Version 4.1.6+200220) in 2020 to conduct the study nationally. A multistage stratified sampling technique was used. Starting by identifying all schools (private and public), (males/females) in all cities and towns in each of the five regions (central, western, eastern, southern, and northern). There were 48 schools selected randomly from each group, and then random students received the survey link through the Ministry of Education's channels.

Data analysis

The data analysis was done using SAS version 9.4 (SAS Institute Inc., USA). Participants were described through their socio-demographics, such as age, gender, nationality, living arrangement, and caregivers. Scores of different types of aggressive behaviors were calculated by summing the scores for the corresponding items. Comparisons of scores according to age, sex, nationality, and types of video games were performed via either an independent, two-sample t-test, or using general linear model (GLM procedure from SAS software). Correlations between the number of video games and self-reported aggression scores were performed by Pearson's correlation test. P values of <0.05 were considered significant.

RESULTS

A total of 4,840 students participated in the study with an average age of 16.15±3.98 years. Males formed around 61% of the study sample while females presented about half of the males' proportion. 84% of the students were Saudi citizens. Approximately three-quarters of the

students played video games, and the average playing time was 4.33±4.3 hours (Table 1).

Table 1: Demographic characteristics of the participants (n=4840).

Characteristics	Number (%)*
Age (years)	
Mean±SD	16.15±3.98
Sex	
Boys	2935 (60.6)
Girls	1905 (39.4)
Nationality	
Saudi	4064 (84.0)
Non-Saudi	776 (16.0)
Caregivers	
Both biological parents	4233 (87.5)
Single biological parent	468 (9.7)
Biological and step-parent	84 (1.8)
Relatives (other than parents)	55 (1.1)
Living arrangements	
Parents only	375 (7.75.0)
Parents and brothers/sisters	3898 (80.5)
Parents and brothers/sisters and other relatives	567(11.71)
How long you have been playing video games (years)	
Mean±SD	6.24±3.7
Currently playing video games	
Yes	3355 (69.3.1)
No	1485 (30.7)
Playing video games per day (hours)	
Mean±SD	4.3±4.3

*Percentages may not add to 100 due to missing data

There was a significant difference in age and gender according to the number of playing video games. The average playing time per day was significant across males and females as well as Saudis and non-Saudis (p<0.0001).

Regarding video game genre, all the types of games showed statistical significance except for strategy/puzzle games. Moreover, both genders showed significant p values in all kinds of games apart from simulation games. Furthermore, strategy/puzzle games presented a significant difference between Saudis and non-Saudis (p=0.02). Regarding the frequency of video game playing, gender and nationality indicated a significant difference as (p<0.0001) and (p=0.02) respectively (Table 2). According to types of video games, students who played action games exhibited significant verbal, physical, and overall aggression scores compared to other students. Correspondingly, those who played adventure games showed significantly higher scores in all types of aggressive behaviors (p<0.001) excluding physical aggression.

There were significant anger (p<0.0001), verbal (p<0.02), and overall aggression scores (p<0.0004) found among the students who played simulation games. Students who played sports presented with significantly higher anger and hostility (p<0.0001) and verbal aggression (p<0.01).

Regarding strategy/puzzle, students showed significant higher mean scores of anger (p<0.02), hostility (p<0.0003), verbal aggression (p<0.02), and overall aggression (p<0.03) (Table 3).

Table 2: Participants' response to play video games.

