



Emotional, psychophysiological and behavioral responses elicited by the exposition to cyberbullying situations: Two experimental studies



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ABSTRACT

Two experimental studies investigated whether the exposure to cyberbullying situations produces in bullied youth, and in young people in general, higher levels of stress, negative emotions, and attention levels, in comparison to other peer interactions, including bullying. In both studies, participants' physiological activation (Study 1 and 2) and behavioral data (Study 2) were recorded while watching four 1-minute videos representing cyberbullying, face-to-face bullying, prosocial, and neutral interactions. Self-report questionnaires assessed participants' emotional responses to the videos, and victimization. Sixty-one adolescents (65.7% girls) participated in Study 1; 35 young adults (60% girls) participated in Study 2. Results indicate that cyberbullying causes higher stress and negative emotions than prosocial and neutral peer interactions, but not than bullying. Cyberbullying also elicited higher levels of stress and negative emotions in victims than non-victims, but only for adolescents.

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Las respuestas emocionales, psicofisiológicas y comportamentales producidas ante la exposición a situaciones de cyberbullying: dos estudios experimentales

RESUMEN

Mediante dos estudios experimentales se investiga si la exposición a situaciones de *cyberbullying* produce en los jóvenes acosados y en los jóvenes en general mayor nivel de estrés, de emociones negativas y de atención comparados con otras interacciones entre compañeros, incluyendo el *bullying*. En ambos estudios se registró la activación psicofisiológica de los participantes (estudios 1 y 2) y se recogieron datos de comportamiento (estudio 2) mientras se veían 4 vídeos de 1 minuto de duración que contenían *cyberbullying*, *bullying* cara a cara e interacciones prosociales y neutras. Mediante cuestionarios de autoinforme se evaluaron las respuestas emocionales de los participantes a los vídeos así como la victimización. Sesenta y un adolescentes (el 65.7% chicas) participaron en el estudio 1 y 35 adultos jóvenes (el 60% chicas) en el estudio 2. Los resultados indican que el *cyberbullying* produce mayor estrés y emociones negativas que las interacciones prosociales y neutras entre compañeros, pero no que el *bullying*. El *cyberbullying* también produjo mayor nivel de estrés y emociones negativas en víctimas que en las personas que no lo eran, aunque solo para los adolescentes.

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Palabras clave:

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The use of Information and Communication Technologies (ICT) is nowadays a daily experience for adults and adolescents (Antonietti, Colombo, & Lozotsev, 2008). Such technologies allow to improve work and learning performances (e.g., Colombo, Antonietti, Sala, & Caravita, 2013), and to favor contacts and socialization among people. However, this widespread use of ICT is

also linked to a higher exposure to violent and aggressive acts, such as cyberbullying. Cyberbullying is any harming behavior that is performed through electronic or digital media (Patchin & Hinduja, 2006). Because of the specific features of cyber-aggression, in particular the possible anonymity of the aggressor and the difficulty or impossibility for the victims to escape the attacks which are perpetrated by electronic devices, cyberbullying has been suggested to cause high stress, possibly even higher than traditional bullying, which stops out of school (Smith et al., 2008). The stress and the negative emotional responses to cyberbullying may be high not only for the bullied youth, but also for the witnesses who can identify with the victim and perceive that they can become the next victim, with small possibilities to avoid or to stop the cyber attacks. In line with this background, this research project is aimed at exploring whether the exposure to cyberbullying episodes causes higher levels of distress and emotional reactions, in comparison to the exposure to other types of peer interactions, including bullying, to youth who witness and to the victims of bullying, by means of two experimental studies.

Bullying and Cyberbullying

Bullying consists of intentional and repeated aggressive behaviors against peers, characterized by an imbalance of power between the aggressor(s) and the victim(s) (Olweus, 1991). The imbalance in the power in favor of the bully it is what mostly distinguishes bullying, because the victim cannot contrast adequately the bully's attacks (Smith & Sharp, 1994). Bullying can be perpetrated by means of different forms of aggressive behavior: direct aggression, physical or verbal, or indirect and relational.

