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Can Dissatisfaction Relative to Perceived Importance Affect Extension Clients' Landscape Management Practices?

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Abstract

Water quality and availability are critical issues currently addressed by agricultural education professionals. Extension professionals need to employ innovative approaches to help residents adopt practices and technologies to reduce the impact of urban landscapes on water resources. This study explored how individuals' dissatisfaction relative to their perceived importance of either clean water for large and local water bodies or plentiful water for local water bodies related to their intent to engage in landscape best management practices following a tailored message. Individuals were randomly assigned to receive a message appealing to improving water quality through good fertilization practices or a message appealing to improving water availability through good irrigation practices. Those who assigned higher importance but perceived lower satisfaction with clean water had greater likelihood of engaging in most fertilizer best practices after receiving a tailored message compared to those who assigned lower importance and perceived higher satisfaction with clean water. Those who assigned higher importance but perceived lower satisfaction with plentiful water were more likely to engage in one of the five irrigation best practices compared to those who assigned lower importance and perceived higher satisfaction with plentiful water after receiving the message. Agricultural education programs should tailor messages to dimensions clientele perceive as important but with which they are unsatisfied, especially when intent is lower.

Keywords: dissatisfaction, home irrigation users, importance-performance analysis, targeted programs, water conservation, water quality protection

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Introduction

In 2007, the number of people living in urban areas worldwide exceeded the number living in rural areas (United Nations, 2014). The urban growth rate is increasing, and the rising number of urban residents will continue to increase the demand on limited water resources (McDonald et al., 2014). Increases in urbanization and a growing population have led to more areas with turfgrass and greater numbers of urban landscapes that receive supplemental fertilizers and irrigation (Bremer, Keeley, Jager, Fry, & Lavis, 2012; Shober, Denny, & Broschat, 2010). Urban irrigated

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areas are estimated to cover between 4.5 and 9.5 million hectares in the United States, which would "rank turfgrass as the single largest irrigated crop in the country" (Milesi, Elvidge, & Nemani, 2009, p. 231). Notably, 50 to 80% of the United States' turfgrass areas are in home landscapes, and the "greatest opportunity for conserving water and minimizing runoff and leaching in urban areas may be in residential lawns" (Bremer et al., 2012, p. 651).

Clean and plentiful water supports a variety of purposes including food production, human health and hygiene, economic development, environmental health, infrastructure, and daily life (McDonald et al., 2014; St. Hilaire, 2009). Water quality risks in rivers and lakes, droughts, and water scarcity are all projected to intensify in some parts of the United States (Georgakakos et al., 2014; Sauri, 2013). Home landscape irrigation represents a large, and sometimes the largest, share of a household's water use (DeOreo, Mayer, Dziegieleski, & Kiefer, 2016). In addition to directly impacting water availability (Fulcher, LeBude, Owen, White, & Beeson, 2016), home landscaping practices can affect water quality. Improper irrigation or fertilizer practices can introduce excess nutrients to water bodies which results in reduced water quality (Carey et al., 2012).

There is a need for agricultural education professionals, such as those working in Extension, to focus on water issues (Roberts, Harder, & Brashears, 2016) and encourage behavior changes that help urban residents reduce their landscape's impact on water resources (Kotler & Lee, 2005). It is challenging to elicit landscape management changes among residents, yet these practices directly affect water quality and quantity. Extension professionals can explore and employ strategic approaches to help residents adopt these practices and technologies.

Conceptual Framework

Extension professionals can increase their efficacy by tailoring water conservation programs based on the needs of their specific audiences (Mahler et al., 2013; McKenzie-Mohr, 2011). To engage Extension stakeholders in information exchange around important science related topics, Extension educators need to present only that information which is relevant and important to the audience (Robinson, 2013). Educational approaches tailored to individuals can be more successful in encouraging water protection behaviors than a mass appeal (Landers, Mitchell, Smith, Lehman, & Conner, 2006).