	Age			Sex			Nationality		
	12-15	16-18	P value	Male	Female	P value	Saudi	Non-Saudi	P value
How long you have been playing video games (years)	5.6±3.6	6.4±3.6	<0.0001	6.6±3.3	5.6±3.7	0.0001	5.4±3.4	6.1±3.4	0.18
Playing video game per day (hours)	4.1±3.5	4.1±3.2	0.15	4.4±3.4	3.6±3.3	<0.0001	4.3±3.5	3.6±2.9	0.0001
Types of video game									
Action	896 (27.93)	1331 (41.49)	0.003	1613 (48.6)	677(20.4)	<0.0001	1939 (58.5)	359 (10.6)	0.30
Adventure	722 (2251)	875 (27.3)	0.0002	1027 (31.0)	628 (19.0)	<0.0001	1411 (42.6)	244 (7.5)	0.8
Simulation	373 (11.53)	619 (19.3)	0.0008	650 (19.6)	369 (11.1)	0.0.04	850 (25.6)	169 (9.8)	0.07
Sports	341 (10.6)	704 (21.9)	<0.0001	899 (26.8)	173(5.2)	<0.0001	893 (26.9)	169 (5.1)	0.26
Strategy/puzzle	536 (16.7)	719 (22.4)	0.5	760 (23.0)	534(16.0)	<0.0001	1079 (32.5)	279 (8.4)	0.02
How often do you play video game weekly									
Never	16 (0.5)	10 (0.2)	0.002	10 (0.3)	18 (0.5)	<0.0001	24 (0.7)	4 (0.1)	0.02
1-3 times/week	520 (16.2)	659 (20.5)		744 (22.4)	475 (14.3)		1107 (30.4)	212 (6.4)	
4-6 times/week	192 (6.0)	344 (10.7.4)		410 (12.4)	145 (4.4)		475 (14.3)	80 (2.4)	
Daily	618 (19.3)	849 (26.5)		1034 (44.1)	480 (14.5)		1316 (39.7)	198 (5.6)	
How long you have been playing video games (years)	5.6±3.6	6.4±3.6	<0.0001	6.6±3.3	5.6±3.7	0.0001	5.4±3.4	6.1±3.4	0.18
Playing video game per day (hours)	4.1±3.5	4.1±3.2	0.15	4.4±3.4	3.6±3.3	<0.0001	4.3±3.5	3.6±2.9	0.0001
Types of video game									

Continued.

	Age			Sex			Nationality		
	12-15	16-18	P value	Male	Female	P value	Saudi	Non-Saudi	P value
Action	896 (27.93)	1331 (41.49)	0.003	1613 (48.6)	677 (20.4)	<0.0001	1939 (58.5)	359 (10.6)	0.30
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4-6 times/week	192 (6.0)	344 (10.7.4)		410 (12.4)	145 (4.4)		475 (14.3)	80 (2.4)	
Daily	618 (19.3)	849 (26.5)		1034 (44.1)	480 (14.5)		1316 (39.7)	198 (5.6)	

Table 3: Aggression scores of the participants playing different types of video games.

Types of video games	Action Mean (SD)			Adventure Mean (SD)			Simulation Mean (SD)			Sports Mean (SD)			Strategy/puzzle Mean (SD)		
	Yes	No	P value	Yes	No	P value	Yes	No	P value	Yes	No	P value	Yes	No	P value
Anger	18.0 (5.6)	16.7 (5.5)	<0.0001	17.9 (5.6)	17.2 (5.4)	<0.0001	18.2 (5.6)	17.4 (5.5)	0.0001	17.05 (5.5)	17.9 (5.6)	<0.0001	17.9 (5.5)	17.4 (5.6)	0.02
Hostility	18.5 (6.9)	17.2 (6.4)	<0.0001	18.7 (6.9)	17.6 (5.9)	<0.0001	18.8 (6.9)	17.8 (6.7)	0.0002	17.4 (6.6)	18.5 (6.8)	<0.0001	17.7 (6.9)	17.8 (6.7)	0.0003
Verbal aggression	13.0 (3.7)	12.1 (3.8)	<0.0001	13.0 (3.7)	12.5 (3.8)	0.001	13.0 (3.7)	12.6 (3.8)	0.02	12.5 (3.8)	12.9 (3.8)	0.01	13.0 (3.7)	12.6 (3.8)	0.02
Physical aggression	19.5 (7.5)	18.0 (7.2)	<0.0001	19.1 (7.7)	18.9 (7.2)	0.59	19.3 (6.9)	18.6 (7.3)	0.44	19.1 (7.4)	19.0 (7.5)	0.85	18.9 (7.5)	19.1 (7.4)	0.64
Overall score	69.1 (19.3)	64.01 (18.9)	<0.0001	68.8 (19.9)	66.3 (18.6)	0.0002	69.3 (19.4)	66.7 (19.2)	0.0004	66.34 (19.4)	68.2 (19.3)	0.002	68.4 (19.2)	66.9 (19.4)	0.03

Table 4: Correlations between different types of video games (total number) and self-reported aggression scores.

