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Joint trajectories of cyberbullying perpetration and victimization: Associations with psychosocial adjustment

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ABSTRACT

Cyberbullying is one of the most disturbing characteristics regarding the relationship between adolescents on the Internet. Although a longitudinal overview of the trajectories that adolescents may develop has been established, there is a lack of understanding of these when both perpetration and victimization are considered together. The present study aimed to analyze the joint trajectories between cyberbullying perpetration and victimization among highly involved adolescents and to examine whether these profiles are associated with social adjustment, need for popularity and perceived popularity (off and online). A total of 3012 adolescents ($M_{AgeT1} = 13.15$, $SD = 1.09$; 50% girls) aged 11–16 participated in the study at four time points (each six months apart). The results of growth mixture modelling yielded a four-class solution for cyberbullying victimization and perpetration separately for those adolescents highly involved. When unified in a parallel process, this resulted in three distinct profiles: decrease both, increase perpetration, and increase both. Finally, multi-group growth mixture models indicated that these profiles showed differences in baseline and evolution of social adjustment, need for popularity and popularity. The findings support the relevance of considering the evolution of both perpetration and victimization when preventing cyberbullying, as well as addressing the psychosocial adjustment and motivations for behavior of those involved.

1. Introduction

The dynamic evolution of technology provides the opportunity for alternative ways for adolescents to learn and develop social interactions. However, problematic use of technology has resulted in a pattern of bullying among adolescents. Cyberbullying is defined as an intentional and repetitive act to harm someone who cannot easily defend her/himself via electronic devices (Smith et al., 2008). Compared to face-to-face bullying, cyberbullying has specific characteristics; anonymity, flexibility in time (the victim is available 24/7), unlimited reproduction and a potentially larger audience (Slonje et al., 2013). Given the psychosocial outcomes that may lead the involvement from late adolescence to adulthood (Katsaras et al., 2018), understanding the factors involved in the phenomenon has become a challenge for the policy and education communities to address or reduce it. For the design of effective prevention and intervention programs, emphasis has been placed on the importance of considering involvement in both victimization and perpetration as well as their characteristics associated with a heterogeneous nature (Sumter et al., 2012).

This phenomenon is particularly relevant during middle adolescence because it peaks at this age range (Kowalski et al., 2014). Thus, it is particularly interesting to examine the trajectories of cyberbullying and its associated motivational and social factors during middle adolescence. However, there may be important individual differences in involvement concerning stability and developmental patterns (Yoo, 2021). Whereas longitudinal studies on cyberbullying have been conducted, few have undertaken growth trajectory analyses to analyze their association on motivational and psychosocial factors. Considering *cyberbullying perpetration* and *cyberbullying victimization*, knowledge about the profiles of involvement between both could provide useful insights into the specific risk groups and psychosocial characteristics that underlie such patterns of development. The present study considered the profiles of the joint trajectories of perpetration and victimization to analyze their stability and changes over time, and the evolution of *social adjustment, popularity* and *need for popularity*.

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1.1. Trajectories of cyberbullying

Cyberbullying is particularly prevalent through adolescence. During early adolescence, general prevalence increases notably, until reaching a peak middle adolescence and thereafter slightly decreasing (Zych & Farrington, 2021). For example, a study using linear growth curve analysis has reported an increase in cyberbullying involvement during early and middle adolescence (Charalampous et al., 2021), while research with the same methodology on middle and late adolescence reported a decrease in cyberbullying behaviours (Cho & Rustu, 2020). Such studies assumed that the trajectory represents the population as a whole (homogeneity). However, there are differences in the trajectories that individual pupils may develop. Therefore, longitudinal studies need to be considered to account for the fact that within the sample there are subpopulations with different trajectories.

Several studies have analyzed the heterogeneity of the *cyberbullying perpetration* and *victimization* trajectories. Considering victimization, Yoo (2021) identified three groups, uninvolved, increase and decrease. Other studies have also identified three groups based on *cyberbullying perpetration*, although varying in patterns: uninvolved, decrease, and moderate to high (Kim et al., 2017; Song et al., 2020); uninvolved, moderate stable, and decrease (Yoo, 2021); and uninvolved, decrease, and increase (Cho & Glassner, 2021). These studies provide support for heterogeneity in cybervictimization and cyberperpetration trajectories independently. Nevertheless, no studies have explored both trajectories as a joint process, leaving an important gap in our knowledge.

Several meta-analyses of cross-sectional studies have shown a moderate to strong association between *cyberbullying perpetration* and *victimization* ($r = .43$ to $r = .51$) (Kowalski et al., 2014; Lozano-Blasco et al., 2020; Walters, 2021). In a representative cross-sectional study among adolescents in southern Spain, 11% of participants were found to be clustered in a group which had high involvement in both *victimization* and *perpetration* in cyberbullying (Zych et al., 2018). This co-occurrence and the transition between *cyberbullying perpetration* and *victimization* requires that common developmental processes should be accounted for when analyzing cyberbullying trajectories and their associated factors.

Although the heterogeneity of both involvements has not been addressed in cyberbullying, the joint trajectory between *victimization* and *perpetration* has been reported in previous studies for the phenomenon of bullying generally (Cho & Lee, 2020; de Vries et al., 2021; Zhou et al., 2022). Such studies have found common trajectories between bullying perpetration and victimization that suggest co-occurrence between both (e.g., increase both, decrease both), and trajectories that differ (e.g., high perpetration, decrease victimization, decrease perpetration). While bullying and cyberbullying are phenomena with different characteristics, the overlap between victimization and perpetration within each phenomenon is similar ($r_{\text{Bullying}} = .39$, $r_{\text{Cyberbullying}} = .44$, see Walters, 2021, for a meta-analysis), so it is expected to find joint developmental trajectories between *cyberbullying perpetration* and *victimization*. The present study focused on parallel process growth mixture modelling to address the changes along time in cyberbullying profiles. This type of analysis is particularly relevant due to the specific characteristics of cyberbullying, where there is a higher fluctuation from one profile to another, with victims and aggressors not fixed and where even a one-time involvement may be considered as relevant (Vandebosch & Van Cleemput, 2009).