With the diffusion of the ICT, a new form of bullying and harassment, realized by means of electronic devices, emerged, i.e., cyberbullying. In cyberbullying the aggression can be performed by text message, email, phone call, picture/videoclip, and use of social network tools. Likewise, in the traditional bullying, attacks can be direct, such as sending offensive messages, or indirect, such as spreading embarrassing videos or pictures in internet. As in traditional bullying, the aggressors intentionally harm the victim with repeated actions. Furthermore, the possibility allowed by ICTs of acting cyber-aggression easily and anonymously, often with the support of other web-users, recreates the imbalance of power between the aggressor(s) and the victim(s). Cyberbullying also presents specific features (Nocentini et al., 2010) that may make the attacks even more harmful for the victims in comparison to traditional bullying. Cyberbullying endures over time, because offensive content posted in the web cannot be erased easily, and kids have fewer possibilities to escape from the aggression (Kowalski, Giumetti, Schroeder, & Lattanner, 2014). Furthermore, anonymity allowed to the aggressors by ICTs (Nocentini et al., 2010) makes defending from the attacks even harder for the victims. In addition, larger audience of bystanders can also be reached (Nocentini et al., 2010) and often peers who witness the cyberbullying action take the side of the bully, by showing to approve the aggression. It happens because, when using ICT, direct contact and face-to-face communication with the victims are lacking, so that the aggressors and the bystanders are less aware of the seriousness of their behavior and of the suffering inflicted to the victim.

Regardless of these specificities of cyberbullying, many victims of cyberbullying are also victims of traditional bullying (Smith et al., 2008), and young people who experienced traditional victimization within the previous 6 months are 2.5 times more likely to be cyber-victimized too (Hinduja & Patchin, 2008). These data support the hypothesis that being victimized in the cyberspace is only another way for bullied kids to suffer peer victimization.

Emotional Consequences of Cyberbullying and Bullying

Victims of traditional bullying have been found to be at risk of poor health symptoms, internalizing problems, and suicidality (e.g., Kim & Leventhal, 2008; Reijntjes, Kamphuis, Prinzie, & Telch, 2010). Among adverse consequences of being victimized there is also experiencing negative emotional reactions (e.g., Rodríguez-Hidalgo, Ortega, & Monks, 2015), linked to the feeling of being defenseless and of having a scarce control of the situation (Caravita, 2007; Graham & Juvonen, 2001). This may affect heart rate variability in witnesses (Barhight, Hubbard, & Hyde, 2013), and the levels of distress, depression and worries for at least some victims of traditional bullying (Ortega, Elipe, Mora-Merchán, Calmaestra, & Vega, 2009).

Focusing on cyberbullying, Fenaughty and Harré (2013) found that approximately 50% of cybervictims consider this experience upsetting. Ortega et al. (2009) showed that there are two clusters of cybervictims: youth, mainly girls, who tend not to be bothered by the situation, and youth, mainly boys, who experience high levels of different negative emotions. In a study involving 1,353 adolescents, being cyberbullied had a greater negative emotional impact especially for victims who were both bullied out of and within the cyberspace, in comparison to peers who were only cybervictimized (Gualdo, Hunter, Durkin, Arnaiz, & Maquilón 2015). Therefore, bullied youth may feel the cyberbullying experience particularly upsetting. However, to our knowledge no studies have investigated whether the exposure to cyberbullying can actually cause in bullied youth, in comparison to peers, higher levels of distress, assessed by means of not only self-reports of negative emotions but also by means of more precise indices (i.e., psycho-physiological responses and attentional behaviors), than the exposure to traditional bullying and other types of peer-interactions. Furthermore, we could not find studies testing the levels of distress and negative emotions elicited by the exposure to cyberbullying as compared to traditional bullying and other forms of peer-interactions in the witnesses, regardless of being bullied or not.