	Anger	Hostility	Verbal aggression	Physical aggression	Overall score
Anger	1.00				
Hostility	0.63**	1.00			
Verbal aggression	0.56**	0.54**	1.00		
Physical aggression	0.57**	0.54**	0.51**	1.00	
Overall score	0.84**	0.84**	0.74**	0.84**	1.00

*Significant at 0.05 level; **Significant at 0.01 level

Table 5: Aggression scores according to age, sex, and nationality of the participants.

	Age			Sex			Nationality		
	12-15	16-18	P value	Male	Female	P value	Saudi	Non-Saudi	P value
Anger	17.4±5.5	17.4±5.5	0.9	16.7±5.4	18.3±5.7	<0.0001	17.3±5.6	17.7±5.4	0.0.09
Hostility	18.3±6.8	17.5±6.6	0.0002	17.2±6.5	18. ±7.0	<0.0001	17.7±6.7	18.8±7.0	<0.0001
Verbal aggression	12.5±3.8	12.6±3.8	0.7	12.5±3.9	12.6±3.7	0.15	12.5±3.9	12.7±3.8	0.32
Physical aggression	17.7±7.4	19.3±7.5	<0.0001	19.4±7.5	17.3±7.4	<0.0001	18.7±7.6	18.1±7.2	0.04
Overall score	65.9±19.6	66.8±19.3	0.14	65.8±19.4	67.1±19.7	0.0.03	66.1±19.6	67.2±19.1	0.14

A positive strong correlation was found between total score and anger, hostility, verbal aggression, and physical aggression scores ((r=0.84, p<0.05) and (0.74, p<0.01), respectively. Furthermore, hostility was moderately correlated with anger (r=0.63, p<0.01) (Table 4). Based on students age, sex, and nationality, older students exhibited significant physical aggression scores compared to younger students (p<0.0001).

On the contrary, hostility among younger teenagers was significantly higher than in older teenagers (p=0.0002). Anger and hostility among females were more likely to show statistical significance (p<0.0001) and (p<0.0001),

respectively. However, males were more likely to show substantial physical aggression scores (p<0.0001). In terms of nationality, non-Saudis reported significant hostility and physical aggression scores compared to Saudis as (p<0.0001) and (p=0.04) respectively (Table 5). Considering gender differences and types of video games, females mean aggression scores were statistically significant than their male counterparts when playing action and adventure games (p<0.0001). On the other hand, males had statistically significant mean physical aggression scores than female when playing action, adventure, simulation, and strategy/puzzle games (p<0.0001).

Playing sports video games showed statistical significance in mean verbal aggression scores in older youth and non-Saudis with a p value 0.04 and 0.2 respectively (Table 6).

Table 6: Aggression scores by different types of video games.