Involvement in cyberbullying remains sporadic and adolescents tend to be involved in specific cyberbullying situations (Camacho et al., 2023; Modecki et al., 2014). Few adolescents are involved in a wide range of cyberbullying situations; although their number is lower, their higher level of involvement corresponds to higher levels of psychosocial risks and requires a differentiated research analysis (Mishna et al., 2012). Analyzing those highly involved in a wide range of cyberbullying situations may led to identify the associated psychosocial characteristics. In contrast, getting involved in one specific situation may be motivated by a momentary impulsive reaction or even by unawareness (Runions & Bak, 2015), which does not have to characterize these adolescents as at risk regarding their psychosocial characteristics. Therefore, the present study aims to analyze the joint trajectories of *perpetration* and *victimization* only with those adolescents with a high involvement in either. This would give insight into the psychosocial characteristics of those adolescents who have been highly involved in cyberbullying and whether they differ from those with low engagement or uninvolved adolescents.

1.2. Cyberbullying and psychosocial adjustment

Cyberbullying as a serious issue involves not just individuals, but rather the whole social and environmental framework. Previous research on abusive patterns has demonstrated how social structure can influence individual adolescent behavior. This impact is particularly noteworthy after the transition from early to middle adolescence, as it changes the landscape for adolescents, requiring them to readjust their social position within the new peer group. Within the social structure of the peer group, the status of adolescents (i.e., *popularity*), motivation towards social domination (i.e., *need for popularity*) or how they are accepted within the peer group (i.e., *social adjustment*) has been associated to being an online victim or perpetrator.

Popularity is a significant social factor in the understanding of the power imbalance, as it characterizes the social structure of peer groups in adolescence. *Popularity* involves a high level of social dominance, reputation and power within the peer group (Cillessen & Marks, 2011). While *popularity* may be prosocial in nature (e.g., leadership), it may also appear to be of a selfish character (e.g., aggressive, arrogant, or rude) (Malamut et al., 2021). Adolescence is a period where behavior is highly influenced by the peer group. According to *social identity theory* (Hogg, 2016), popular adolescents are considered more valuable within the peer group, through the recognition, consideration, support and admiration of others, or the ability to influence and attract others. Previous studies have found that bullies often are more popular and able to establish and maintain their dominance over others (Romera et al., 2019). Popular adolescents may perceive themselves as safe to behave offensively against others without worrying about adverse social effects from the peer group (Vanden Abeele et al., 2017). Meanwhile, victims tend to have lower levels in comparison with uninvolved adolescents (Romera et al., 2019). Although adolescents generally consider bullying perpetration as immoral, the association between perpetration and popularity has been identified by them as a normative risk behavior (i.e., cool or extrovert image) during adolescence (Strindberg et al., 2020). In that sense, bullying has been characterized as a deliberate strategy to keep a position of dominance (Pouwels et al., 2018). In addition to its intentional nature, the harm caused by the perpetrator may also involve a conscious act accepted in the peer group, as socially motivated behavior.

With Internet connectivity, cyberbullying has also been discussed as socially oriented behavior playing a role in providing higher social status (Vanden Abeele et al., 2017). Although cyberbullying behaviors take place on the Internet, during adolescence it is intrinsically contextualized in a social network as the classroom or school. Adolescents often use social networks or chats on the Internet to support or reinforce offline relationships. *Self-perceived peer popularity* has been also associated with a higher later involvement in *cyberbullying perpetration* (Ranney & Troop-Gordon, 2020; Vanden Abeele et al., 2017; Wang & Ngai, 2022; Wright, 2014). Furthermore, online perpetration has also been reported as associated with popularity (Wegge et al., 2016). This implies that popularity and online perpetration are associated factors that reinforce each other in a bidirectional way. Online *perpetration* may be targeted at a lower socially visible individual, as evidenced by the lower popularity of those adolescents who experience *cyberbullying victimization* (Festl & Quandt, 2013).

A complementary research approach, in addition to the achievement of popularity, addresses the importance of the motivation to reach

popularity (see meta-analysis by Samson et al., 2022). The achievement of a key social position is a goal of adolescents (de Vries et al., 2021). Adolescents commonly pursue increased status among their peers, perhaps by providing power-related access to group resources. Adolescents may engage in a certain pattern of behavior aimed at being identified as popular within the group, which is known as the *need for popularity* (Santor et al., 2000). According to *social information processing theory* (Dodge, 2014), adolescents may take decisions based on their expectations of the outcome of their behavior. Motivation encourages individuals to target information about the goal to be achieved, to appraise the suitability of alternatives, and to activate behavioral responses to achieve the goal. The *need for popularity* has been broadly addressed in terms of its association with other risk factors involved on the Internet (i.e., sexting, grooming, disclosure of feelings, body dissatisfaction or porn use) (Del Rey et al., 2019; Kim, 2020; Swirsky et al., 2022; Vanden Abeele et al., 2014).

Given that perpetration may be a tool that provides adolescents with a valued social status of privilege, they may find enough reason to engage in perpetration to achieve the desired recognition within the peer group (Romera et al., 2021). Previous research reported that high levels of *need for popularity* are associated with higher involvement in *cyberbullying perpetration* (Romera et al., 2017; Vanden Abeele et al., 2017). Differences have been found in the literature on the association between need for popularity and victimization. In a descriptive study about the roles of cyberbullying, higher levels of need for popularity were found for those adolescents involved in both *cyberbullying perpetration* and *victimization* (Romera et al., 2016). The experience of only *victimization* on the Internet has not been found to be related with higher status motivations (Romera et al., 2017). This may be explained by the fact that purely victimized adolescents may not prefer to be the focus of interest, rather they may wish to be more unnoticed, avoiding the chance of further victimization (Breslend et al., 2018). However, *need for popularity* can be a risk factor for cybervictimization (Goagoses et al., 2022; Wright et al., 2022) when the overlap between victimization and perpetration is not controlled for. For this reason, need for popularity may lead to further cyberbullying victimization since high levels may also represent high involvement in perpetration.