To target programs addressing a specific issue, some agricultural educators have incorporated the audience's perceived importance of issues specifically in the context of water. Lamm, Lundy, Warner, and Lamm (2016) found perceived importance of plentiful water can guide water conservation behaviors among high water users. The authors suggested there was an opportunity to focus on individuals who assigned high importance to plentiful water but who were unengaged in conservation practices (Lamm et al., 2016). In another study, Adams et al. (2013) found people who perceived water quality, water conservation in residential landscapes, and water for other purposes as being important were more likely to engage in water conservation behaviors outside their homes. Other researchers found individuals responded more positively to assertive requests if the topic of the message was important to them (Kronrod, Grinstein, & Wathieu, 2012). These studies exhibit empirical support for the opportunity to incorporate the audience's perceived importance of an issue into targeted programs and message design.

Other agricultural educators have proposed considering satisfaction along with perceived importance to target educational programs (Warner, Kumar Chaudhary, & Lamm, 2016; Warner, Kumar Chaudhary, Lamm, Rumble, & Momol, 2017). Warner, Kumar Chaudhary, et al. (2016) proposed considering perceived satisfaction along with perceived importance to effectively guide Extension educators' communication strategies. For example, the authors recommended Extension educators spend more time and resources on those water related issues where Extension clients felt that a specific issue (e.g., clean water for recreation) was important but where they were less satisfied with it (Warner, Kumar Chaudhary, et al., 2016). In another study, Warner et al. (2017) considered perceived satisfaction along with perceived importance of water for different purposes and found vital differences with perceived water issues among three target areas (Florida, California, Chesapeake Bay).

Perceived importance and satisfaction with a topic affects how programming resonates with an audience. Therefore, a concept which can help target programs is the gap between perceived satisfaction and perceived importance (Levenburg & Magal, 2004; Warner et al., 2017). For the purpose of this study, we operationalized a satisfaction-importance gap as the difference between perceived importance of a specific water issue/dimension and perceived satisfaction of the same water issue/dimension. A negative satisfaction-importance gap indicates low satisfaction with something that is more important while a positive satisfaction-importance gap indicates high satisfaction with something that is less important (Warner et al., 2017). Warner et al. (2017) compared satisfaction-importance gaps associated with water for different purposes among Florida, California, and Chesapeake Bay area residents. Based on these gaps the authors provided implications for agricultural educators focusing on specific water issues to encourage water protection behaviors among residents. This approach can be effective because people may be motivated to act when they are not satisfied with something they think is important (Festinger, 1957). In the context of home landscapes, residents may "change their yards to reflect environmental concerns, or they may change their beliefs about the ecological impacts of yards to match their choices" (Larson, Casagrande, Harlan, & Yabiku, 2009, p. 924).

The concept of satisfaction-importance gaps can be useful in changing behaviors. We undertook this study to determine if messages could play a role in engaging individuals in landscape best management practices when targeted to negative satisfaction-importance gaps. Applied to water issues, when a specific dimension of water is important to someone but they are unsatisfied with its current status (e.g., a negative satisfaction-importance gap), they may either perceive it to be of lesser importance or take action to improve its performance. For example, when residents feel that plentiful water for recreation is highly important, but are not satisfied with the availability of plentiful water for recreation, there is a negative satisfaction-importance gap which may be used to motivate water conservation behavior.

Purpose

The purpose of the study was to examine how satisfaction-importance gaps might relate to tailored appeals so impactful Extension programs could be developed. Because people should be more motivated to act when they can help resolve a problem that is important to them, we sought to determine whether people with greater negative satisfaction-importance gaps surrounding a dimension of water resources responded differently to messages tailored to that dimension. By exploring possible relationships between satisfaction-importance gaps and behaviors specific to home landscape practices, we examined how reducing inconsistencies surrounding different dimensions of water could be part of best landscape management extension programs.

The specific objectives were to a) compare responses to a clean water message on fertilizer intent between two groups with low or high satisfaction-importance gaps; and b) compare responses to a plentiful water message on irrigation intent between two groups with low or high satisfaction-importance gaps. We tested the following null hypotheses:

HO_1: Among those who receive a tailored water quality message (landscape fertilization message), there is no difference in intent to adopt good fertilization practices between the High Importance/Low Satisfaction with Clean Water group and the Low Importance/High Satisfaction with Clean Water group.

HO_2: Among those who receive a tailored water quantity message (landscape irrigation message), there is no difference in intent to adopt good irrigation practices between the High Importance/Low Satisfaction with Plentiful Water group and the Low Importance/High Satisfaction with Plentiful Water group.

