Prosociality declines after a collective ritual: Patron saint festivals in Oaxaca, Mexico

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Abstract

The cross-cultural ubiquity of costly collective rituals presents a puzzle. Researchers have proposed that collective rituals enhance group solidarity, facilitating these rituals' spread through intergroup competition. Accordingly, studies indicate that collective rituals can foster cohesion and cooperation in lab and real-world settings. We test this hypothesis in a novel, naturalistic setting: patron saint festivals (*fiestas*) in indigenous communities of Oaxaca, Mexico. In this preregistered natural experiment, we use mixed methods to study changes in cohesion, prosocial attitudes, and cooperation after a *fiesta* in one Zapotec village. Our within-subjects design included 36 participants. Contrary to prior research, we find declines in altruism and cooperation, and no change in cohesion. Nonetheless, the *fiesta* is a huge cooperative endeavor. While the sample is constrained by the community's size and this naturalistic event does not offer a fully controlled field experiment, these results offer important nuance to our understanding of collective ritual.

Keywords: ritual; cooperation; cohesion; cultural evolution; field experiment

1. Introduction

Collective rituals, such as those involving communal singing, dancing, pain, or terror, are ubiquitous across human societies (Norton, 2024; Xygalatas, 2023). In the Kalahari, !Kung hunter-gatherers traditionally danced, clapped, and sang all night during elaborate healing ceremonies (Marshall, 2009[1973]). Starting in boyhood, men in Papua New Guinea underwent a series of group initiation rituals that involved genital mutilation, adhering to strict food taboos, and head-hunting victims from rival groups (Tuzin, 1976, 2001)– an example of *rites of terror* that recur across many small-scale societies (Whitehouse, 1996). In contemporary, large-scale societies, collective ritual is common in the form of group worship, hazing rituals, and patriotic parades. Given that these rituals are often costly for participants (Henrich, 2009; Sosis & Alcorta, 2003), this ubiquity poses a puzzle. How did these costly cultural practices become so widespread?

Building on ethnographers' longstanding observations that collective rituals seem to bind groups more closely together (Durkheim, 2001[1912]), one leading hypothesis proposes that collective rituals promote group cohesion and cooperation (Hobson et al., 2018; Irons, 2001; Norenzayan et al., 2016; Sosis & Alcorta, 2003; Watson-Jones & Legare, 2016; Xygalatas, 2023). According to cultural evolutionary theory, cultural practices that enhance cooperation spread through intergroup competition, including intergroup conflict (war, raiding), selective copying (less successful groups copy more successful groups), and selective migration (people in less successful groups migrate to more successful groups) (Richerson et al., 2016). Thus, psychologically potent collective rituals may have spread as groups with rituals that fostered greater cohesion and cooperation outcompeted less cooperative, cohesive groups (Norenzayan et

al., 2016). However, some scholars have argued that collective ritual does not serve any adaptive function (Liénard & Boyer, 2006).

Supporting the cultural evolutionary hypothesis, lab-based experiments have found that key elements of collective ritual promote group cohesion and cooperation. Many collective rituals feature behavioral synchrony (matched rhythmic movement, such as dancing or drumming) and shared physiological arousal. In experiments with adults, behavioral synchrony and shared physiological arousal increase trust, feelings of "being on the same team", affiliation, cohesion, and cooperation (Jackson et al., 2018; Mogan et al., 2017; Wiltermuth & Heath, 2009). Similar effects have been observed in children. For example, preschoolers were more likely to spontaneously help and cooperate with a partner after participating in a ritualized group activity that involved singing and walking in step (Kirschner Sebastian & Tomasello, 2010). Meanwhile, repeated participation in a ritualized group activity increases children's self-reported ingroup affiliation, affiliative ingroup displays, and outgroup monitoring (Wen et al., 2016, 2020). The early emergence of these tendencies suggests that humans may come into the world psychologically prepared to engage in ritual (Wen et al., 2016).

Taking this research "into the wild", empirical studies of real-life collective rituals have found associations between collective ritual, cohesion, and cooperation. For example, in Spain, people reported increased feelings of belonging and identity fusion– a visceral feeling of "oneness" with the group– after participating in folkloric drumming marches (Páez et al., 2015). Similarly, self-reported measures of cohesion increased during a Hindu religious festival (Singh et al., 2020), and participation in such festivals is associated with more cohesive networks of social support (Power, 2018). Providing evidence that collective rituals may enhance prosocial behavior, Israeli kibbutz members who participated in more collective prayer rituals were more

cooperative in a behavioral economics game (Ruffle & Sosis, 2007). In Mauritius, observing an extreme ritual was associated with donation of a larger proportion of a cash endowment to the local temple (Xygalatas et al., 2013).