Social adjustment provides a useful overview of adolescents' fit with their immediate social context. It involves spending time with others, positive relationships, and supportive and caring friends (Romera et al., 2016). *Social adjustment* serves a central function in the socio-emotional development of adolescents. Peer group membership protects individuals from contextual distress. Adolescents with low *social adjustment* may perceive their interpersonal connections as impaired and decrease interaction with peers (Ding et al., 2020). As a result, low *social adjustment* has been associated with higher *cyberbullying victimization* (Romera et al., 2016), even as an outcome (Espino et al., 2023). Adolescents who have been involved in both *perpetration* and *victimization* online also tend to have lower *social adjustment* compared to uninvolved adolescents (Romera et al., 2016). Conversely, online perpetrators have been identified with normative levels of *social adjustment* (i.e., like uninvolved adolescents) (Romera et al., 2016). Online *perpetration* may be perceived as a way of attaining acceptance among peers. In groups established on the assumption of immoral norms, group integration may be strengthened through *perpetration*.

While there are cross-sectional studies on the co-occurrence of involvement in *cyberbullying perpetration* and/or *victimization* with *popularity* (face-to-face and online), *need for popularity* and *social adjustment*, there are no studies that have analyzed whether and how such correlates are associated over time.

1.3. The current study

The present study focused on two objectives. The first objective was to analyze the joint trajectories between *perpetration* and *victimization* in those adolescents highly involved in cyberbullying. As evidenced by previous meta-analyses (Kowalski et al., 2014; Lozano-Blasco et al., 2020; Walters, 2021) and longitudinal research on bullying generally (Cho & Lee, 2020; de Vries et al., 2021; Zhou et al., 2022), common trajectories were expected to reveal the co-occurrence between cyberbullying perpetration and victimization (i.e., increase and/or decrease perpetration and victimization) (Hypothesis 1.1). It is expected that these common patterns would not be the case for all adolescents, so that, as has been evidenced in bullying perpetration (Cho & Lee, 2020; de Vries et al., 2021; Zhou et al., 2022), there would be some adolescents whose trajectories over time would be different in perpetration and victimization (i.e., increase perpetration and decrease victimization and vice versa) or those who are only highly involved in one specific area over time (Hypothesis 1.2). The second objective was to explore the motivational and psychosocial characteristics associated with cyberbullying trajectories. It was expected that those adolescents with common perpetration and victimization trajectories, or only victimization trajectories, showed inverse associations with the development of *popularity* and *social adjustment*, but that there was no link with the *need for popularity* (Hypothesis 2.1). Conversely, trajectories associated only with perpetration would be positively associated with the development of *popularity*, *need for popularity*, and *social adjustment* (Hypothesis 2.2).

2. Method

2.1. Participants and procedure

The study used data from a six-month four wave longitudinal project designed to investigate developmental risk and protective factors on adolescents' involvement in bullying and cyberbullying. A convenience sample was recruited from 13 middle schools from the south of Spain. Data were obtained from 3012 adolescents (52% rural; 48% urban). The study was approved by the Bioethics and Biosafety Committee of the Universidad de Córdoba. Each school was contacted and enquired about their participation in the study. After approval by the management team, governmental permissions were obtained. Each parent authorized their child to take part in the study. This study is part of a broader research project aimed at studying the risk and protective factors of bullying and cyberbullying. The participants completed the questionnaire collection during school hours for approximately 40 min under the supervision of experienced researchers in psychology and with the attendance of a teacher. Participants received standardized instructions and were informed of their voluntary, anonymous, and confidential participation. Two annual measurements were taken at the beginning and at the end of both 2017/18 (grades 7, 8 and 9) and 2018/19 (8, 9 and 10) academic years, over 18 months. The mean age of the participants at the beginning of the research was 13.15 (SD = 1.09). Girls accounted for 50% of the sample. The participation at each measurement point was 2788 (Time 1; T1), 2551 (T2), 2473 (T3) and 2360 (T4). The main reason for attrition was that participants did not attend school on the day of collection or because they moved to another school. Missing data were addressed via Full Information Maximum Likelihood (FIML) estimation, given the data was missing at random (MAR; $\chi^2/df =$ 1.40) (Bollen, 1989).

2.2. Measures

2.2.1. Cyberbullying

Cyberbullying perpetration and victimization were measured with the Spanish version of the European Cyberbullying Intervention Project Questionnaire (Del Rey et al., 2015), comprising 22 items. Each form of cyberbullying was addressed by 11 items covering physical, verbal, and relational cyberbullying: for example, "I created a fake account, pretending to be someone else" (perpetration); "Someone posted embarrassing videos or pictures of me online" (victimization). Participants were asked to report the frequency with which they had experienced each situation over the last three months, with five response options (0

= *never*, 1 = *once or twice*, 2 = *once a month*, 3 = *once a week*, 4 = *more times a week*). The measure reported a good internal reliability for each time point (McDonald's Omega, $\omega_{perpetration}$; T1 = 0.87, T2 = 0.89, T3 = 0.89, T4 = 0.89; $\omega_{victimization}$; T1 = 0.88, T2 = 0.85, T3 = 0.88, T4 = 0.89). In T1, the Confirmatory Factor Analysis (CFA) reported that the two-factor structure of the scale has good psychometric properties χ^2 (208) = 2104.488, $p < .001$; CFI = 0.918, TLI = 0.909, and RMSEA = 0.058, 90% CI [0.056, 0.060].

2.2.2. Social adjustment

This was assessed using a subscale from the Adolescent Multidimensional Social Competence Questionnaire (Gómez-Ortiz et al., 2017). The social adjustment subscale consists of eight items (e.g., "My classmates and friends know they can count on me when they have to organize some kind of activity"). Adolescents responded on a 5-point Likert-type scale ranging from 1 (*completely false*) to 7 (*completely true*). This subscale has shown to have good reliability previously with Spanish adolescents (Romera et al., 2022). In the present study, the measure reported a good internal reliability for each time (McDonald's Omega, ω; T1 = 0.86, T2 = 0.88, T3 = 0.88, T4 = 0.90). In T1, good psychometric properties of the scale were reported in the CFA: χ^2 (20) = 499.678, $p < .001$; CFI = 0.959, TLI = 0.942, and RMSEA = 0.093, 90% CI [0.086, 0.100].

