

The way you make me feel: a network analysis of social ties that could exacerbate compulsive exercise among a sample of sorority women

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Abstract

Purpose – *The purpose of this study is to assess factors related to sorority women connecting with people who exacerbate feelings of exercise guilt and body dissatisfaction (BD), both of which preclude compulsive exercise.*

Design/methodology/approach – *In all, 207 sorority women (egos) completed online surveys measuring physical activity, BD, compulsive exercise and egocentric networks (n = 1,105 social ties/ alters). Two random coefficient multilevel models assessed factors related to an ego connecting to someone who makes her feel: guilty about her exercise habits and good about her looks.*

Findings – *Exercise patterns within networks related to how often an alter made ego feel guilty about her exercise habits; alter gender and communication frequency related to how often an alter made ego feel good about her looks; and ego's BD score was related to both feelings of guilt and body satisfaction.*

Originality/value – *The findings of this study support and extend literature highlighting the importance of someone's immediate social network on their body image and related behaviors.*

Keywords Egocentric networks, College students, Body dissatisfaction, Compulsive exercise, Social network analysis, Obligatory exercise

Paper type Research paper

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While exercise is typically promoted because of copious health benefits (Powell *et al.*, 2019), exercise can become harmful. When exercise becomes compulsory or obligatory, it can lead to mental and physical consequences, including the development of eating disorders (Hausenblas *et al.*, 2017; Meyer *et al.*, 2011). Compulsive exercise (CE) is characterized by a drive or desire to exercise, usually excessively to control weight, and is laden with feelings of guilt and anxiety when exercise is postponed or cancelled (Dittmer *et al.*, 2018; Taranis *et al.*, 2011). When someone engages in CE, they typically prioritize exercise over other activities and continue exercise despite physical or social consequences (Hausenblas *et al.*, 2017).

Research shows that CE often precedes eating disorder diagnosis and represents the most difficult behavior to treat among those affected (Dalle Grave, 2009; Polivy and Herman, 2002). Eating disorders are among the deadliest of all mental illnesses, resulting in approximately 10,200 deaths per year in the USA (Deloitte Access Economics, 2020). Adolescent females, usually between ages 15 and 29 years, account for the majority of diagnoses (Polivy and Herman, 2002) and, as a result, disproportionately affect college women compared to other groups (Fitzsimmons-Craft *et al.*, 2019). Several studies have shown sorority involvement can lead to women being less satisfied with their bodies,

increasing their odds of developing unhealthy weight management practices (Allison and Park, 2004; Becker *et al.*, 2018).

Body dissatisfaction (BD) has been cited as a primary driver in the development of and engagement in CE and disordered eating (Dalle Grave *et al.*, 2008; Patterson and Goodson, 2017). BD is defined as negative feelings regarding a perceived difference between one's current body size/shape and one's ideal body size/shape (Gardner and Brown, 2010). Because women tend to worry more about their weight and shape compared to men (Kashubeck-West *et al.*, 2005), they are especially likely to feel guilty about their exercise behaviors not being consistent or rigid enough (Abraham, 2003; Taranis *et al.*, 2011). A better understanding of women's experiences of guilt and BD is needed to identify opportunities to prevent the development of CE and potential eating disorders.

Theoretical frameworks

Tripartite influence model

The Tripartite Influence Model suggests that parents, peers and popular media are primary social influences related to body image (Thompson *et al.*, 1999). According to the Tripartite Influence Model, personal relationships have an impact on body image, with studies suggesting the opinions of close friends and family influencing a woman's feelings about her body (Mills *et al.*, 2014; Paquette and Raine, 2004; Rayner *et al.*, 2013; Tompkins *et al.*, 2009). Consequently, this study will apply social network analysis (SNA) – a theoretical framework and extensive set of methods – to acutely explore the interpersonal relationships within sorority women's networks that potentially impact they feel about their body and exercise habits.