The Present Study

Two experimental studies have been realized to examine emotional (self-report), physiological (*biofeedback* equipment), and behavioral (*eye-tracker* equipment) responses to the exposure to situations of cyberbullying, bullying, prosocial, and neutral peer interactions. The situations have been represented via multimedia video-stimuli.

Study 1 involved 61 adolescents (11–16 years), while study 2 was a retrospective study involving 35 young adults (20–26 years). First objective of the studies was exploring whether the vision of cyberbullying situations elicits different levels of emotional and physiological responses in the victims of bullying at school as compared to non-victims. Cyberbullying situations were compared to bullying situations, prosocial, and neutral peer interactions (all showed by means of videos). The first hypothesis was that watching cyberbullying elicits in the victims of bullying higher levels of distress and negative emotions than watching bullying happening, because of the features of cyberbullying, i.e., possible anonymity of the bullies and permanency of the attacks in the cyber-space, which get difficult to escape the cyber-aggression for the victim. The vision of both cyberbullying and bullying was also expected to elicit different levels of physiological responses and negative emotions in the victims than the vision of prosocial or neutral peer interactions. The second hypothesis was that the vision of both cyberbullying and bullying elicits higher levels of stress (as measured by variation in physiological indexes) and negative emotions in bullying victims than peers.

The second purpose of the study was exploring whether, independently of being bullied, watching cyberbullying happening causes higher levels of distress and negative emotions than being exposed to bullying situations or other kinds of peer interactions (third hypothesis). Vision of bullying was also expected to elicit higher levels of physiological and negative emotional responses than the vision of other types of peer interactions.

In Study 2, besides examining the same hypotheses we had for the Study 1, we also explored the pattern of visual attention and cognitive elaboration, by using eye-tracking technology (ET). Participants' eye-movements were recorded while they were watching the peer-interaction videos. Using ET to assess the link between emotions and cognitive behaviors (e.g., attention) has been used successfully in different studies (e.g., Neath & Itier, 2014; Schmid, Schmid Mast, Bombari, Mast, & Lobmaier, 2011) highlighting how different visual behaviors mirror different attentional and cognitive states (Colombo, Di Nuzzo, & Mazzuchelli, 2010; Colombo et al., 2013b). We would expect that bullying and cyberbullying videos should elicit more attention than the other, because of their emotional content. People experiencing more negative and active emotions (like anger) look more and earlier toward emotional stimuli. Hence, victims may show a more active exploration in response to the cyberbullying and bullying videos, as more emotional for them than the other videos. Based on literature on bullying, which consistently shows gender-related differences with regards to involvement in bullying and responses to bullying, the effects of gender were controlled for in the analysis design.

Study 1

Method

Participants

Participants were 61 early adolescents (age: 11–16 y., $M = 12.9$ y., $SD = 1.5$ y.; 65.7% girls), attending middle (86.7) and high (13.3%) schools in the north of Italy, in the areas of Brescia and Milano; 92.6% of the students were from Italian descent. Participants were contacted through educational centers that they attended in the post-school time and their middle schools. Participants' parents provided active consent by signing a letter informing on the study. Less than 6% of the contacted youth were not consented to participate by parents.

Procedure

The Ethical Committee of the Department of Psychology of the Catholic University of the Sacred Heart approved the research project. Data were collected at the participants' schools/educational centers. First, the self-report measure on victimization (see the Measures section) was administered in (approximately) 1 hour group-sessions, with participants sitting at single desks. A research assistant supervised each session, answering possible participants' questions. Then, during single sessions each participant watched the four videos, which were displayed on a personal computer in a random order. While watching each movie participants' physiological responses were assessed using a biofeedback equipment (see description below). Before starting to watch the videos, baseline scores of the physiological indexes were recorded during a 1-minute session in which participants were asked to relax, and not to talk. After watching each movie, participants answered a self-report measure (see the Measures section) to assess the emotional responses elicited by the movie. A researcher, who was also a psychologist, supervised each session and realized a subsequent debriefing to ensure that participants were not upset by watching the movies and ended the session with a positive or a neutral feeling. At the beginning of any

session, participants were assured confidentiality and were told that they could withdraw from the study at any time without consequences.