We build on this literature by testing the hypothesis that collective ritual fosters cohesion and cooperation in a novel, naturalistic setting. Every year, indigenous communities in Oaxaca, Mexico host elaborate, multi-day festivals (*fiestas*) in honor of town patron saints. *Fiestas* involve various collective ritual activities, including dancing, music-making, and processions (Figure 1). These celebrations are costly for participants in terms of money, time, and energy (de la Fuente, 1949; Stephen, 2005). There are undoubtedly a variety of proximate reasons why people participate in *fiestas*, including religious devotion, local customs, and social norms. At a more ultimate level, however, *fiestas* may serve an adaptive function by binding communities closer together and promoting cooperation. This could be particularly important in Oaxaca,

Figure 1. Dancing during the *fiesta*. (A) Women dressed in traditional garments (*huipiles*) danced traditional dances (*jarabes*) with baskets of flowers and sparklers during the opening celebration of the *fiesta.* Soon, other community members joined the dancing. Over the course of about 6 hours, the community and bands processed around town, stopping frequently to dance. (B) Costumed dancers performed a traditional regional dance for about 1.5 hours. Source: [redacted for peer review], 2022.

where communities are relatively self-sufficient and violent intergroup conflict is common (Cook, 2014; Dennis, 1987; López-Bárcenas, 2004; Yannakakis, 2008). Oaxacan *fiestas* thus serve as a compelling natural experiment for studying how collective ritual shapes ingroup-oriented prosociality.

To test the hypothesis that *fiestas* enhance group cohesion and cooperation, we compared the prosocial attitudes and behavior of community members before and after the largest annual *fiesta* in one Zapotec village. Building on prior literature, we pre-registered (https://tinyurl.com/FiestaOSFAn) the hypotheses that after the *fiesta*, participants would (1) feel a greater sense of cohesion with the community, (2) report more prosocial attitudes towards community members, and (3) behave more cooperatively with community members.

This study extends current scholarship in several ways. First, we expand sampling to a novel real-world setting, contributing to ongoing efforts to assess the generalizability of established findings and to sample from populations underrepresented in the psychology literature. Second, we leverage mixed methods– including psychological surveys, interviews, and a behavioral economics game– in a preregistered within-subjects design. Previous studies of real-world collective rituals have combined only some of these elements, such as within-subjects surveys (e.g. Páez et al., 2015; Singh et al., 2020) or between-subjects surveys and/or behavioral games (e.g. Ruffle & Sosis, 2007; Xygalatas et al., 2013). Finally, detailed ethnography adds important context for interpreting the results– [Author names redacted for blind review] spent 4 months living in the community.

2. Methods

Data for this study were collected in as part of a larger research project in a Zapotec village in the Sierra Norte region of Oaxaca, Mexico. We collected data in two waves: baseline

(May-June 2022) and *fiesta* (October 2022). During each wave, participants were invited to complete a survey and a Public Goods Game (PGG). Here, we briefly introduce the study setting and methods.

2.1 Study setting

Like many indigenous Oaxacan communities, the village (population 430) is semi-autonomous from the Mexican government, self-governed under a traditional system locally known as *usos y costumbres* ("customs and traditions"). This system involves collective decision-making, communal control of resources, ingroup justice, and community service obligations. As part of this, each male citizen serves a series of unpaid leadership positions called *cargos* (literally, "burdens").

The annual five-day *fiesta* honors the town's patron saint. The celebration involves many instances of collective ritual, including traditional dancing, music-making, processions, and Catholic masses (Figure 1). Although the *fiesta* formally lasts five days, associated preparations and celebrations last for a month and a half (Figure S1). Throughout this time, *cargo*-holders and other villagers host smaller gatherings that involve dancing and processions, for example to celebrate the donation of bulls to be eaten during the *fiesta*.

Although the *fiesta* is a community endeavor, participation varies. First, while the community is predominantly Catholic, 23% of villagers are Pentecostal Evangelicals (INEGI, 2020). The Evangelicals view the adoration of Catholic saints as idol worship and therefore do not celebrate the *fiesta*. Second, some citizens– including *cargo*-holders, their wives, single mothers, and widows– serve obligatory roles in the *fiesta*. They must provide labor during the *fiesta*, such as coordinating events or working in the communal kitchen. These obligations

supersede religious affiliations; Evangelicals must fulfill their duties. Shirking one's duties is punished, typically with a fine.

For a more complete ethnographic description of this community and the *fiesta*, see Supplemental Material S1.

2.2 Participants

After an extensive and comprehensive recruitment process involving door-to-door canvasing, 48 participants completed the baseline survey. However, over the course of data collection, 12 participants dropped out (see Supplement S2.1), leaving 36 participants (18 female, with a mean age of 44.8). While this sample is small, it represents a sizeable portion of the eligible adult population of the village. Forty-eight participants represent 15.5% of the adult Spanish-Zapotec bilingual population (INEGI, 2020). However, we believe that our sample captured a larger proportion of eligible participants, because some older villagers who could converse in Spanish (and thus may have been counted as "bilingual" in the Mexican census) were not sufficiently fluent to participate. All participants gave informed consent. This research received approval from the [university name redacted for blind review] Area Institutional Review Board.