	Age			Sex			Nationality		
	15-16	17-18	P value	Male	Female	P value	Saudi	Non-Saudi	P value
Action									
Anger	18.1±5.2	18.3±5.1	0.75	17.1±5.2	19.5±4.8	<0.001	18.0±5.0	18.6±5.6	0.39
Hostility	17.6±6.2	16.6±5.4	0.17	16.7±6.1	17.6±5.3	0.17	16.9±5.8	17.8±5.9	0.23
Verbal aggression	12.7±3.4	13.0±3.8	0.46	13.0±3.7	12.8±3.4	0.66	12.6±3.5	13.6±3.6	0.04
Physical aggression	18.9±7.1	20.0±7.2	0.20	21.1±7.8	17.8±5.8	<0.001	19.5±7.2	19.8±7.3	0.76
Overall score	67.4±17.5	68.0±17.6	0.76	68.0±19.4	67.8±14.8	0.92	67.2±17.1	70.0±18.5	0.23
Adventure									
Anger	19.3±5.5	19.1±4.3	0.77	17.5±4.8	20.2±4.7	<0.001	19.0±4.9	19.3±5.1	0.64
Hostility	18.8±6.8	17.3±5.0	0.07	17.0±6.2	18.7±5.5	0.03	17.8±5.9	18.4±5.9	0.52
Verbal aggression	12.7±3.5	13.2±3.5	0.26	13.3±3.5	12.8±3.5	0.36	13.0±3.5	13.0±3.3	0.93
Physical aggression	19.4±6.9	19.8±6.9	0.70	21.1±7.7	18.6±6.2	<0.001	19.8±7.2	19.2±6.6	0.54
Overall score	70.3±17.7	69.5±15.6	0.74	69.0±18.4	70.4±15.1	0.51	69.8±16.8	70.0±16.3	0.92
Simulation									
Anger	18.7±5.5	19.8±4.2	0.29	17.9±4.3	20.2±5.1	0.02	19.2±5.1	19.5±4.5	0.79
Hostility	18.1±6.7	17.6±4.5	0.72	18.1±6.0	17.6±5.5	0.69	18.4±5.9	16.5±5.0	0.14
Verbal aggression	13.7±3.7	13.5±3.6	0.71	15.5±3.7	13.6±3.6	0.89	13.4±3.8	13.8±3.0	0.65
Physical aggression	19.6±7.3	18.6±6.4	0.52	21.6±7.8	17.4±5.6	0.004	18.7±7.3	18.7±7.1	0.50
Overall score	70.2±17.4	69.6±15.0	0.87	71.3±17.6	69.0±14.8	0.51	70.1±16.8	69.9±14.9	0.96
Sports									
Anger	17.0±5.5	17.3±4.6	0.78	17.0±4.9	18.3±5.0	0.29	16.7±5.0	18.2±4.6	0.10
Hostility	17.2±6.8	16.1±5.2	0.28	16.5±6.0	17.3±5.1	0.57	16.1±6.0	17.7±5.6	0.15
Verbal aggression	12.0±3.8	13.3±3.5	0.04	12.8±3.7	12.3±3.6	0.58	12.4±4.0	13.7±2.7	0.02
Physical aggression	19.4±8.0	20.4±7.1	0.45	20.4±7.7	17.6±5.2	0.13	19.5±8.0	21.3±6.3	0.19
Overall score	65.8±20.5	67.2±17.3	0.66	66.8±19.0	65.6±15.7	0.79	64.8±19.9	71.1±14.5	0.04
Strategy/puzzle									
Anger	18.5±5.6	19.8±4.8	0.13	18.1±5.4	19.6±5.1	0.11	19.1±5.5	18.9±5.1	0.82
Hostility	18.6±6.1	17.2±4.9	0.14	18.8±6.7	17.8±5.1	0.82	18.0±5.9	17.7±5.3	0.70
Verbal aggression	12.7±3.5	13.5±3.5	0.15	13.5±3.5	12.8±3.5	0.30	12.8±3.4	13.4±3.6	0.27
Physical aggression	18.0±6.8	20.0±7.3	0.08	22.6±8.6	17.0±5.4	<0.001	19.3±7.3	18.2±6.8	0.38
Overall score	67.8±17.6	70.7±16.6	0.31	72.3±20.1	67.3±15.1	0.08	69.3±17.9	68.4±15.8	0.74

DISCUSSION

Our study demonstrated that video games are prevalent among adolescents in Saudi Arabia. There was a positive correlation between playing video games and aggression, with some variations across gender, age and types of video games.

Among the studied sample, males and older adolescents presented with extensive use of video games in terms of years and about 4 hours of playing per day. Consistently, longer time spent on video games was associated with offensive acts, as reported by the participants in an Iranian study.[1] Moreover, males in this study were approximately double the females in playing all kinds of video games. This result ties well with previous studies wherein males scored significantly higher than females in playing violent video games.[17]

Regarding the genres of video games and aggression, we found higher verbal, physical, and overall aggression scores presented among students who played action games as shown in Table 3. This finding was consistent with Lee et al, as they found that in students who play

violent video games, there is an increase in verbal and physical aggression among heavy players in light of stimulation theory. Conversely, intensive players who played video games to release aggressiveness, presented with lesser aggression.[8,18] Correspondingly, Graybill and his colleagues suggest that video games might have a positive influence on children.[18,19]