Measures

Psychophysiological reactions. Psychophysiological reactions were recorded by means of the Biofeedback 2000^{x-pert} (BFB; Schuhfried GmbH, Austria) equipment, which is a non-invasive instrument that monitors and records individual's physiological activity. Physiological indexes are recorded and directly delivered to the 2000^{x-pert} software via Bluetooth thanks to a sensor which is connected to the participant's finger and does not cause any pain or discomfort to the person. The physiological indexes we recorded were: skin conductance (SCL, recorded with a resolution of 16 Bit, a sample rate of 2 KHz, range between 0 and 50 μ S and an accuracy of 0.65 μ S @ 0.012 μ S resolution), blood volume pulse (BVP, recorded with a resolution of 12 Bit, sample rate 500 Hz and integration time of 100ms), pulse volume amplitude (PVA derived from BVP), and pulse frequency. BVP, PVA, and pulse frequency indexes reflect heart rate variability (HRV).

Victimization. A reduced version of the Olweus' Bully/Victim Questionnaire (Solberg & Olweus, 2003) was administered. The measure consisted of 16 items, exploring the experiences of bullying and being bullied at school during the last two months. One item assessed the frequency of being victimized (How often have you been bullied by other children at school or at the route to school during last two months?). The measure reported at the beginning a definition of bullying (as compared to other types of aggression), which was read aloud and discussed with participants by the administrator, before participants answering the measure. The item response scale consisted of 5 options: *never, it happened only once or twice, sometimes, once per week, and several times per week*. Pupils who answered to be bullied at least once or twice were codified as victims.

Self-reported emotions. Participants evaluated their emotional responses to each video, by rating 20 emotions on a 7-points Likert scale. We selected the 20 emotions following the dimensions used to devise the rating scale for the IAPS system (Lang, Bradley, & Cuthbert, 1997), and suggestions by Lang et al. (1997). Accordingly, the emotions covered the following three main dimensions of emotional responses: affective valence (ranging from pleasant to unpleasant), arousal (ranging from calm to excited), and control. We selected such a wide range of emotions in order not to influence participants' response, guiding their preference towards our targets emotions. For the current study we considered only the four primary negative emotions (Ekman, Sorenson, & Friesen, 1969): anger, fear, sadness, disgust; the two social emotions of blame and shame; and, based on literature on bullying victims, the emotional responses of anxiety and despair.

Videos. Four 1-minute videos were used. All the videos represented interactions among adolescents characters: one video represented a cyberbullying peer interaction in which a pupil was bullied by two classmates who shared by phones a victim's embarrassing video among classmates; one video represented a face-to-face bullying situation in which a child was physically bullied (i.e., intentionally hit with a basket-ball to make him falling) by a classmate; one video represented a prosocial interaction, in which during a night camp in an isolated area an adolescent comforted his friend who was scared; one neutral situation, in which four adolescents were waiting and discussing the arrival of a cousin. The videos about bullying, prosocial, and neutral interactions were built for a previous study (Caravita, Fabio, & Pagnin, 2003¹), and

¹ The first author of the current manuscript can be contacted to receive detailed information on this study, the procedure to build the movies, and the pilot study in

Table 1
Study 1: Means and Standard Deviations of Physiological Indexes and Emotions.