2.3 Survey measures

2.3.1 Repeated measures

At both baseline and post-*fiesta*, participants responded to survey questions designed to measure perceptions of group cohesion, prosocial attitudes towards ingroup members, ingroup trust, and household economic stability. For details regarding these measures, please refer to Table 1.

Table 1. Repeated survey measures

Variable	Category	Description	Source
Willingness to Help (Generalized Altruism)	Ingroup Altruism	"I would help a fellow community-member, even if they could never return the help" (5-point response scale from "strongly disagree" to "strongly agree")	
Likelihood of donating to sick child	Ingroup Altruism	Responding to a vignette, participants reported their likelihood of donating to the family of a sick child for hospital bills (5-point response scale from "very unlikely" to "very likely").	
Likelihood of supporting widow	Ingroup Altruism	Responding to a vignette, participants reported their likelihood of bringing food or other support to a widow after her husband's death (5-point response scale from "very unlikely" to "very likely").	
Identity fusion	Cohesion	Measure of porousness between one's personal and collective identities and visceral feeling of "oneness" with the group. We used the Visual Identity Fusion Scale (Fig. 2).	Adapted from Swann et al. (2009), following Purzycki & Lang (2019)
Shared Fate	Cohesion	Measure of perceived interdependence. Scale includes items like, "When my community feels good, I feel good" and "My community and I rise and fall together" (5-point response scale from "strongly disagree" to "strongly agree"). To create the scale, we averaged across 5 items (Cronbach's $\alpha = 0.79$ [95% CIs 0.67, 0.86]).	Ayers et al. (2023)
Trust	Ingroup Trust	"How much do you trust people in this community?" (5-point response scale from "trust completely" to "distrust completely")	
Material security	Economic stability	"How certain are you that you will be able to buy or produce enough food to eat in the next month?" (5-point response scale from "very uncertain" to "very certain")	Purzycki et al. (2016)

Notes: These measures were collected in both waves of the survey: baseline and post-*fiesta*. For more details about these measures, please refer to the Supplemental Materials (S2.2).

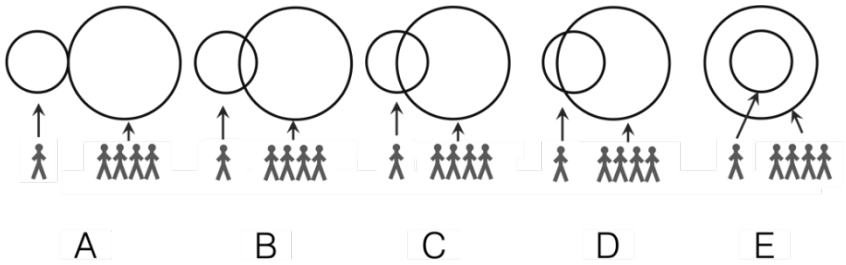

Figure 2. Visual Identity Fusion Scale (adapted from Swann et al., 2009). Participants were asked: "In each of these images, imagine that you are the little circle, and this community is the big circle. Using these pictures, how emotionally close do you feel to this community?"

2.3.2 Fiesta participation measures

The *fiesta*-wave of data collection included survey questions about donations to the *fiesta*, *fiesta*-associated work obligations, and how the participant felt during the *fiesta* (free-response). In addition, for each of the 5 days of the *fiesta* plus one day before and after, we asked participants whether they participated in collective ritual activities: attending mass, participating in a religious procession, participating in a general procession, playing music in the band, dancing traditional dances (*jarabes*), and performing a dance for an audience (*danzas*). We also asked about participation in other *fiesta* activities, such as doing communal labor or watching dance performances. A Collective Ritual Index was created by summing and then standardizing counts of participation in mass, processions, music-making, and dancing. Because people may have participated in a single activity more than once on a given day, these totals likely underestimate participation.

2.4 Public Goods Game

To measure cooperative behavior, participants played an anonymous, one-shot Public Goods Game (PGG) with three other community members. In this game, each player was asked to divide a cash endowment of $100 MXN (ten $10 MXN coins, about $5 USD total) between two envelopes: a "self" envelope and a "common fund" envelope (Figure S2). Players kept any

money that they placed in the "self" envelope, while contributions to the common fund envelope were doubled and then divided evenly between the four players. Payouts from both envelopes were made in a lump sum several weeks after participating. In this classic behavioral economics game, contributions to the common fund are understood as a measure of cooperation. The group can do best if everyone contributes to the common fund; however, an individual can do best if they free ride while the rest of the group cooperates. For more details about the PGG, see Supplemental Materials S2.3.