Network Theory

Network Theory guides SNA and posits the importance of social connections on individuals and systems. According to Network Theory, the patterns and characteristics of social networks influence individual and collective behavior. For example, Network Theory suggests humans tend to connect with, and behave like, their close social ties (i.e. *homophily*, Gudzune *et al.*, 2018; McPherson *et al.*, 2001). Further, Network Theory posits social networks consist of four distinct dimensions, including structure, function, strength and content – all of which inform what to measure when collecting social network data. A network's *structure* is the architectural aspect of networks, representing the presences and patterns of linkages between network members. The *function* of a network shows the types of exchanges, services or supports accessible through network ties. *Strength* shows the intensity and duration of bonds between network members. And *content* is represented through the substance of the network, such as attitudes, opinions and beliefs that are potentially transferred across network ties. Network Theory suggests these four dimensions interact to influence individual behaviors. As such, we will measure structure, function, strength and content of social networks and explore how these dimensions might influence a person's feelings that could precede or support CE.

Thus far, SNA research has found college women who are more peripheral in their social network were more likely to register higher CE scores, and women closely connected to popular/powerful people in their network were more likely to struggle with CE (Patterson and Goodson, 2017). Research also shows sorority women who have higher BD and eating pathologies tend to be less connected within their networks compared to those with more positive scores (Becker *et al.*, 2018; Prochnow *et al.*, 2019). From an egocentric network perspective, Patterson and Goodson (2018b) found college women who indicate siblings and roommates in their egocentric networks tended to be less impacted by CE compared to students who did not. While SNA has been useful in revealing social patterns and relationships important to explaining BD, eating pathology and CE, one question that

remains is how aspects of CE (e.g. body image, guilt) present through social connections (i.e. what explains someone being socially connected to a person that might exacerbate feelings of guilt and/or BD). Therefore, the purpose of this study is to examine relationships within sorority women's social networks and how they relate to her experiencing underlying factors of CE, including feeling guilty about exercise and BD.

Methods

Egocentric network analysis

This study used egocentric network analysis (ENA), a specific approach to SNA, to investigate personal networks in a sample of college sorority women. By eliciting information from a sample of respondents (i.e. egos) about themselves and their social network ties (i.e. alters), ENA provides a methodological approach to examining ways social relationships impact various health behaviors and outcomes (Perry *et al.*, 2018).

Participants and procedure

Women involved in sororities from a large, private school in the Southern USA were invited to participate in the study, resulting in 207 completed online surveys. Each potential participant received an email describing the study's overall purpose with a link to participate using *Qualtrics* software. All study procedures were vetted and approved by the institutional review board before data collection.

Measures

Each ego indicated their grade classification and answered questions measuring physical activity, BD, CE and egocentric networks.

Physical activity. The Godin-Shepard Leisure Time Exercise Questionnaire (Godin LTEQ; Godin and Shephard, 1985), a four-item scale that measures intensity and duration of strenuous, moderate and mild physical activity during a typical seven-day period, was used to measure respondents' physical activity behavior. Participants reported how many times, on average, they engaged in various exercise intensities for more than 15 min in a given week. Sum scores were created by multiplying reported instances of strenuous activity by 9, moderate activity by 5 and mild activity by 3 and adding those products together into one score (Godin and Shephard, 1985). Acceptable test-retest reliability was previously established with the Godin LTEQ, with coefficients ranging between 0.74 and 0.80 (Ainsworth *et al.*, 1993; Joseph *et al.*, 2014).

Body dissatisfaction. The Body Shape Questionnaire created by Evans and Dolan (1993) was used to assess BD in this study. The short-form, 16-item version was used. Each item is measured on a six-point Likert scale (1 = never and 6 = always) and asked respondents to indicate how often over the past four weeks they had feelings of BD (e.g. "felt bad about your body" and "even a small amount of food made you feel fat"). A sum score was created by totaling all 16 items for each participant, with higher scores indicative of greater BD. Previous studies have reported Cronbach's α ranging from 0.88 to 0.94 (Pook *et al.*, 2008; Rosen *et al.*, 1996). A Cronbach's α of 0.94 was found for this sample.

Compulsive exercise. The Compulsive Exercise Test (CET), a 24-item self-report measure, was used to assess core features of CE (Taranis *et al.*, 2011). CET uses a six-point Likert scale (0 = never true and 5 = always true) and comprises five subscales:

1. avoidance and rule-driven behavior (e.g. "I feel extremely guilty if I miss an exercise session");
2. weight control exercise (e.g. "I exercise to improve my appearance");

3. mood improvement (e.g. "I feel happier and/or more positive after I exercise");
4. lack of exercise enjoyment (e.g. "I do not enjoy exercising"); and
5. exercise rigidity (e.g. "I follow a set routine for my exercise sessions").