Method

Data for this national study were collected in May 2016 to identify water conservation and quality protection behaviors and perceptions among residents nationwide. The target audiences for this study were national residents who control their landscape irrigation because this audience has the potential to positively affect water resources by changing their landscape management behaviors (Warner, Rumble, Martin, Lamm, & Cantrell, 2015; Warner, Lamm, Rumble, Martin, & Cantrell, 2016). Prior to data collection the study was approved by the University of Florida Institutional Review Board.

Sampling and Data Collection

There was no existing sampling frame of national residents who control their landscape irrigation (Warner, Lamm, et al., 2016), and we secured the sample for this study using non-probability opt-in panel sampling techniques from a web-based survey sampling company. We recruited participants who met screening criteria that defined the target population. The specific screening criteria used in this study were: no less than 18 years of age, had a lawn or landscape with an irrigation system, and had control over their landscape irrigation. Non-probability opt-in panels are often used in the absence of a sampling frame to make inferences about the target audience (Baker et al., 2013). Various studies have shown non-probability opt-in panels can produce comparable or even better results compared to probability based panels (Abate, 1998; Twyman, 2008; Vavreck & Rivers, 2008).

After the screening questions, there were 1,692 participants eligible to complete the survey. We also incorporated a few quality control questions in the survey to ensure responses were only collected from respondents who were answering thoughtfully (Lavrakas, 2008). From the eligible respondents, there were 1,080 complete responses, which corresponded to a 63.8% participation rate (Baker et al., 2016).

Just over half of the respondents (54.8%, n = 592) were female and the mean age was 40 years. Most respondents (85.7%, n = 926) were white and just over half (51.5%, n = 556) had a four-year college degree or higher education. The most common total family income category for the respondents was $50,000 to $74,999 (22.4%, n = 242) followed by $75,000 to $99,999 (20.3%, n = 219). The majority of respondents (85.3%; n = 921) indicated they were homeowners.

Instrumentation

We collected data using a researcher-developed web survey. The dependent variables of interest were intent to engage in four proper fertilization practices and intent to engage in five proper irrigation practices. For both variables, we asked participants to indicate their likelihood of adopting several best management practices in the future.

We measured intent to engage in proper fertilization practices using four statements measured on a five-point Likert scale (1 = *very unlikely*, 2 = *unlikely*, 3 = *undecided*, 4 = *likely*, 5 = *very likely*). We excluded respondents who selected *not applicable* from this analysis. The specific proper fertilization practices were: *apply fertilizers carefully to prevent their leaching*, *reduce the application of fertilizers to lawn*, *engage in good lawn fertilization practices*, and *prevent spilling of fertilizers on paved surfaces*.

We measured intent to engage in individual proper irrigation practices using five statements measured on a five-point Likert scale (1 = *very unlikely*, 2 = *unlikely*, 3 = *undecided*, 4 = *likely*, 5 = *very likely*). Again, we excluded any respondents who selected *not applicable* from further analysis. The specific proper irrigation practices were: *prevent irrigation when it is raining*, *conserve water by reducing irrigation*, *follow good irrigation practices*, *irrigate only when needed*, and *irrigate properly to reduce water use*.

We used importance-performance analysis (IPA; Martilla & James, 1977) to measure the satisfaction-importance gap for clean water for local and large water bodies and plentiful water for local water bodies. We selected these two dimensions from several water dimensions, which a previous study revealed had the greatest difference between satisfaction and importance nationwide (Warner et al., 2017). The respondents were asked to indicate the level of importance they associate with three clean water statements and three plentiful water statements and in separate questions they were asked to indicate their satisfaction with same three clean water and three plentiful water statements (see Table 1).

Table 1

Clean and Plentiful Water Indices in a Study to Assess the Effect of Different Messages on Fertilization and Irrigation Intent among Residents Who Control their Landscape Irrigation in the United States

Index Name	Individual Statements in Index
Importance of clean water for local and large water bodies[a]	Clean lakes, springs, rivers
Satisfaction with clean water for local and large water bodies[b]	Clean oceans
	Clean bays and estuaries
Importance of plentiful water in local water bodies[a]	Plentiful water in aquifers and springs
Satisfaction with plentiful water in local water bodies[b]	Plentiful water in rivers
	Plentiful water in lakes

Note: [a]Importance question stem: Please identify the level of importance you associate with each of the following water-related items. [b]Satisfaction question stem: Please indicate how satisfied you are with the availability of clean/plentiful water for each of the following items. Each respondent was presented with individual importance and satisfaction items.