2.5 Data analysis

We used Linear Mixed Effects Regressions (LMER, R package lme4, version 1.1–23) to analyze the results. In the basic analysis, for participant *i*:

$$Y_i = \beta_0 + \beta_1 Fiesta_i + \sigma_i + \varepsilon_i$$

where:

- Y one of the following outcome variables: identity fusion, Shared Fate Index, trust, willingness to help, likelihood of donating to the family of a sick child, likelihood of bringing support to a new widow, or PGG allocation
- $Fiesta$ is a categorical variable that equals 0 for baseline and 1 for *fiesta* data collection wave
- σ is the random intercept for participant *i*
- ε is the error term

Because changes in economic stability between waves could impact cooperation in the PGG and willingness to help needy ingroup members, material security was included as a control in the altruism and PGG analyses. Two participants were removed from the PGG analysis

because they got fewer than 70% of the test questions correct, suggesting poor understanding of the game.

To increase power in this small sample, we stacked standardized variables that measured similar constructs. This created data sets in which there were multiple observations for each participant at baseline and post-*fiesta*. To capture altruism, we stacked Willingness to Help and the two altruism vignette outcomes (6 observations total per participant). To capture cohesion, we stacked the responses for identity fusion and Shared Fate Index (4 observations total per participant). LMER models analyzing stacked outcomes include crossed random intercepts for participant and outcome measure (R package glmmTMB, version 1.1.3).

2.6 Materials & data availability

Study materials, data, and analysis scripts are publicly available at [link redacted for peer review].

3. Results

3.1 Changes in prosocial psychology from baseline to post-*fiesta*

From baseline to after the *fiesta*, ingroup altruism declined. Figure 3 shows that when the three measures of altruism were stacked (6 observations per participant), there is a sizeable decline in altruism in both the full sample ($\beta = -0.41$, [95%CIs –0.69, –0.12], $p = 0.006$) and the subsample of non-Evangelical participants ($\beta = -0.39$, [95%CIs –0.69, –0.10], $p = 0.008$) (Table S2, Column 2; & Table S3, Column 2). When analyzing each measure separately, there was a 0.74 standard deviation decline in people's willingness to help a community member who couldn't return the help (full sample: $\beta = -0.74$, [95%CIs –1.16, –0.13], $p < 0.001$, Table S2, Column 4; Non-Evangelical subsample: $\beta = -0.74$, [95%CIs –1.21, –0.15], $p = 0.002$, Table S3, Column 4). There was also evidence of declines in reported likelihood of bringing food or other

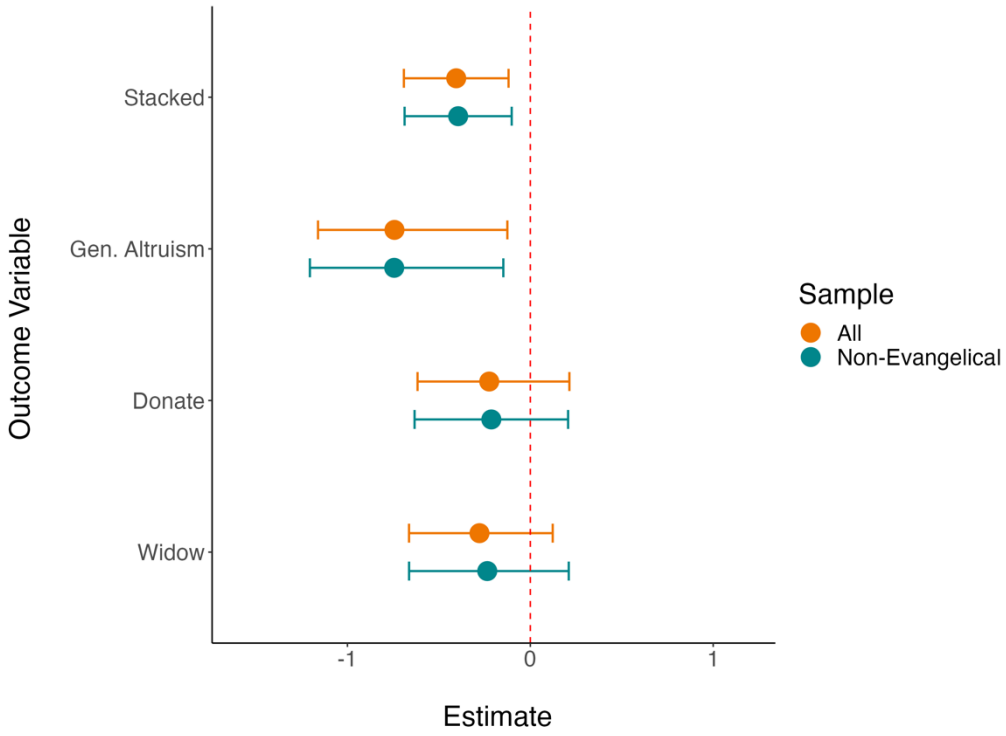

Figure 3. Ingroup altruism declined from baseline to post-*fiesta* in the full sample and non-Evangelical sub-sample. This plot shows LMER estimates with 95% confidence intervals. *Generalized altruism* asked participants to state their level of agreement with the statement, "I would help a fellow community-member, even if they could never return the help." *Donate to a sick child* and *Bring food to widow* represent responses to vignettes wherein participants were asked how likely they would be to help a community member in need. *Stacked* shows the analysis of a stacked dataset, wherein the three measures of altruism are collapsed into a single column (6 observations per participant). All continuous variables have been standardized. All models include a control for material security and random intercepts for participant. The stacked models include crossed random intercepts for participant and altruism measure.