2.2.3. Need for popularity

This was measured with the Spanish version of the Need for Popularity Scale (Del Rey et al., 2019; Santor et al., 2000). The instrument comprises 12 items (e.g., "I've been friends with some people, just because others liked them") with 7 Likert-type response options from 1 = *Strongly disagree* to 7 = *Strongly agree*. The measure reported a good internal reliability for each time (McDonald's Omega, ω; T1 = 0.87, T2 = 0.89, T3 = 0.89, T4 = 0.90). In T1, good psychometric properties of the scale were reported in the CFA: χ^2 (44) = 725.142, $p < .001$; CFI = 0.973, TLI = 0.966, and RMSEA = 0.075, 90% CI [0.070, 0.080].

2.2.4. Popularity

Adolescents rated popularity by being asked two items about how popular they considered themselves to be among their peers and on the Internet (Self-perceived peer popularity: "I am popular among the peers in my class"; Self-perceived Internet popularity: "I am popular in the virtual social networks"; r_{T1} = .53, r_{T2} = .57, r_{T3} = .62, r_{T4} = .66) (Pozzoli & Gini, 2021). Participants answered each item on a scale ranging from 1 (*completely false*) to 7 (*completely true*).

2.3. Statistical analyses

Three steps were taken to address the objectives of the study. In the first step, participants with a high level of involvement in cyberbullying (using the average score of the items), at least at one time point in the study, were selected. These criteria are stricter than other criteria that selection those involved based on involvement in any form of cyberbullying. In our study, we used a stricter criterion, following studies that recommend an averaged cut-off with multiple-item scales to prevent targeting those adolescents who were involved only in one form of cyberbullying (see Zych et al., 2016 for a systematic review). We first considered a strict cut-off of an average equal to or more than 2 ("once a month"), while being prepared to relax this to ensure that at least 5% of the sample were included so that heterogeneous trajectories could be analyzed.

In the second step, a parallel process growth mixture modelling was performed to capture the joint developmental trajectory of cyberbullying perpetration and victimization simultaneously for those adolescents involved in cyberbullying. From 2 to 6 classes were estimated. The most optimal solution was adopted by comparing the different classes under the criteria of: Akaike Information Criterion (AIC; lowest value), Bayesian Information Criterion (BIC; lowest value), the adjusted Bayesian Information Criterion (aBIC; lowest value), entropy (values close to 1 support a better classification accuracy), and theoretical meaningfulness (Nylund et al., 2007).[1] The *loglinear parameterization* was applied to determine combinations between categorical latent variables.

In the third step, multi-group analysis was used to examine differences in the trajectory of social adjustment, need for popularity, self-perceived peer popularity and self-perceived Internet popularity among the joint cyberbullying trajectory classes. The intercept and slope were identified as indicators of trajectory. The intercept established if social domain differed between the groups at the beginning of the study, while slope reported the change of trajectory over time. Significant differences between intercept and slope among classes in comparison with the uninvolved adolescents in cyberbullying were analyzed with the Wald Test (Muthén & Muthén, 1998). Analyses were performed with M*plus* 8.7. (Muthén & Muthén, 1998), with robust maximum likelihood (MLR) as an estimator. FIML was used to account for all available information without removing any missing information or replacing missing data.

3. Results

First, those adolescents involved in cyberbullying were selected. When selecting on the basis of cut-off (greater or equal to 2), less than 5% of participants were involved (3%), so this subsample was not sufficient for analyzing growth trajectories. Therefore, the slightly relaxed criterion of 1.5 was set, which resulted in a sufficient sample of 224 (7%) adolescents highly involved in cyberbullying perpetration and/or victimization. In this sample, boys (66%) were more involved in cyberbullying than girls (34%) ($\chi^2_{(1)} = 23.43$, $p < .001$). No differences were found in involvement by age ($\chi^2_{(5)} = 8.18$, $p > .05$). Of those adolescents, 24% were involved at some point in perpetration (33% girls), 40% in victimization (43% girls), and 36% in both (25% girls). These 224 adolescents were selected for the analysis on simultaneous trajectories of cyberbullying perpetration and victimization.

Parallel process growth mixture modelling was developed to analyze joint trajectories in cyberbullying perpetration and victimization (see Table 1 for model fit indices). While the five-profile solution had better entropy, the BIC value was considerably lower in the four-class solution, which was finally retained. Fig. 1 overviews the following four classes for cyberbullying perpetration: (a) *decrease class* (55%), (b) *low and increase class* (23%), (c) *middle and increase class* (12%), and (d) *high stable class* (10%). Regarding the categories of cyberbullying victimization, the following classes were found: (a) *high decrease class* (48%), (b) *low decrease class* (24%), (c) *low increase class* (15%), and (d) *high increase class* (12%) (see Fig. 1).

One main interest of the study was to analyze the role of adolescents in cyberbullying perpetration and victimization as parallel processes. A total of 16 classes were identified according to the simultaneous trajectory in cyberbullying perpetration and victimization (see Table 2 for the joint probabilities membership). This led to a low probability of simultaneity for several classes. Consequently, and because of the theoretical rationale and providing enough probability for further comparative analysis, the classes were clustered according to the common direction of the same involvement (i.e., "high decrease" and "low decrease" classes in cyberbullying victimization were treated together as a decrease) and the shared or different direction in the trajectories both perpetration and victimization (i.e., shared direction: increase both perpetration and victimization; different direction: increase perpetration and decrease victimization).

[1] The Lo–Mendell–Rubin Test, the Vuong–Lo–Mendell–Rubin likelihood ratio test, and the Bootstrapped Likelihood Ratio Test have not been reported because it is not available for growth mixture modelling with more than one categorical latent variable (Muthén & Muthén, 1998–2017).

Table 1
Model fit indices of parallel process growth mixture models.

Number of profiles	AIC	BIC	aBIC	Entropy	Cyberbullying perpetration						Cyberbullying victimization					
					1	2	3	4	5	6	1	2	3	4	5	6
2	3126.85	3253.08	3135.82	0.782	.81	.19					.82	.18				
3	3034.36	3245.89	3049.40	0.802	.72	.17	.10				.65	.28	.08			
4	**2942.54**	**3273.47**	**2966.06**	**0.811**	**.49**	**.24**	**.15**	**.11**			**.43**	**.27**	**.17**	**.13**		
5	2921.65	3406.11	2956.08	0.832	.36	.26	.17	.12	.09		.33	.32	.14	.10	.10	
6	2994.09	3666.18	3041.86	0.777	.25	.23	.20	.17	.11	.03	.31	.20	.16	.15	.09	.08

Note. AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion; aBIC = adjusted Bayesian Information Criterion.