We measured the importance of clean water using a five-point Likert scale (1 = *not at all important*; 2 = *slightly important*, 3 = *fairly important*; 4 = *highly important*; 5 = *extremely important*), and we also measured satisfaction with availability of clean and plentiful water on a five-point Likert scale (1 = *not at all satisfied*; 2 = *slightly satisfied*; 3 = *fairly satisfied*; 4 = *highly satisfied*; 5 = *extremely satisfied*). We created a clean water importance index, clean water satisfaction index, plentiful water importance index, and plentiful water satisfaction index by averaging three clean water importance statements, three clean water satisfaction statements, three plentiful water importance statements, and three plentiful water satisfaction statements, respectively.

We calculated the clean water satisfaction-importance gap by subtracting the clean water importance index score from the clean water satisfaction index score, and the plentiful water satisfaction-importance gap by subtracting the plentiful water importance index score from the plentiful water satisfaction index score. We standardized these satisfaction-importance gaps, and then divided them each into two groups for clean water and two groups for plentiful water (see Table 2). Larger negative values were associated with high importance and low satisfaction while smaller negative values or positive values were associated with low importance and high satisfaction. Thus, people in the low importance/high satisfaction groups were satisfied enough to match the perceived level of importance they associated with a particular water issue. Conversely, people in the high importance/low satisfaction groups perceived high importance associated with a particular water dimension, but their satisfaction with that dimension was low.

Table 2

Groups Defined by Importance and Satisfaction with Clean and Plentiful Water Indices in a Study to Assess the Effect of Different Messages on Fertilization and Irrigation Intent among Residents Who Control their Landscape Irrigation in the United States

Water Dimension	Group	Description
Clean water for local and large water bodies	High importance/low satisfaction	Consider clean water for local and large water bodies overall very important, but dissatisfied with the availability of clean water for local and large water bodies
	Low importance/high satisfaction	Consider clean water for local and large water bodies less important, and are satisfied with the availability of clean water for local and large water bodies
Plentiful water in local water bodies	High importance/low satisfaction	Consider plentiful water in local water bodies overall very important, but dissatisfied with the availability of plentiful water for local water bodies
	Low importance/high satisfaction	Consider plentiful water in local water bodies less important, and are satisfied with the availability of plentiful water in local water bodies

We used a print-based message treatment, and one-half of respondents randomly received a message appealing to clean water (*By responsibly using fertilizer in your home landscape, you will ensure there is clean water in our oceans*) and other one-half of respondents randomly received plentiful water message (*By conserving water through good irrigation practices, you will ensure there is plenty of water in our rivers*).

The face and content validity of the instrument was established using a panel of experts specialized in water conservation outreach programming, survey methodology, and agricultural and biological engineering. Next, we pilot tested our instrument and based on the results of the pilot test we revised our final instrument. The reliability of the instrument was established by calculating Cronbach's alpha and post-hoc Cronbach's alpha values were found satisfactory (0.84 and higher) for all the study variables including intent to engage in proper fertilization practices, intent to engage in proper irrigation practices, clean water importance index, clean water satisfaction index, plentiful water importance index, and plentiful water satisfaction index (Santos, 1999).

Data Analysis

To test the null hypotheses, we used Chi-square analyses to determine if there was a relationship between: (a) fertilization intent and the high importance/low satisfaction with clean water group and the low importance/high satisfaction with clean water group who received a tailored clean water message, and (b) irrigation intent and the high importance/low satisfaction with plentiful water group and the low importance/high satisfaction with plentiful water group who received a tailored plentiful water message. Prior to conducting the Chi-square analysis, we normalized each index using z-scores for ease of categorization into groups. We used the normalized index to separate respondents into two groups (high importance/low satisfaction and low importance/high satisfaction) for each dimension.