	Bullying video				Cyberbullying video			
	Boys		Girls		Boys		Girls	
	Non-victims Mean (SD)	Victims Mean (SD)	Non-victims Mean (SD)	Victims Mean (SD)	Non-victims Mean (SD)	Victims Mean (SD)	Non-victims Mean (SD)	Victims Mean (SD)
SCL	14.67 (6.75)	17.59 (12.94)	11.82 (8.21)	16.24 (7.73)	14.17 (6.80)	17.12 (13.04)	11.31 (8.28)	15.76 (7.78)
BVP	49.84 (0.12)	49.74 (0.19)	49.86 (0.21)	49.86 (0.11)	49.50 (0.03)	49.48 (0.04)	49.50 (0.05)	49.50 (0.02)
PVA	35.02 (9.79)	45.90 (13.15)	38.80 (10.22)	32.71 (9.22)	34.33 (7.40)	42.54 (9.94)	37.18 (7.72)	32.58 (6.97)
Pulse	74.07 (5.40)	69.26 (8.04)	75.82 (8.96)	78.21 (6.19)	72.67 (5.07)	68.16 (7.54)	74.31 (8.41)	76.56 (5.81)
Anger	5.39 (1.54)	5.38 (1.69)	5.38 (1.47)	5.67 (1.41)	3.38 (1.88)	3.75 (1.48)	3.75 (1.96)	4.67 (2.06)
Fear	1.83 (1.20)	1.63 (1.06)	1.64 (1.35)	1.78 (1.56)	1.44 (1.04)	1.75 (1.16)	1.44 (.82)	2.44 (1.81)
Sadness	4.39 (1.97)	4.38 (2.39)	4.08 (1.66)	4.56 (2.30)	2.89 (1.57)	3.13 (1.13)	3.04 (1.67)	4.56 (1.51)
Disgust	4.44 (1.85)	3.75 (2.55)	4.50 (2.30)	3.88 (2.71)	2.94 (1.73)	2.38 (1.85)	3.67 (2.08)	2.78 (2.17)
Blame	1.94 (1.35)	1.50 (1.07)	1.75 (1.15)	1.00 (0.00)	2.11 (1.75)	1.88 (1.25)	1.71 (1.30)	1.67 (1.66)
Shame	2.72 (2.30)	1.75 (1.16)	1.67 (1.31)	1.78 (1.99)	2.83 (1.86)	2.25 (1.28)	2.17 (1.79)	1.89 (1.17)
Anxiety	3.06 (1.96)	2.25 (1.91)	2.63 (1.97)	2.00 (2.12)	2.61 (2.03)	2.25 (1.58)	2.29 (1.76)	3.00 (2.65)
Despair	3.50 (2.07)	2.75 (1.98)	2.08 (1.67)	3.67 (2.74)	2.50 (2.00)	1.38 (.74)	1.67 (1.13)	3.44 (2.51)