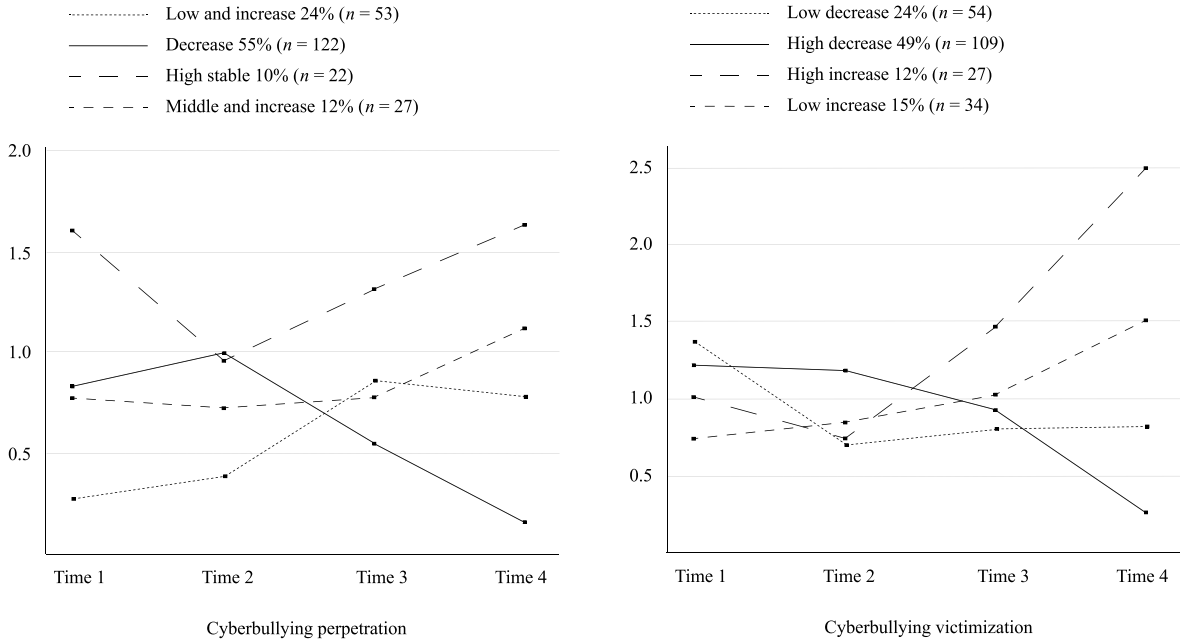

Fig. 1. Estimated cyberbullying perpetration and victimization trajectories.

Table 2
Joint probability of trajectory group membership.

Cyberbullying perpetration	Cyberbullying victimization			
	High decrease	Low decrease	Low increase	High increase
Decrease	34% (n = 76)[a]	18% (n = 49)[a]	2% (n = 5)	0% (n = 1)
Low and increase	9% (n = 21)[b]	4%[2] (n = 9)[b]	7% (n = 15)[c]	4% (n = 8)[c]
Middle and increase	1% (n = 3)[b]	0%[2] (n = 1)[b]	6% (n = 13)[c]	5% (n = 10)[c]
High stable	4% (n = 9)	2% (n = 4)	0% (n = 1)	4% (n = 8)

Note.
[a] *Decrease both class.*
[b] *Increase perpetration class.*
[c] *Increase both class.*

The first class was labelled *decrease both class* (52%; n = 125), for adolescents whose levels of cyberbullying perpetration and victimization tended to decrease simultaneously. In the second class, labelled as *increase perpetration class* (14%; n = 34), involvement in cyberbullying perpetration tended to increase while victimization decreased. Finally, a third class was labelled *increase both* (22%; n = 46), because cyberbullying perpetration and victimization increased simultaneously. Three more classes could have been identified as sharing common trends but were not considered due to the low number of participants in each (increase victimization, n = 6; high perpetration and decrease victimization, n = 13; and high perpetration and increase victimization n = 9).

Multi-group analyses were performed to address the second main objective of the study, on the motivational and psychosocial characteristics associated with cyberbullying trajectories. Those adolescents largely uninvolved in cyberbullying (n = 2788) comprised the reference class. Table 3 reports the intercept and slope for each class based on their initial levels and trajectories in *social adjustment*, *need for popularity*, *perceived peer popularity*, and *perceived Internet popularity* while these trends are shown in Fig. 2.

Wald Test results indicated that adolescents clustered in *decrease both class* (d = 0.38) and *increase perpetration class* (d = 0.78), reported lower initial levels of *social adjustment* compared to those adolescents not involved in cyberbullying. Both the *uninvolved class* and the *increase perpetration class* reported an ascending trajectory across the four time points. The *increase both class* had a decreasing trend.

Based on *need for popularity*, the *decrease both class* (d = 1.23), *increase perpetration class* (d = 0.73), and *increase both class* (d = 0.82), displayed higher initial levels compared to those adolescents not involved in cyberbullying. The *need for popularity* decreased over time for the *decrease both class*. According with *perceived peer popularity*, those adolescents in *increase both class* reported higher initial levels compared to *uninvolved class* (d = 0.80). The *perceived peer popularity* increased over time for the *increase perpetration class*, while the trajectory of those *uninvolved* was decreasing.

Regarding *perceived Internet popularity*, those adolescents clustered in *decrease both class* (d = 1.22) and *increase both class* (d = 1.39) reported higher initial levels compared to those adolescents not involved. The

Table 3
Multivariate growth mixture models for the joint trajectories of cyberbullying perpetration and victimization on motivation and psychosocial adjustment.