support to a new widow (β = –0.28, [95%CIs –0.66, 0.12], p = 0.16, Table S2, Column 8) and of donating to the family of a sick child (β = –0.22, [95%CIs –0.62, 0.21], p = 0.26, Table S2, Column 7), although the 95% confidence intervals include 0.

There is no evidence of a change in group cohesion from baseline to post-*fiesta*, as measured by identity fusion (β = 0.08, [95%CIs –0.20, 0.35], p = 0.58), Shared Fate Index (β = –0.17, [95%CIs –0.53, 0.18], p = 0.34), or when these two measures are stacked (β = –0.04, [95%CIs –0.33, 0.25], p = 0.78). Moreover, there was flatly no change in trust from baseline to post-*fiesta* (β = –0.01, [95%CIs –0.37, 0.36], p = 0.97).

3.2 Changes in cooperation in the Public Goods Game from baseline to post-*fiesta*

From baseline to post-*fiesta*, contributions to the common fund in the Public Goods Game declined. Controlling for changes in material security, contributions to the common fund were $14 MXN smaller after the *fiesta* (β = –13.89, [95%CIs –27.77, -0.04], $p = 0.047$, Table 2, Column 2). Contributions to the common fund declined from a mean of about $54MXN at baseline to about $41MXN after the *fiesta*. Results are similar in the non-Evangelical subsample (β = –15.71, [95%CIs –31.40, –0.11], $p = 0.047$, Table 1, Column 4). In contrast, material security increased from baseline to post-*fiesta*: after the *fiesta*, participants reported feeling 0.30 standard deviations more certain that they could buy or produce enough food in the coming month (β = 0.30, [95%CIs 0.01, 0.62], $p = 0.046$). In the discussion section, we will discuss how this change likely reflects seasonality.

Table 2. Evidence of a decline in cooperation in the Public Goods Game

	Contributions to the Common Fund ($MXN)			
	Full sample		Non-Evangelical	
	(1)	(2)	(3)	(4)
Fiesta	–12.00+ (–25.04, 1.04)	–13.89* (–27.77, –0.04)	–13.81+ (–28.91, 1.28)	–15.71* (–31.40, –0.11)
Material security		4.98 (-3.79, 13.72)		5.26 (–3.42, 13.90)
Random Eff.				
Sub.Std. Dev.	12.17	11.92	6.97	6.43
N	50(25)	48(25)	42(21)	41(21)

Notes: LMER estimates with 95% confidence intervals. *Contributions to the Common Fund* shows how many pesos of their $100MXN endowment participants contributed to the common fund in the Public Goods Game. *Material security* asked participants how certain they were that they would be able to "buy or produce enough food to eat in the coming month". This variable has been standardized, with higher values indicating greater certainty. The columns labeled "Non-Evangelical" show results from the sub-sample of non-Evangelical participants (Catholics and non-religious). All models include random intercepts for participants. Sample sizes show the number of observations, with the number of participants in parentheses. For an explanation of these sample sizes, see Supplemental Materials S2.3.

*** p < 0.001, ** p <0.01, * p < 0.05, + p < 0.07

3.3 Participation in the *fiesta*

On average, Catholics and non-religiously affiliated participants took part in 15.5 *fiesta* activities, including 8.4 collective ritual activities (dancing, processing, music-making, and attending mass) (Figure 4). 54% of non-Evangelicals who had no *fiesta*-related obligation still did communal work on at least one day of the *fiesta*. Evangelicals who had a *fiesta*-related obligation ($N = 3$) participated in an average of 17 *fiesta* activities, including 7 collective ritual activities, whereas Evangelicals who had no obligation ($N = 5$) did not take part in any *fiesta*-related activities.

In addition to a $500MXN cash contribution required of all households to help fund the *fiesta*, 50% of Catholic and non-religiously affiliated participants made a voluntary donation, while none of the Evangelical participants donated. Voluntary donations– which included cash, food, costumes for the dances, and decorations– ranged in value from $200MXN (~$10USD, a little less than local average daily wage) to $10,000MXN (~$500USD), with an average value of $2,755MXN (~$135USD). When asked why they donated, the top reasons that participants gave were that: they simply wanted to help; it is local custom to support the *fiesta*; and they had made a vow to a saint to donate something.