	Prosocial video				Neutral video			
	Boys		Girls		Boys		Girls	
	Non-victims Mean (SD)	Victims Mean (SD)	Non-victims Mean (SD)	Victims Mean (SD)	Non-victims Mean (SD)	Victims Mean (SD)	Non-victims Mean (SD)	Victims Mean (SD)
SCL	13.61 (5.74)	16.10 (11.02)	11.19 (6.99)	14.96 (6.58)	14.11 (5.97)	16.70 (11.45)	11.60 (7.27)	15.51 (6.83)
BVP	49.78 (0.01)	49.79 (0.02)	49.78 (0.02)	49.78 (0.01)	49.81 (0.05)	49.77 (0.08)	49.82 (0.09)	49.82 (0.05)
PVA	39.09 (9.02)	49.11 (12.12)	42.57 (9.41)	36.96 (8.50)	39.33 (8.76)	49.06 (11.77)	42.71 (9.14)	37.26 (8.25)
Pulse	74.98 (4.81)	70.69 (7.16)	76.53 (7.98)	78.67 (5.51)	74.07 (4.50)	70.06 (6.71)	75.53 (7.47)	77.52 (5.16)
Anger	1.94 (1.73)	2.00 (1.20)	1.25 (.53)	1.00 (0.00)	2.50 (1.50)	3.25 (1.75)	2.00 (1.44)	3.44 (2.40)
Fear	1.78 (1.11)	3.00 (2.07)	1.76 (1.45)	3.00 (2.78)	1.56 (.92)	1.25 (.46)	1.44 (.87)	1.11 (.33)
Sadness	4.11 (1.32)	3.50 (1.69)	4.44 (1.98)	3.44 (2.40)	3.00 (2.06)	3.13 (2.03)	2.96 (2.05)	3.22 (2.49)
Disgust	1.78 (1.59)	1.63 (1.41)	1.21 (.83)	1.33 (1.00)	2.72 (1.60)	2.50 (2.27)	2.17 (1.69)	2.66 (2.35)
Blame	1.44 (1.42)	1.50 (0.76)	1.17 (0.48)	2.44 (2.60)	1.50 (0.92)	2.00 (1.60)	1.38 (0.77)	1.67 (2.00)
Shame	1.28 (.46)	1.63 (.92)	1.17 (.38)	1.22 (.67)	2.00 (1.19)	1.25 (.46)	1.38 (.77)	1.78 (1.99)
Anxiety	2.44 (1.79)	2.25 (1.75)	2.54 (1.93)	2.44 (2.60)	2.06 (1.51)	2.13 (1.13)	2.17 (1.74)	2.00 (2.12)
Despair	2.89 (2.11)	1.88 (1.13)	1.54 (1.22)	2.33 (2.18)	2.78 (1.83)	1.88 (1.64)	1.58 (1.10)	2.11 (1.36)

Note. SCL: Skin Conductance Level; BVP: Blood Volume Pulse; PVA: Pressure Volume Amplitude; Pulse: Pulse Frequency.

Table 2
Study 1: Summary of ANOVA Indexes for Physiological Indexes as Dependent Variables.

	Skin conductance level		Blood volume pulse		Pressure volume amplitude		Pulse frequency	
	<i>F</i> (<i>df</i>)	η^2	<i>F</i> (<i>df</i>)	η^2	<i>F</i> (<i>df</i>)	η^2	<i>F</i> (<i>df</i>)	η^2
Video	21.43 (3, 162)***	.284	174.07 (3, 162)***	.763	317.27 (3, 162)***	.855	151.27 (3, 162)***	.737
Being victim	2.203 (1, 54)	.039	1.076 (1, 54)	.020	.630 (1, 54)	.012	0.306 (1, 54)	.006
Gender	0.717 (1, 54)	.013	1.967 (1, 54)	.035	2.437 (1, 54)	.043	5.982 (1, 54)*	.100
Video x being victim	2.203 (3, 162) [†]	.039	1.076 (3, 162)	.020	0.630 (3, 162)	.012	0.306 (3, 162)	.006
Video x gender	0.717 (3, 162)	.013	1.967 (3, 162)	.035	2.437 (3, 162) [†]	.043	5.982 (3, 162)***	.100
Being victim x gender	0.092 (1, 54)	.002	1.189 (1, 54)	.022	7.924 (1, 54)**	.128	2.709 (1, 54)	.048
Video x being victim x gender	0.092 (3, 162)	.002	1.189 (3, 162)	.022	7.924 (3, 162)***	.128	2.709 (3, 162) [†]	.048

[†] $p < .10$.

* $p < .05$.

** $p < .01$.

*** $p < .001$

were extracted by movies targeting an adolescent audience. The video about cyberbullying has been designed for school interventions on cyberbullying and consisted of a story in which a girl was cyberbullied by classmates. None of participants had seen the video or the original movies before their participation in the study.