Variable	Uninvolved (n = 2788)	Decrease both (n = 116)	Increase perpetration (n = 34)	Increase both (n = 46)	Wald Test
Intercept					[1] $\chi^2_{(1)} = 7.67$**
Social adjustment	5.61	*5.35*[1]	*5.07*[2]	5.49	[2] $\chi^2_{(1)} = 6.96$**
Need for popularity	1.87	*2.77*[3]	*2.39*[4]	*2.45*[5]	[3] $\chi^2_{(1)} = 50.38$***
Perceived peer popularity	4.48	4.76	4.03	*5.04*[6]	[4] $\chi^2_{(1)} = 5.75$*
Perceived Internet popularity	3.79	*4.67*[7]	3.74	*4.77*[8]	[5] $\chi^2_{(1)} = 9.56$*
Slope					[6] $\chi^2_{(1)} = 4.23$*
Social adjustment	**0.02**	0.04	**0.19**	**−*0.14***[9]	[7] $\chi^2_{(1)} = 21.75$***
Need for popularity	0.00	**−*0.24***[10]	0.05	0.17	[8] $\chi^2_{(1)} = 13.33$***
Perceived peer popularity	**−0.04**	0.02	***0.23***[11]	−0.16	[9] $\chi^2_{(1)} = 6.55$*
Perceived Internet popularity	0.01	0.03	***0.30***[12]	−0.01	[10] $\chi^2_{(1)} = 24.48$***
					[11] $\chi^2_{(1)} = 6.83$**
					[12] $\chi^2_{(1)} = 4.99$*

Note. Significant slopes are reported in bold ($p < .05$). Intercept and slope significantly different from the uninvolved group (reference) in italic.

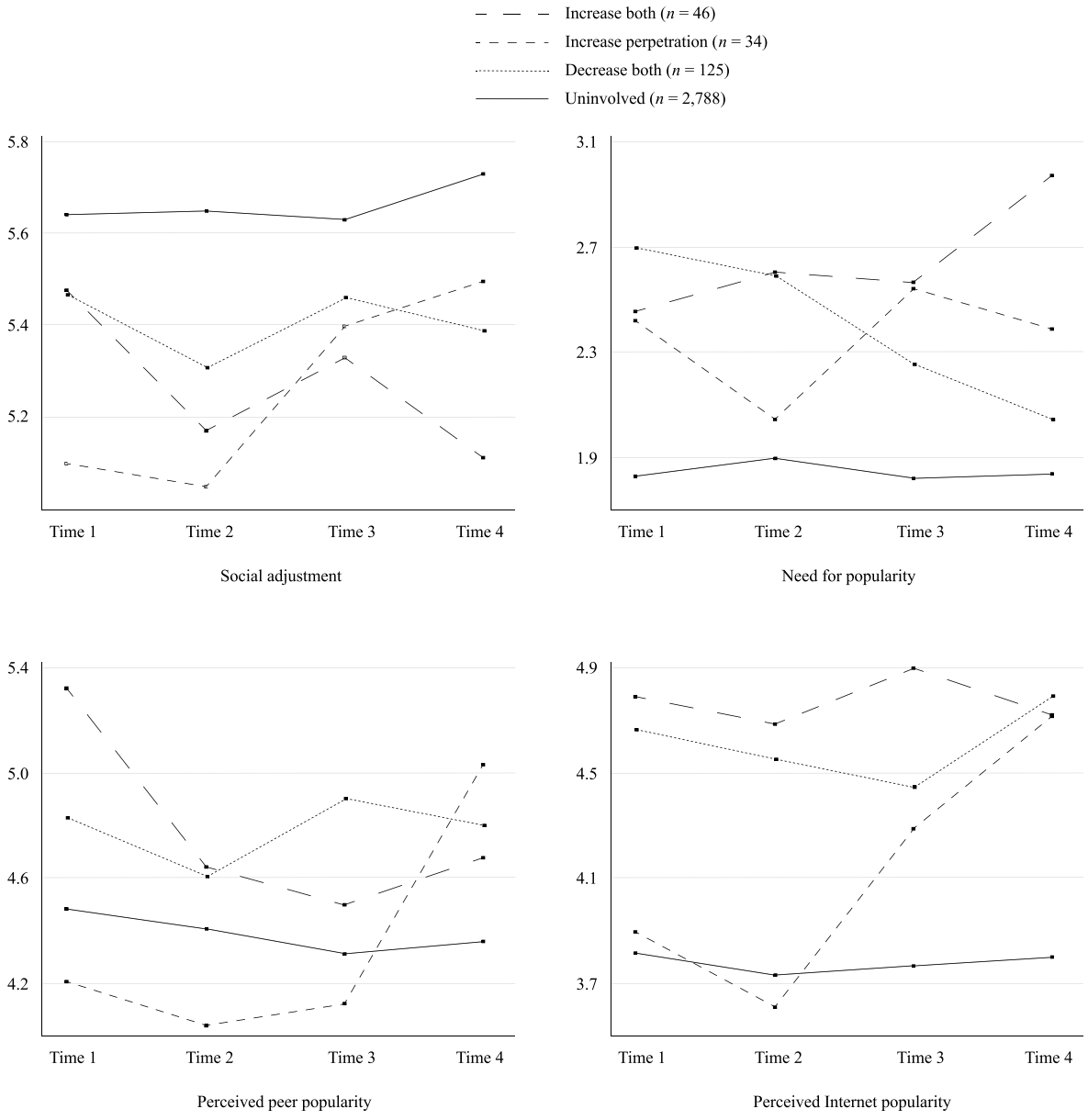

Fig. 2. Estimated cyberbullying classes on the multivariate growth mixture models.

increase perpetration class increased over time in *perceived Internet popularity*.

4. Discussion

The present explores the joint trajectories of *cyberbullying perpetration* and *victimization* and their association with motivational and social factors. Based on longitudinal data from early and middle adolescence, the study focused on trajectories in common or different between perpetration and victimization in adolescents highly involved in cyberbullying. The selection on the basis of an averaged cut-off with multiple-items (Zych et al., 2016) allowed us to focus longitudinally on only those adolescents who have had a high involvement in cyberbullying, and to analyze the characteristics of psychosocial adjustment in these adolescents who have a higher level of exposure.