A CET total score was created by summing the average scores from each subscale, with higher scores indicating a stronger likelihood of CE. Reliability coefficients in previous studies have ranged from 0.71 to 0.88 (Goodwin *et al.*, 2011a, 2011b; Goodwin *et al.*, 2011a, 2011b; Taranis *et al.*, 2011). This sample reported a Cronbach's α of 0.84.

Egocentric networks variables. To assess structure, function, strength and content within egocentric networks, each participant was asked two types of questions: name generators and name interpreters (Perry *et al.*, 2018). Name generators ask the ego to list people they are connected to in some way. In this study, egos were asked to indicate, "up to five people they felt closest to in their life." Name interpreters ask the ego to provide information about each person they nominated in the name generator question (details below).

The data gleaned from name generators and name interpreters allow variables to be measured at two analytic levels. Level 1 variables represent characteristics of alters and ties (Perry *et al.*, 2018). Level 2 variables constitute characteristics of the ego as well as aggregated characteristics of the ego's social network (Perry *et al.*, 2018).

Level 1 variables: alters and ties. Characteristics of alters and ties include the alter's sex, relationship to the ego (e.g. friend, relative), how frequently the alter and ego communicated (7 = everyday, 6 = 3–6x/week, 5 = 1–2x/week, 4 = 1–2x/month, 3 = 1–2 = 2x/year, 1 = less than once/year and 0 = never), how often alters exercised (0 = rarely, 1 = sometimes or 2 = often) and the length of the relationship between ego and alter (in months). Additionally, the degree to which an alter makes the ego feel guilty about her exercise habits and the degree to which an alter makes the ego feel good about her looks (0 = Never, 1 = Rarely, 2 = Sometimes, 3 = Usually and 4 = Always for both) were measured at Level 1.

Level 2 variables: egos and networks. To understand whether characteristics of the ego were related to the ego connecting with people who might exacerbate feelings of guilt and BD within her network, we measured ego's physical activity scores, BD scores and CE scores. Measures of total network characteristics (also examined at Level 2) included proportions of the network that: the ego communicated with on a daily basis; was female; and exercised "often," according to ego. All Level 2 network variables were computed using E-Net statistical software (Borgatti, 2006).

Analytic strategy

We conducted two multilevel models using the multilevel package (Bliese, 2016) within R programming language and software (R Core Team, 2020). Because of its ability to account for variance between and within egocentric networks, multilevel modelling is an ideal analytic strategy when conducting egocentric network analyses (Perry *et al.*, 2018; Perry and Pescosolido, 2015).

Based on intraclass correlation coefficients and likelihood ratio tests, we determined it most appropriate to compute two random-coefficient multilevel models (Perry *et al.*, 2018), the first to predict an ego being connected to alters who make her feel guilty about her exercise habits more often (Guilty Model) and the second to assess an ego connecting with alters who make her feel good about her looks more often (Image Model). Random-coefficient models assess Level-1 alters nested in Level-2 egos and account for dependence by including a random intercept for each ego. In addition, random-coefficient models add a

unique slope for each ego based on some dyadic trait. In this case, we used a random-coefficient model and adjusted slope based on how often the alter exercises in both models.

Independent variables present in both models included:

- ego's: Godin LTEQ score, Body Shape Questionnaire score and CET score at Level 2;
- alters': sex, relationship to the ego, frequency of communication with ego and length of the relationship with ego at Level 1; and
- proportion of the network that the ego communicates with daily, that is female and that exercises often (Level 2).

A Levels-1 and –2 interaction term between an alter exercising more often and the overall network composition being higher exercisers was included in the Guilty Model. Interaction terms were insignificant in the Image Model and were, therefore, removed.

Results

Descriptive statistics

Participants ($n = 207$) nominated 1,105 total alters. More than three quarters of alters nominated were female (75.67%, $n = 768$), 24.8% ($n = 252$) were family members and 54.7% ($n = 556$) were friends. Alters registered an average communication score of 6.14 ($SD = 0.93$). Mean relationship length between alter and ego was 117.46 months ($SD = 98.80$) and alters' exercise scores were 1.24 ($SD = 0.70$; range 0–2), on average. Egos reported their alters "usually" made them feel good about their looks and "rarely" made them feel guilty about their exercise habits, on average.