Analysis Strategy

Data were analyzed by means of analyses of variance test (with Student Newman Keuls post-hoc tests, and pairwise comparison), to test differences in the mean scores of physiological

which the movies were tested to ensure the balance of their structure and that they were representative of the three categories of peer interactions.

responses and self-evaluations of emotions. “Videos” was introduced in the model as within variable, victim condition (victims vs. non-victims) and gender as fixed factors. At a preliminary screening of the data, no outliers emerged. To exclude any possible influence due to the individual variability in physiological activation, we preliminarily regressed each physiological index value recorded during the task on the baseline value. We saved the unstandardized residuals and used these values to run our analyses. This procedure for cleaning data derived from biofeedback recordings is commonly used in experiments that rely on psychophysiological data (e.g., Antonietti, Colombo, & Di Nuzzo, 2015; Colombo, Grati, Di Nuzzo, & Antonietti, 2013). When significant interaction effects emerged, follow-up ANOVAs were performed to clarify them.

Results

Physiological Reactions

Means and standard deviations of the physiological variables (residual scores) are displayed in **Table 1**. When performing ANOVAs, the main effect of the videos was significant for all the indexes (**Table 2**). In pairwise comparisons (main significant results), SCL scored higher for the bullying video than for the other videos. SCL for the cyberbullying video was higher than SCL for the prosocial video. BVP index was higher for the bullying video than for the cyberbullying video; BVP for Cyberbullying was also lower than BVP for the prosocial and the neutral videos. PVA indexes for all videos significantly differed from each other, with PVA scoring lower for cyberbullying than for the other videos. Pulse frequency for the cyberbullying was lower than pulse frequency for the other videos. Pulse frequency for bullying was also lower than pulse frequency for the prosocial video.

The interaction effect type of video x being victimized was marginal for the SCL index (**Table 2**). In follow-up ANOVAs the effect of being victimized was not significant for all the four videos, but in each video victims showed higher SCL indexes than non-victims.

For the PVA index the interaction effects type of video x gender, and of type of video x gender x being victimized were marginal and significant, respectively. In follow-up ANOVAs no significant differences between victims and non-victims emerged among girls. Among boys, the interaction effect of type of video x being victimized was significant, $F(3, 69) = 5.391, p < .001, \eta^2 = .19$: victims scored significantly higher than non-victims for all the four videos, all videos, $F(1, 21) = 5.391, p < .05, \eta^2 = .19$ but among victims, cyberbullying elicited significantly lower PVA than bullying, and both cyberbullying and bullying caused lower PVA than the other types of peer interactions. Among non-victims, PVA indexes were significantly lower for the bullying and cyberbullying videos than the other videos.

Effects of type of the video, type of video x gender and of type of video x gender x being victimized were significant for the pulse frequency. When examining the three-way effect, among girls only the main effect of the type of video was significant, $F(3, 93) = 64.156, p < .001, \eta^2 = .67$: pulse frequency scored significantly lower for the cyberbullying video than for the other videos, and for the bullying video in comparison to the prosocial one. Among boys, significant effects of type of video, $F(3, 69) = 112.312, p < .001, \eta^2 = .83$, and of the type of video x being victimized, $F(3, 69) = 3.151, p < .05, \eta^2 = .12$, emerged. When examining the two-way interaction effect, only the effect of type of video was significant, and it was for both non-victims, $F(1, 16) = 10.388, p < .001, \eta^2 = .39$, and victims, $F(3, 21) = 29.834, p < .001, \eta^2 = .81$. The significant differences between pairs of videos were similar among non-victims and victims: cyberbullying elicited lower pulse frequency than the other videos; pulse frequency was also lower for bullying in comparison to the prosocial situation.

Self-reports of Emotions

Means and standard deviations of the self-rated emotional responses are reported in **Table 1**; ANOVAs indices are displayed in **Table 3**. No significant main and interaction effects emerged for anxiety. For all the other emotions, apart from blame, the main effect of the video was significant. The bullying video elicited significantly higher levels of anger than the other three videos, and gender moderated this effect (**Table 3**). Among both boys and girls, the main effect of video was significant: boys, $F(3, 75) = 33.19, p < .001, \eta^2 = .57$; girls, $F(3, 96) = 72.85, p < .001, \eta^2 = .70$, and all the differences between types of video were significant at the pairwise comparison, with bullying video eliciting the highest anger, and

Table 3
Study 1: Summary of ANOVA Indexes for Emotions as Dependent Variables.