As shown in Table 4, there was strong a positive link between the total score of aggression, anger, hostility, verbal aggression, and physical aggression. These findings support previous studies that assessed teenagers' behaviors in relation to violent video games. They found that 5% of adolescents' aggression might be in response to violent video games.[17] In 2017, Anderson et al found a positive association between violent media and aggressive behaviors across seven countries.[20] On the contrary, a longitudinal study done by Kuhan et al revealed no significant difference between participants who played violent video games and those who did not play in regards to violent behavior.[21] A probable explanation for this contradiction is that our study captured aggressive behaviors based on teenagers' reports with the presence of multi covariates; however, Kuhan's study is an interventional study over a duration of 2 months with the presence of a control group.[20] These results go beyond a previous study in 2018, showing that early exposure to video games has an effect on expressing negative behaviors and lowering kindness at a cross-sectional level rather than the 5 years longitudinal study.[22] By comparing our results to the previous studies, we conclude that the use of video games might have an effect in a short period of time, and this effect would fade with time. Interestingly, the use of video games and other non-academic screen-based activities in moderation (60 minutes or less) was found to be somewhat of a protective factor in regards to suicidal ideas, depressive symptoms and exposure to bullying.[23]

Another finding revealed that physical offence was common among older adolescents, whereas anger and hatred took larger space among younger teenagers, as shown in Table 5. Furthermore, female students presented with more irritation and hostility, but male students showed aggression that was more physical. These findings are consistent with previous studies, as males who started playing video games at an early age were dramatically affected.[1] Likewise, in Japan, they found more violence across males than females in response to violent media, which was justified by excessive exposure to violent media in males compared to females.[24] Moreover, expressing aggressive behaviors was mediated by a higher amount of exposure to video games.[1] Additionally, gender differences were apparent beyond behavior, as it appeared to affect mood, specifically depressive symptoms and cognitive skills, which also correlated with the time spent video gaming; furthermore, females were found to have a steady upward correlation between hours spent video gaming and the expression of mental health challenges in behavior, depression and suicidal ideas. However, males were found to follow a J-shaped correlation in regards to the effect on behavior, depression and suicidal ideas, being exaggerated with hours spent exceeding 4 hours/day.[23]

When discussing video gaming and its effect on behavior, it is important to discuss the possibility of the adolescents' fulfilling criteria for an internet gaming disorder, which is a disorder currently being researched to be included by the American Psychiatric Association in the diagnostic and statistical manual.[25] In such a behavioral disorder, there is a high impact on the functioning of adolescents and their ability to engage in the "real" world in regards to academic, social and relational functioning. Hence, this is an important aspect to be further explored in future research.[26]

With the increase in prevalence of video game use in our youth population, and its apparent negative effect on behavior despite gender differences, it becomes extremely critical to involve schools, parents and adolescents in the process of education around the importance of having clear limits around video game use, especially in regards to time spent playing video games and the genres with the highest probability to affect behavior which will in turn could aid in preventing behavioral challenges which we found to correlate with the above mentioned variables. This is similar to a finding provided by Brazilian researchers in 2021, who recommended involving guardians to help them identify early signs for problematic use of video games in order to help influence prevention measures and early intervention.[27]

In our study, we encounter several limitations; firstly, a descriptive study that lacks a control group. Moreover, it is a cross-sectional design that captures a specific period. Another limitation is that aggressive behaviors are measured using a self-reported questionnaire with scarce objectivity. Furthermore, some questions in the survey, such as; time spent playing video games, can be influenced by recall bias and observation bias. Besides, participants in this study were limited to students who presented to schools.

CONCLUSION

Our study suggested that playing video games might be associated with violent behaviors among male and female adolescents in Saudi Arabia, with a gender difference in regards to the behaviors exhibited; as suggested and supported by previous international studies. Furthermore, we found that the 2 main predictors for behavioral challenges are time spent playing video games and the video game genres the adolescents play.

We aimed to increase awareness about video games' benefits and drawbacks within schools. In addition, instruct and educate families to guide and observe the

genres of video games their children play and the time they spend on them.

Overall, there is a high need for more studies in this area. Moreover, investigative research needs to be done to identify possible related disorders such as internet gaming disorder and their effect on mental health and functioning, at multiple levels including academic, relational and social.

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