Nearly 40% (39.1%, $n = 81$) of participants were freshmen, and the average Godin LTEQ score in this sample was 48.84 ($SD = 23.65$, range = 9–141), with more than a quarter (27.5%, $n = 57$) indicating they exercised "often" 51.2% ($n = 106$). Egos reported an average BD score of 48.57 ($SD = 15.47$, range = 18–94) and mean CE score of 12.37 ($SD = 2.55$, range = 5.27–19.81). On average, 39.46% of egocentric networks ($SD = 24.88$) exercised "often." See [Table 1](#) for all descriptive statistics.

Table 1 Sample characteristics for 207 sorority members and their alters ($n = 1,105$)

Variable	<i>n</i>	%	<i>M</i>	<i>SD</i>
Ego classification				
Freshman	81	39.1		
Sophomore	51	24.6		
Junior	40	19.3		
Senior	33	15.9		
Ego Godin LTEQ			48.84	23.65
Ego BSQ Sum			48.57	15.47
Ego CET Sum			12.37	2.55
Alter gender: Female	768	75.7		
Alter relation: Family Members	252	24.8		
Alter relation: Friends	557	54.7		
Communication frequency with alter (eight-point scale, 0–7)			6.14	0.93
Length of relationship with alter (in months)			117.46	98.80
Alter exercise scores (three-point scale, 0–2)			1.24	0.70
Frequency alter makes ego feel good about looks (five-point scale, 0–4)			3.20	0.89
Frequency alter makes ego feel guilty about exercise (five-point scale, 0–4)			0.68	0.99
Percentage of egocentric network exercising "Often"			39.46	24.88

Notes: M = mean; SD = standard deviation

Source: Table by authors

Multilevel models

The Guilty Model (Table 2) shows that egos were more likely to be connected to alters who made them feel guilty about their exercise habits when they reported higher BD scores ($b = 0.01, p < 0.001$). Alters with lower exercise scores tended to make ego feel more guilty about her exercise ($b = -0.18, p = 0.04$). Egos whose networks exercised less frequently overall reported feeling guilt from their alters more often ($b = -0.40, p < 0.001$), yet an ego reported more guilt from higher exercising alters when they were also a part of a network that exercised more frequently overall ($b = 0.07, p < 0.001$).

The Image Model (Table 3) suggests lower BD scores for the ego were related to an ego being connected to alters who made her feel good about her looks ($b = -0.02, p < 0.001$).

Table 2 Random coefficient multilevel model predicting the extent to which an ego feels exercise guilt from her alters

Variables	<i>b</i>	Model 1: Guilty	
		<i>t</i>	<i>p</i>
Ego BSQ	0.01	2.53	<0.001
Ego Godin LTEQ	<0.001	-1.85	0.07
Ego CET	<0.01	-0.13	0.90
Alter: Friend	0.08	0.94	0.35
Alter: Family	0.11	1.18	0.24
Alter: Comm	-0.01	-0.37	0.71
Alter: Female	0.06	0.86	0.39
Alter: Length	<0.01	0.56	0.58
Alter: Ex	-0.18	-2.01	0.04
Net: Comm Daily	<0.01	1.46	0.15
Net: Female	<0.01	-0.61	0.54
Net: Ex	-0.40	-4.15	<0.001
Alter Ex*Net Ex	0.07	3.82	<0.001

Notes: b = unstandardized beta; BSQ = body dissatisfaction scores; Godin LTEQ = exercise scores determined by the Godin LTEQ; CET = compulsive exercise scores; Comm = communication frequency with alter; Length = length of relationship with alter; Ex = exercise; Net = network

Source: Table by authors

Table 3 Random coefficient multilevel model predicting the extent to which alters make an ego feel good about her looks

Variables	<i>b</i>	Model 2: Image	
		<i>t</i>	<i>p</i>
Ego BS	-0.02	-4.28	<0.001
Ego Godin LTEQ	<0.01	0.33	0.75
Ego CET	-0.01	-0.56	0.58
Alter: Friend	0.02	0.28	0.78
Alter: Family	0.08	0.92	0.36
Alter: Comm	0.07	2.32	0.02
Alter: Gender	-0.19	-2.70	0.01
Alter: Length	<0.01	-0.28	0.78
Alter: Ex	<0.01	-0.04	0.97
Net: Comm Daily	<0.01	1.39	0.17
Net: Female	<0.01	-0.21	0.83
Net: Ex	-0.05	-1.06	0.29