When asked how they felt during the *fiesta*, participants gave mixed responses (Table 3). About 44% of participants reported feeling positive emotions, including happiness, pride, and excitement. Meanwhile, about 35% of participants reported feeling negative emotions during the *fiesta*, including stress and fatigue associated with *fiesta*-related responsibilities and annoyance at the poor organization of the *fiesta* by the town leaders. The remaining participants reported neutral emotions (e.g. “normal” and “same as always”).

Table 3. Emotions during the *fiesta* were mixed

Valence	% of Sample	Examples
Negative	35%	• "Stressed due to my obligations [as a *cargo*-holder]." • "Stressed, and tired feet." • "Hectic. Worried about the *fiesta* turning out well." • "Angry that [the leaders] didn't organize the *fiesta* well."
Neutral	21%	• "Calm, passing the day" • "Normal, normal daily life" • "Same as always"
Positive	44%	• "Happy to see my countrymen return and to be convivial with my neighbors." • "Excited that the *fiesta* happened again [after COVID]; it's wonderful that people are convivial, and that people come from other communities." • "Happy, proud to be serving all the people, the townspeople, the visitors." • "Happy, because the *fiesta* was really wonderful."

Notes: Table summarizes responses to the free-response question, "How did you feel during the *fiesta*?" Responses were coded for emotional valence (negative, neutral, or positive).

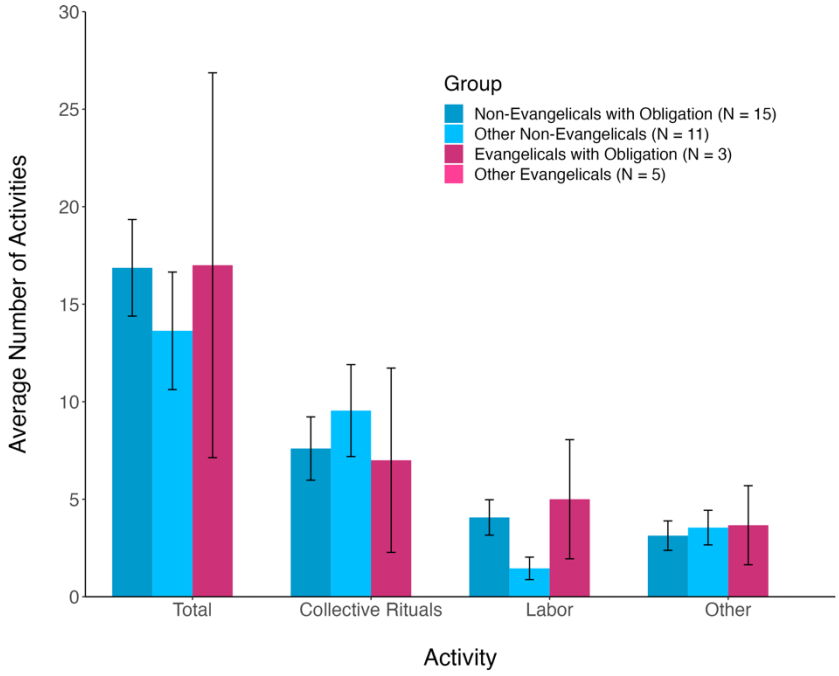

Figure 4. Average number of *fiesta*-related activities participated in during the *fiesta*. Participants are subset by religion and by whether they had an obligation do *fiesta*-related work (for example, *cargo* duties that required them to serve food in the community kitchen; coordinate dance performances; or ensure safety at the rodeo). Non-Evangelicals include Catholics and those with no religious affiliation. To estimate participation, we asked participants whether they had participated in various activities on each day of the *fiesta* plus one day before and one day after (0 = no, 1 = yes). "Collective ritual" activities include dancing *jarabes*, performing a dance, processing, attending mass, and playing music in the band. "Labor" activities include working in the community kitchen and other collective labor associated with the *fiesta*. "Other" activities include amusements such as watching the rodeo, dance performances, basketball tournament, or sparkler show.

3.4 Exploratory analyses of moderating effects of *fiesta* participation and *fiesta* emotions

Given the small sample sizes, any analyses with interactions must be considered exploratory. To test whether actual participation in collective ritual activities had any moderating effects on psychological outcomes, we included a two-way interaction between data collection wave and Collective Ritual Index in the model. There are no clear patterns of interaction on measures of ingroup altruism or cohesion in either the full sample or the non-Evangelical subsample (for full results, see Supplemental Materials S3.1).