Results

We found a significant difference in fertilizer intent between the high importance/low satisfaction and low importance/high satisfaction with clean water for local and large water bodies groups on three of the four individual fertilizer intent statements after receiving the message (see Table 3). Following the message treatment, 66.4% of those in the high importance/low satisfaction with clean water for local and large water bodies group were very likely to engage in good lawn fertilizer practices, while only 46.8% of those in the low importance/high satisfaction with clean water for local and large water bodies group were very likely to do so. Additionally, 56.5% of those in the high importance/low satisfaction with clean water for local and large water bodies group were very likely to engage in reducing fertilizer application to lawns, while only 36.1% of those in the low importance/high satisfaction with clean water for local and large water bodies group were very likely to do so. Because there was a statistically significant relationship for the majority of the practices, we rejected null hypothesis HO_1.

After the message treatment, we found a statistically significant difference in irrigation intent between the high importance/low satisfaction and low importance/high satisfaction with plentiful water in local water bodies groups for only one of the five practices, irrigating only when needed (see Table 4). Among those in the high importance/low satisfaction with plentiful water in local and large water bodies group, 71.5% were very likely to conserve water by irrigating only when needed while 66.8% of those in the low importance/high satisfaction group indicated they were very likely to do so. Because there was only a significant relationship on one of the items, we did not reject the null hypothesis HO_2.

Table 3

Chi-square analysis comparing residents' intent to engage in good fertilization practices as a function of the gap between satisfaction and importance of clean water for large and local water bodies (n =540)

Fertilizer Intent Statement	Clean water group*	Very unlikely % (*n*)	Unlikely % (*n*)	Undecided % (*n*)	Likely % (*n*)	Very likely % (*n*)	χ^2	*p*	Cramer's *V*
Reduce application of fertilizers to lawn	LI/ HS	3.0 (8)	5.6 (15)	21.1 (56)	34.2 (91)	36.1 (96)	23.64	<.001	.214
	HI/ LS	1.6 (4)	2.0 (5)	13.7 (34)	26.2 (65)	56.5 (140)			
Engage in good lawn fertilizer practices	LI/ HS	1.1 (3)	0.4 (1)	11.4 (30)	40.3 (106)	46.8 (123)	20.49	<.001	.200
	HI/ LS	1.2 (3)	0.4 (1)	6.9 (17)	25.1 (62)	66.4 (164)			
Apply fertilizers carefully to prevent their leaching	LI/ HS	1.5 (4)	1.5 (4)	11.6 (31)	37.7 (101)	47.8 (128)	11.55	.021	.150
	HI/ LS	1.6 (4)	0.8 (2)	7.7 (19)	27.5 (68)	62.3 (154)			
Prevent spilling of fertilizers on paved surfaces	LI/ HS	1.5 (4)	1.1 (3)	9.5 (25)	31.6 (83)	56.3 (148)	8.35	.080	
	HI/ LS	1.3 (3)	0.4 (1)	5.0 (12)	25.8 (62)	67.5 (162)			

Note. *LI/HS – Low importance/high satisfaction with clean water group (*n* = 278); HI/LS – High importance/low satisfaction with clean water group (*n* = 262)

Table 4

Chi-square analysis comparing residents' intent to engage in good irrigation practices as a function of the gap between satisfaction and importance of plentiful water for local water bodies (n = 540)

Irrigation intent statement	Plentiful water group*	Very unlikely % (*n*)	Unlikely % (*n*)	Undecided % (*n*)	Likely % (*n*)	Very likely % (*n*)	χ^2	*p*	Cramer's *V*
Irrigate only when needed	LI/HS	0.9 (2)	0.0 (0)	5.6 (12)	26.6 (57)	66.8 (143)			
	HI/LS	0.6 (2)	0.3 (1)	1.0 (3)	26.5 (82)	71.5 (221)	10.70	.030	.143
Follow good irrigation practices	LI/HS	0.5 (1)	0.9 (2)	4.1 (9)	32.9 (73)	61.7 (137)			
	HI/LS	0.6 (2)	0.0 (0)	1.9 (6)	26.8 (83)	70.6 (219)	8.12	.087	
Conserve water by reducing irrigation	LI/HS	0.9 (2)	2.2 (5)	5.4 (12)	43.0 (96)	48.4 (108)			
	HI/LS	0.6 (2)	1.3 (4)	6.4 (20)	32.5 (102)	59.2 (186)	7.79	.100	
Irrigate properly to reduce water use	LI/HS	0.9 (2)	1.4 (3)	3.2 (7)	29.6 (64)	64.8 (140)			
	HI/LS	0.7 (2)	0.0 (0)	2.0 (6)	28.1 (86)	69.3 (212)	5.68	.224	
Prevent irrigation when it is raining	LI/HS	1.8 (4)	1.8 (4)	4.4 (10)	24.0 (54)	68.0 (153)			
	HI/LS	1.0 (3)	1.3 (4)	3.5 (11)	25.3 (79)	68.9 (215)	1.27	.866	