Notes: b = unstandardized beta; BSQ = body dissatisfaction scores; Godin LTEQ = exercise scores determined by the Godin LTEQ; CET = compulsive exercise scores; Comm = communication frequency with alter; Length = length of relationship with alter; Ex = exercise; Net = network

Source: Table by authors

Further, male alters ($b = -0.19, p = 0.01$) and alters who egos communicated with more often ($b = 0.07, p = 0.02$) tended to make egos feel better about her looks.

Discussion

The purpose of this study was to explore how relationships within sorority women's social networks relate to them experiencing underlying factors of CE. Results suggest that higher BD and network exercise patterns explained an ego's social ties making her feel guilty about her exercise habits. Contrarily, an ego reporting less BD was related to her connecting to people who make her feel good about her looks, especially when those connections were male and communicated more frequently with the ego.

Body dissatisfaction

Higher BD scores were associated with egos connecting to alters who invoked feelings of guilt about exercise habits and poor body image. Much of the literature around body image describes how people, especially young women, misperceive their own bodies and create a negative image that impacts their ability to function and relate with others (Cash and Smolak, 2011). This could be happening within social relationships, where an ego with higher BD experiences greater feelings of guilt about exercise and fewer positive feelings about how she looks through her social ties because of her BD. In this case, BD could be breeding insecurity at the intra- and the interpersonal levels for women in our sample (Mills et al., 2014; Rayner et al., 2013). These results could also mean ego's body image is socially influenced – that connecting with people who make an ego feel good about her looks and less guilty about her exercise will promote better body image for the ego (Kluck, 2010; Smolak, 2004). Because these data are cross-sectional, we cannot definitively say whether an ego's BD prompts how she perceives connections with people or if the connections with those people influence positive or negative body image. Realistically, the relationship between BD and social ties is likely a bidirectional, reinforcing loop (Meadows, 2008), where positive body image leads to healthy relationships with others, while healthy relationships with others simultaneously reinforces positive body image.

Exercise patterns within networks

Not only do studies suggest women generally feel they do not exercise enough (Harman and Burrows, 2019), but also Network Theory supports homophily related to exercise behaviors, meaning people tend to connect closely with others who participate in similar exercise behaviors (Gudzune et al., 2018; McPherson et al., 2001). Thus, in this study, we could expect egos to participate in similar levels of exercise as their alters based on homophily and potentially experience shared guilt about not engaging in enough exercise (Dittmar and Howard, 2004; Myers et al., 2012). Studies show that individuals who want to change exercise behavior often use each other as a commitment device (i.e. workout partners); therefore, the failure to exercise will result in disappointing friends (Rogers et al., 2014) and may continue exercise-related guilt (Harman and Burrows, 2019). On the contrary, it could be that alters who do not engage in the same level of exercise as ego could make ego feel badly about how often she exercises. Studies show that discrepancies in exercise behaviors among dyads can create tension, particularly if the ego exercises more often than the alter (Hurst et al., 2017; Rhodes and Matheson, 2005). If an ego's behavior is a source of tension for a less frequent exerciser in her network, then it might create feelings of guilt related to her own exercise habits.

Though feeling guilty about exercise was generally associated with lower exercise across the network, when the ego was nested in higher exercising networks, it was the alters who reported more frequent exercise that made the ego feel guilty about her exercise habits. This finding could suggest that an ego feels pressure to meet certain standards set by her

network, and despite how much the ego exercises, she might feel the need to match, or compete with, high levels set by her network (Burg and Seeman, 1994; Myers *et al.*, 2012). While consistent exercisers are often motivated by competition (Box *et al.*, 2019), competition can also result in inappropriate criticism that results in unhealthy behaviors like CE (Flett and Hewitt, 2005; Forney *et al.*, 2019). Previous literature suggests that being connected within high exercising networks can result in anxiety for the ego (Patterson *et al.*, 2019), which might also result in an ego feeling guilty about her exercise habits.