To explore whether emotional valence during the *fiesta* had any moderating effect on outcomes, we included a two-way interaction between emotional valence and data collection wave in the models. When the two measures of cohesion are stacked (4 observations per participant), analyses reveal a significant negative interaction between data collection wave and emotional valence on cohesion when comparing non-Evangelical participants who reported positive emotions to those who reported negative emotions (β = –0.81, [95%CIs –1.57, –0.05], p = 0.04). Analyzed separately, there is evidence of a negative interaction between data collection wave and valence of *fiesta* emotions among non-Evangelicals on identity fusion (β = –0.74, [95%CIs –1.27, –0.20], p = 0.009, Figure S3A) and Shared Fate Index (β = –0.86, [95%CIs –1.82, 0.09], p = 0.08, Figure S3A). As illustrated in Figure 5, non-Evangelical participants who reported positive emotions showed signs of increases in identity fusion and Shared Fate Index, whereas those who reported negative emotions experienced trending declines in these measures of cohesion. In the full sample, the coefficient on the interaction term remains negative for identity fusion (β = –0.48, [95%CIs –1.13, 0.16], p = 0.15), Shared Fate Index (β = –0.64,

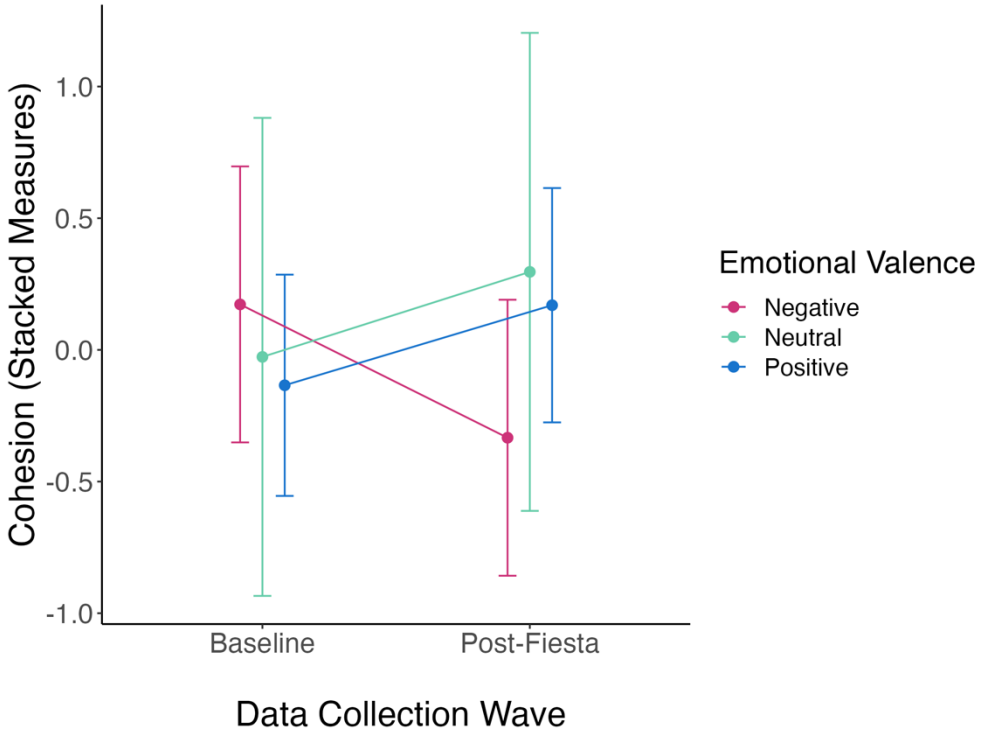

Figure 5. Interactions between *fiesta* emotions and data collection wave on stacked measures of cohesion among non-Evangelicals. The regression lines show fitted values and 95% confidence intervals produced by a LMER model predicting stacked measures of identity fusion and Shared Fate Index (2 observations per participant) from the interaction between data collection wave and valence of emotions felt during the *fiesta*. The model includes crossed random intercepts for participants and cohesion measure.

[95%CIs –1.45, 0.18], $p = 0.13$), and the stacked measure (β = –0.57, [95%CIs –1.25, 0.11], $p = 0.10$), but the coefficients are imprecisely estimated and the 95% confidence intervals include 0. There is little evidence of any interaction between data collection wave and emotional valence on other outcomes (Supplemental Materials S3.2).

4. Discussion

Our results do not support the hypothesis that cohesion and cooperation increased in the community after the *fiesta*, a large and complex collective ritual. From baseline to post-*fiesta*, there were no changes in cohesion or ingroup trust. Moreover, there is strong evidence of a decline in ingroup-oriented altruism and cooperation. These findings contrast prior research in both lab and naturalistic settings, which has consistently found evidence that collective rituals

enhance group solidarity and prosociality (Jackson et al., 2018; Kirschner Sebastian & Tomasello, 2010; Páez et al., 2015; Reddish et al., 2013; Wen et al., 2016, 2020; Xygalatas et al., 2011, 2013).