Note. * LI/HS – Low importance/high satisfaction with plentiful water group (*n* = 225); HI/LS – High importance/low satisfaction with plentiful water group (*n* = 315)

Discussion and Conclusions

Those who place higher importance and lower satisfaction on clean water are more likely to intend to adopt fertilizer best management practices after receiving a message tailored toward clean water, compared to those who assign lower importance and perceive higher satisfaction to clean water. This implies tailored clean water messages could play a role in encouraging good fertilizer practices among agricultural education clientele who are unsatisfied with the availability of clean water but consider it highly important.

Those who place higher importance and lower satisfaction on plentiful water are not more likely to intend to adopt irrigation best management practices after receiving a message tailored toward plentiful water, compared to those who assign lower importance and perceive higher satisfaction to plentiful water. This implies among agricultural education clientele who are unsatisfied with the availability of plentiful water but consider it highly important, tailored water conservation messages may not play as large a role in encouraging them to adopt good irrigation practices. Intent to engage in good irrigation practices was overall much higher than intent to engage in good fertilization practices, and there were more differences between the high importance/low satisfaction and low importance/high satisfaction groups for fertilizer. It is possible appealing to satisfaction-importance gaps is more effective when overall motivation is low. This aligns with the recommendations from Lamm et al. (2016), who proposed agricultural education professionals should target individuals who assign high importance to plentiful water but who were unengaged in conservation practices.

Providing a mass message to remedy a complex problem is not effective as it may create message fatigue or simply not be noticeable to recipients. Tailoring or reframing the message based on target audience needs, such as the identified satisfaction-importance gaps used in this study, is a way to overcome potential message fatigue and enhance use of information presented in the message (Landers et al., 2006; Robinson, 2013). When people receive a message tailored to water dimensions they find important but with which they are unsatisfied, they are more likely to adopt a best practice that could remedy the gap.

Our findings align with those of Robinson (2013) and Kronrod et al. (2012) that designing scientific information messages based on their relevancy and importance to target audiences can promote higher engagement in using the information to make necessary changes. There is a need to engage clientele by appealing to dimensions of water with which there is a satisfaction-importance gap (Levenburg & Magal, 2004; Warner et al., 2017). This study provided evidence that good landscape management behaviors can be promoted by using print media to promote a reduction in the satisfaction-importance gap among target audiences. Agricultural education clientele may have more motivation to act when there is a potential to reduce this gap (Festinger, 1957; Larson et al., 2009).

The use of satisfaction-importance gaps in this study (considering joint importance of and satisfaction with an issue) can help to focus agricultural educational programs and guide Extension programming and communications (Warner et al., 2017; Warner, Kumar Chaudhary, et al., 2016). Agriculture education professionals should explore possible satisfaction-importance gaps surrounding specific dimensions among clientele and conduct targeted communications with their audiences to promote behaviors that reduce impact on water resources. We also recommend that agricultural education professionals consider conducting satisfaction-importance gap analysis as an additional step or as a part of their needs assessment prior to designing educational programs to promote positive behavior changes, such as adopting conservative landscape water-use behaviors.

This study employed print-based messages, and because videos may be more effective, future research should examine the effect of short video messages, along with a combination of tailored print and video messages, on irrigation and fertilization intent (Perrin, 2011). Future research should also be conducted in an authentic agricultural education environment with repeated exposures. Our study examined the relationship between satisfaction-importance gaps and response to a targeted message, and a future replication of this study should also consider perceived responsibility as a variable. Future researchers can also consider exploring whether the relative strength of a target audience's satisfaction and importance relates to their landscape water protection behaviors.

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