While the previous literature has overcome some of the limitations of the early research on developmental processes in cyberbullying through the identification of heterogeneous trajectories, it remains to explore such variety by controlling the possible overlap between perpetration and victimization. The first objective of this study was to address whether the trajectories of *cyberbullying perpetration* and *victimization* have a common or different development in involved adolescents. We found that boys were more involved than girls, as also found in an earlier meta-analysis, (3:1 ratio; Smith et al., 2019). The results of the parallel process growth mixture modelling found a solution of four profiles for both dimensions of cyberbullying. In relation to the trajectories of *cyberbullying perpetration*, the results of the development of the profiles are in line with previous studies on increasing (Cho & Glassner, 2021), decreasing (Cho & Glassner, 2021; Kim et al., 2017), and stable high profiles in perpetration (Kim et al., 2017), and increasing and decreasing profiles in victimization (Song et al., 2020; Yoo, 2021). The finding that a stable high profile was not found in victimization is in line with a previous latent transition analysis, where cybervictims tended to be more sporadic, as 70–81% were not subsequently involved (Tian et al., 2023). Greater stability in perpetration could be explained by the overlap with victimization that can be mutually reinforcing (Walters, 2021). This argues for the need to analyze both trajectories combined as a way of identifying common patterns.

The growth mixture modelling derived 16 profiles on parallel trajectory between victimization and perpetration that were clustered into three profiles due to the overlap in the direction of development. The profiles found were *increase both* (perpetration and victimization), *increase perpetration* (and decrease victimization), and *decrease both*. These results highlight the heterogeneity of adolescents' cyberbullying involvement in terms of its temporal evolution (stability, increase or decrease) and involvement in the phenomenon (victimization and/or perpetration).

As reported in different meta-analyses on cyberbullying (Kowalski et al., 2014; Lozano-Blasco et al., 2020; Walters, 2021) and on joint trajectories in bullying (Cho & Lee, 2020; Zhou et al., 2022), two of the profiles found had common trajectories between perpetration and victimization (Hypothesis 1.1). However, the overlap between perpetrator and victimization is different in cyberbullying due to its specific characteristics. In this case the power imbalance may be related to the anonymity of the perpetrator so that victims, afraid of retaliation, may use the Internet to equally harm another (Runions & Bak, 2015). In addition, known and visible perpetrators in cyberbullying are exposed to others which increases their likelihood of being attacked by others and becoming cybervictims at the same time (Kowalski et al., 2014). As in previous studies, a tendency was found, where trajectories did not converge but had opposite directions so that there was a group of adolescents initially involved in many forms of cybervictimization (not involved in perpetration) which was decreasing over time as perpetration increased (Hypothesis 1.2). A further interesting trend is to discuss why these adolescents involved in victimization to a large extent were not involved in perpetration at the same time, but only subsequently. This can be explained by social learning (Bandura, 1986), so that the experience of these events makes adolescents learn maladaptive coping strategies; rather than acts of revenge that develop immediately as a response to their own victimization (Runions & Bak, 2015), they may develop patterns to interact aggressively with others in their own future relationships. In addition, having suffered from victimization may lead them to develop the necessary means to attack online without being recognized.

Of particular interest in the longitudinal trend is to consider what differentiating characteristics may distinguish the increase both and increase perpetration groups, since both share the increase in perpetration but differ in their involvement in victimization. It is also of interest to identify such characteristics between the decrease both and increase both profiles because they follow opposite trajectories.

Regarding the development of popularity, significant differences in the initial levels and the trajectories were found between adolescents involved in cyberbullying and those uninvolved. In line with previous results (Wegge et al., 2016), the present research reinforces the account of *perceived popularity* (independently of the context) as a relevant factor to understand involvement and change in cyberbullying. For the *increase both class*, although at baseline they did not show involvement in cyberbullying, their initial levels of *perceived peer and Internet popularity* were higher compared to uninvolved participants. While *decrease both class* (high initial cyberbullying) had initially high levels of perceived popularity, these levels remained stable over time, despite their decrease in cyberbullying involvement. Furthermore, findings provide evidence that *perceived popularity* may be linked differently for perpetration and victimization (Hypotheses 2.1 and 2.2). It appears that perpetration can be associated and developed over time in the same way with *perceived peer and Internet popularity* (Hypothesis 2.2). This is evidenced by a significant increase in *perceived popularity* over time in both contexts for the *increase perpetration class*.

However, popularity was inversely correlated with victimization (Hypothesis 2.1). Thus, *increase perpetration class* (high initial *cyberbullying victimization*) exhibited lower levels of *perceived peer popularity* (not in the Internet context) baseline compared to the uninvolved class. This experience may have an immediate effect on their social relationships with their peers and their perception in real life, due to increased withdrawal or inhibition and thus affect their attraction, interest with peers or social exclusion. However, the lack of differences at baseline with *perceived Internet popularity* may be supported by the specific characteristics of online context. On the Internet, adolescents can interact with a much larger number of people than in their immediate environment, which means that they can have a larger group of followers and friends than in their everyday life (Breslend et al., 2018). In addition, the self-identity that adolescents may develop on the Internet may mean that their *cyberbullying victimization* may not affect their *perceived Internet popularity* and attention because of the online disinhibition.

While *perceived popularity* may be an indicator of social adjustment, the motivations adolescents may have to achieve visibility are also relevant. In the present study, *need for popularity* was found to be an associated factor over time for adolescents' later involvement in cyberbullying. Being highly involved in cyberbullying at any of the time points was associated with higher levels of *need for popularity* in any of the groups compared to those *uninvolved* at the beginning of the study. These results are in line with previous studies that have shown that adolescent behaviors aimed at achieving status within the peer group are linked to involvement in cyberbullying (Romera et al., 2016; Vanden Abeele et al., 2017). However, the development of *need for popularity* was not equal for all groups. It remained high and stable in the *increase perpetration* and *increase both* groups. These results indicate that no matter whether initially being victimized online or not (*increase perpetration* and *increase both* groups), initial levels of *need for popularity* (as a risk factor) were subsequently associated with involvement in *cyberbullying perpetration*.