Although we did not find the expected increases in cohesion and cooperation, we found evidence that the *fiesta* demands substantial cooperation within the community. The *fiesta* was a huge cooperative endeavor, involving both obligatory and voluntary cooperation. *Fiesta*-related norms required community members to contribute their time, energy, and money to ensuring that the *fiesta* was a success. In addition to obligatory contributions, we found that half of the non-Evangelical participants made a voluntary donation, and the majority provided voluntary labor. Moreover, ethnographic observations revealed a custom of hospitality during the *fiesta*, wherein villagers prepared extra food at home and welcomed friends and neighbors to eat and socialize. Finally, the lengthy *fiesta* season (Figure S1) featured many smaller celebrations, each of which involved a mutual aid institution called *gozona* (Curtin et al., 2024). Villagers supported the host by contributing goods (cash, food items) and labor, which the host will slowly reciprocate over the coming years. Together, this evidence suggests that the *fiesta* does encourage cooperation within the community.

Why, then, do we see a decline in altruism and cooperation after the *fiesta*? One hypothesis is that community members experience cooperation fatigue after such an intense period of cooperation. Villagers may feel that they have done enough for the community during the *fiesta* season and are thus less willing to help or cooperate with ingroup members. In interpreting low Dictator and Ultimatum Game offers among the Hadza hunter-gatherers, the anthropologist Marlowe (2004) raised a similar possibility. He suggested that food-sharing within Hadza camps led to “weariness”, and that low offers reflected an attempt to escape from

constant sharing. A similar dynamic could be at play after the *fiesta*, as participants seek reprieve after an intense period of cooperation. A complementary hypothesis is that normative expectations about cooperation change following the *fiesta*. There may be a community-wide understanding that everyone deserves a break, and cooperative norms weaken for a period. Finally, given that community members are *obliged* to provide a large portion of the labor and financing for the *fiesta* (and may be punished for failing to contribute), a third alternative is that intrinsic prosocial motivation is crowded out by external forces after the *fiesta*. Extrinsic motivation– in the form of reward or punishment– can weaken intrinsic motivation (Frey & Jegen, 2001).

A limitation of this correlational study is that changes from baseline to post-*fiesta* may be caused by an unobserved variable. To account for the most obvious alternative– changes in economic stability over the study period– we showed that our results are robust to controlling for material security. This is an important control, since we would expect that willingness to help a community member or contribute in the PGG would decrease if economic stability worsened. Interestingly, we found that material security increased over the study period. We interpret this as reflecting the local agricultural cycle. Baseline data were collected near the end of the dry season, before crops could be planted, whereas the post-*fiesta* period was very close to the corn harvest (staple crop). However, because our measure of material security did not capture actual "cash on hand", it is still possible that *fiesta*-related expenditures drove the observed declines in prosociality.

Given that several studies have found a positive relationship between collective ritual and group cohesion (Jackson et al., 2018; Páez et al., 2015; Power, 2018), the lack of change in cohesion from baseline to post-*fiesta* is puzzling. However, our exploratory analyses point to a

moderating effect of emotional valence on cohesion: participants who reported feeling positive emotions during the *fiesta* perceived a greater increase in cohesion compared to those who felt negative emotions. While some researchers have proposed that rituals characterized by high levels of *dysphoria* have a potent effect on cohesion (Whitehouse & Lanman, 2014), these results suggest that positive emotions during ritual can better bond groups in some cases.

This study points to new avenues for research into the social and psychological effects of *fiestas*. If they do not enhance cohesion and cooperation, why do costly Oaxacan *fiestas* persist? One possibility is that *fiestas* do foster group solidarity, but the effects emerge over the longer-term– either after a post-*fiesta* dip, or ontogenetically as people grow up participating in many *fiestas.* As a preliminary step, future research should test whether Oaxacan communities with more *fiestas* are more cohesive and cooperative. Second, *fiesta* may shore up networks of social support within the community via mutual aid (*gozona*). *Fiestas* provide an important context for ritual exchange and mutual aid in Oaxacan communities (Beals, 1970; Ramos Gil, 2017; Stephen, 2005). Social network research should probe whether *fiestas* enhance the cohesion of social support networks (Power, 2018). Finally, *fiestas* may improve or sustain peaceful intergroup relationships in a region where intergroup conflict is common (Cook, 2014; Dennis, 1987; López-Bárcenas, 2004; Yannakakis, 2008). During the *fiesta*, outsiders from nearby communities visit and partake in the festivities. The *fiesta* may function as a credible signal of the community's ability to cooperate on a large-scale (Mehr et al., 2021). Future work should examine the psychological impact of these rituals on visitors from nearby communities.

Broadly, this research adds nuance to the literature on collective ritual. To our knowledge, this is the first study to document declines in altruism and cooperation after a collective ritual. We also found that, despite dancing, music-making, and processing, participants

on average experienced no increase in perceived cohesion. These results suggest that not all collective rituals have lasting psychological effects on cohesion or ingroup-oriented prosociality. Future research should investigate the temporal dynamics of the psychological impacts of collective rituals and consider moderating effects of emotional valence. While the sample is small, we hope that this study will motivate more research into complex, real-world collective rituals and how they shape social psychology in societies around the world.

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6. Declarations

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