Alter communication and gender

In this study, alters who communicated with ego more frequently were more likely to make ego feel good about her looks. Communication frequency has been considered a measure of tie strength in network literature (van den Berg *et al.*, 2002), meaning social ties consistent of more frequent communication are usually stronger and more secure. Thus, this result could mean that alters with whom egos communicate with more regularly represent their strongest relationships, creating an element of security for ego. Positive body image is largely correlated to a person feeling secure, both about themselves and in their relationships (Cash and Smolak, 2011). And, studies show that image becomes less important in stronger, more developed relationships (Tiggemann, 2004). An ego might feel more comfortable being her authentic self with the people she communicates with more often, resulting in a more positive body image.

Alter's gender also impacted ego's body image, with male alters being more likely to make ego feel good about her looks. Several studies show that healthy relationships with male figures can result in better body image for women (Goldsmith and Byers, 2016; Steinhilber *et al.*, 2020). For example, young women indicate positive partner messages led to increase in confidence and improvements in body image acceptance (Goldsmith and Byers, 2016). On the contrary, sometimes connections with other females can be the most hostile/toxic relationships for women, resulting in poor body image. Studies show that when a woman is a part of a social environment that is predominately female, she becomes more self-critical and competitive with her counterparts (Rolnik *et al.*, 2010). Further, as noted earlier, women who have poor body image may be less inclined to engage with male alters, given BD can drive the connections women make (Paquette and Raine, 2004; Tompkins *et al.*, 2009).

Strengths and limitations

This study uniquely adds to literature using the Tripartite Influence Model and Network Theory to understand social drivers behind guilt and body image. By taking an ENA approach, combined with a multilevel modeling statistical design, we were able to unpack factors related to social connections that contribute to feelings of guilt and body image. Our study is the first, to our knowledge, to explicitly test ego-, alter- and network-level factors related to connections with people who might exacerbate risk of CE. This information provides a new lens into ways social dynamics impact body image and feelings about exercise, along with new opportunities for intervention, particularly for sorority women.

Despite its strengths, this study is not without limitations. The most important and glaring limitations are in regard to study design: our study was cross-sectional and conveniently sampled from a single university. Thus, generalizability of findings is largely limited. Future research using random sampling from a more representative sampling frame could confirm whether patterns in our findings hold.

Implications for future research and practice

This study supports the continued use of SNA to identify and understand important social influences on health. Similar to this study and others that explored health concepts such as

drinking, physical activity and intimate partner violence (Patterson *et al.*, 2019, 2022; Russell *et al.*, 2020), future research should capitalize on the utility of SNA to explore the impact of social connections on college student health and well-being. Moreover, using a longitudinal design would provide even greater insight into how critical network connections develop and evolve over the course a student's time in college, which would reveal social network properties that are important to longer-term health and quality of life.

From a practical vantage point, this study does suggest the importance of body satisfaction on how sorority women experience their social relationships. Health promotion efforts focused on healthy body image and positive food and exercise behaviors could improve the way sorority women experience their social relationships, on top of improving individual physical and mental health. Findings also highlight the importance of considering the exercise behaviors of network members, individually and collectively, on an ego's feelings of guilt and BD. Mental health practitioners working specifically with college women combatting CE and related feelings should consider how a person's direct social connections and their behaviors drive the way students think and feel about themselves. In the same vein, this study supports the development of close social connections, both in terms of communication frequency and type of relationship (e.g. family and romantic partnership) as a way to combat guilt and BD. Various professionals working with college students – from mental health counselors to professors to health and wellness practitioners – could help students combat CE by fostering strong connections between and among social network members.

Conclusion

In this sample, we determined factors associated with social relationships that increase an ego's feelings toward exercise guilt and negative body image. We found ego's BD score was important in explaining if an alter made her feel guilty about her exercise habits, as well as if an alter made her feel good about her looks. Further, we found the exercise behaviors present within egocentric networks can have varying impacts on the ego, particularly given the properties of the network as a whole. This collection of results represent the importance of someone's immediate social environment on exercise-related behaviors and feelings. Finally, male alters and alters who communicated with ego more routinely tended to be alters who made the ego feel good about her looks. This finding suggests promoting healthy, communicative relationships, especially between women, could protect sorority members from BD.

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