Moreover, such levels of *need for popularity* did not decrease over time. As an associated factor, *need for popularity* only decreased when the involvement in cyberbullying declined over time (Hypothesis 2.2). During adolescence, *cyberbullying perpetration* may be a coercive strategy motivated by obtaining the desired power that comes with popularity among peers. Consistent with recent studies (Goagoses et al., 2022; Wright et al., 2022), *need for popularity* was also found to be a risk factor for *cyberbullying victimization*, as higher initial levels of *need for popularity* were associated with an increase in victimization (at the same time as perpetration increased). This may be explained because the implementation of different strategies (e.g., cyberbullying perpetration) to gain status may make a student vulnerable to be the focus for *cyberbullying victimization* (Walters et al., 2021).

A further characteristic related to cyberbullying is the adolescents' involvement in positive and supportive relationships with peers. The results of the present study indicate that the different patterns of engagement in cyberbullying found were closely correlated with *social adjustment*. The baseline differences in *social adjustment* found are consistent with previous cross-sectional research about the roles of cyberbullying (Romera et a., 2016). Lower levels of initial *social adjustment* were found for those adolescents with a high baseline involvement in *cyberbullying victimization*, either together with low (*increase perpetration class*) or high (*decrease perpetration class*) involvement in *cyberbullying perpetration* (compared to the *uninvolved group*). Even lower levels of *social adjustment* were found only when there was initially low perpetration and high victimization (*increase perpetration class*). No differences were found with the *increase both class*, due to their initial low involvement in cyberbullying.

Consistent with previous research (Espino et al., 2023), the trajectories found in the present study have evidenced that *social adjustment* was differently associated with *cyberbullying perpetration* and *victimization*. The *increase both* and *increase perpetration classes* have in common an increase in perpetration over time. However, their trajectories on *social adjustment* were significant, but in opposite directions. This is explained by their different relationship with perpetration and victimization. As perpetration increases and victimization decreases, there is an increase in *social adjustment*. However, there is a decrease in social adjustment in *both increase class*. These results further support that the experience of online victimization severely affects peer relationships (Hypothesis 2.1). However, even with disrupted offending behaviors (and decreased victimization) such adolescents can enhance and develop support and positive interactions within their peer group. Lower *social adjustment* was stable by *decrease both class*. While the initial involvement of this group in cyberbullying accounts for lower *social adjustment*, such adjustment remained stable throughout the remaining times despite both victimization and perpetration decreasing over time (Hypothesis 2.2).

Understanding joint trajectories and diverse profiles helps to identify how adolescent cyberbullying activity is growing. This evidence is critical to design more effective preventive and mitigating effects, as it helps to determine which groups of adolescents are more likely to perpetuate and/or become victims of cyberbullying in a consistent way and what their associated outcomes are. The findings highlight that involvement in cyberbullying can be fluctuating; there are common and distinctive aspects in the evolution of adolescents' involvement in perpetration and victimization and how this is connected to their motivation and psychosocial adjustment. The profile of increase perpetration reflects the social characteristics linked to perpetration and victimization, because their initial victimization was linked to a greater deterioration of social adjustment and popularity, which were increasing at the same time as victimization decreased and perpetration increased. It implies that at these ages students may learn that cyberaggression is an effective strategy to get out of victimization and gain social position. Specifically, the high social status linked to these harmful actions fuels their greater involvement as cyberperpetrators (Kowalski et al., 2014).

Coping socialization strategies also play an important role in the prevention of cyberbullying perpetration, since as shown in the longitudinal profiles, these adolescents improve their social adjustment as they engage in perpetration (at the same time as need for popularity and perceived popularity). Through coping socialization (Bradbury et al., 2018), adolescents learn to cope with stressful online events through the communication they establish with their immediate context by sharing these experiences. Given the predominant focus on the social group during adolescence, peers are the most influential context for the development of coping strategies, it is necessary to empower those adolescents who suffer most forms of cyberbullying through social support and integration into the peer group.

4.1. Limitations

The findings of the present study must be considered in the context of some limitations. All measures used were self-reports with the risk of social desirability associated. Future studies could consider collecting information from other actors. For example, both *peer popularity* and *social adjustment* could be peer reported. Also, some qualitative research, for example interviews or focus groups with pupils at the end of the study, might help interpret certain findings (Smith, 2019).

Although the present study applies a longitudinal design, its findings could not be considered in light of evolutionary developmental patterns due to the heterogeneity in the age of the participants (from seventh to ninth grade at T1). Future studies could explore whether the development of cyberbullying involvement is developmentally associated with these social cues at homogeneous ages (e.g., by taking a particular grade and tracking its evolution over time across several grades). Even more rigorous studies through the establishment of cohorts could examine the difference in evolution between different age groups. It would also be of particular relevance to control for certain developmental stages that could affect their involvement in cyberbullying, as well as their psychosocial adjustment (e.g., transition from primary to middle school). The decision to use 1.5 as the average score cut-off resulted in a largely sufficient (for analysis) but relatively small percentage of the sample (7%); nevertheless, when doing the joint trajectories of cyberbullying some of the subgroups were underestimated and it was not possible to interpret the evolution of the social characteristics and motivations of this minority. These issues could be addressed in future studies that work on larger representative samples so that in the selection of those highly involved larger numbers may be obtained and greater heterogeneity in the joint trajectories between cyberbullying perpetration and victimization could be estimated.

5. Conclusions

The present study has highlighted the relevance of analyzing cyberbullying trajectories considering both factors of victimization and perpetration. It has shown that, in adolescents with a high involvement in at least one time point, their involvement may be common or differential in both behaviors. While for some adolescents there is an overlap between victimization and perpetration, for others their involvement over time may be the inverse. Moreover, students' individual differences in cyberbullying involvement have been shown to vary in psychosocial adjustment as a function of their involvement and trajectories in perpetration and victimization, with the increase in psychosocial adjustment and in cyberbullying perpetration being the most significant association.

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CRediT authorship contribution statement

Antonio Camacho: Conceptualization, Formal analysis, Methodology, Software, Visualization, Writing – original draft. **Peter K. Smith:** Conceptualization, Supervision, Writing – original draft. **Rosario Ortega-Ruiz:** Supervision, Validation, Writing – review & editing. **Eva M. Romera:** Data curation, Funding acquisition, Investigation, Project administration, Resources, Supervision, Validation, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no competing financial and personal relationships with other people or organizations that have influenced the work reported in this paper.

Data availability

Data will be made available on request.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.chb.2023.107924.

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