	Anger		Fear		Sadness		Disgust		Blame		Shame		Anxiety		Despair	
	F(df)	η^2	F(df)	η^2	F(df)	η^2	F(df)	η^2	F(df)	η^2	F(df)	η^2	F(df)	η^2	F(df)	η^2
Video	81.979*** (3, 165)	.598	8.361*** (3, 168)	.130	6.568*** (3, 168)	.105	22.344*** (3, 165)	.289	.744 (3, 165)	.013	7.070*** (3, 165)	.114	1.268 (3, 165)	.023	5.519*** (3, 165)	.091
Being victim	1.859 (1, 55)	.033	2.166 (1, 56)	.037	0.102 (1, 56)	.002	0.774 (1, 55)	.014	0.085 (1, 55)	.002	0.541 (1, 55)	.010	0.164 (1, 55)	.003	0.083 (1, 55)	.002
Gender	0.029 (1, 55)	.001	0.033 (1, 56)	.001	0.327 (1, 56)	.006	0.001 (1, 55)	.000	0.240 (1, 55)	.004	1.385 (1, 55)	.025	0.000 (1, 55)	.000	0.129 (1, 55)	.002
Video x being victim	2.117 (3, 165)	.037	5.431** (3, 168)	.088	2.553 (3, 168)	.044	0.895 (3, 165)	.016	3.859 (3, 165)	.066	0.886 (3, 165)	.016	1.107 (3, 165)	.020	0.716 (3, 165)	.013
Video x Gender	2.878* (3, 165)	.050	0.472 (3, 168)	.008	0.797 (3, 168)	.014	0.843 (3, 165)	.015	1.227 (3, 165)	.022	0.503 (3, 165)	.009	0.472 (3, 165)	.009	2.043 (3, 165)	.036
Being victim x gender	0.230 (1, 55)	.004	0.249 (1, 56)	.004	0.238 (1, 56)	.004	0.071 (1, 55)	.001	0.163 (1, 55)	.003	0.986 (1, 55)	.018	0.094 (1, 55)	.002	7.507** (1, 55)	.120
Video x being victim x gender	0.365 (3, 165)	.007	0.316 (3, 168)	.006	0.648 (3, 168)	.011	0.216 (3, 165)	.004	1.487 (3, 165)	.026	1.170 (3, 165)	.021	0.601 (3, 165)	.011	0.792 (3, 165)	.014

† p < .10.
* p < .05.
** p < .01.
*** p < .001.

cyberbullying video causing higher levels of emotion than the neutral and the prosocial video. Boys reported to feel higher anger than girls only for the prosocial video, $F(1, 58) = 7.76, p < .01, \eta^2 = .12$.

Significantly, higher fear was elicited by the prosocial video in comparison to the bullying video, and by the cyberbullying video in comparison to the neutral video. Witnessing bullying caused significant higher sadness than witnessing cyberbullying and neutral peer-interactions. Bullying also elicited higher despair and disgust than the other videos. Cyberbullying caused significantly higher shame than the prosocial and the neutral videos and higher disgust than the prosocial video.

With regards to being victimized, and focusing on the main results, the 2-way interaction effects of being victimized \times video was significant for fear, blame, and (marginally, $p = .06$) sadness. In follow-up ANOVAs, in comparison to non-victims, victims scored higher for fear and sadness for the cyberbullying video: fear, $F(1, 58) = 4.46, p < .05, \eta^2 = .07$; sadness, $F(1, 58) = 4.00, p = .05, \eta^2 = .07$, and they scored marginally lower for the blame responses that were elicited by the bullying video, $F(1, 58) = 3.61, p = .06, \eta^2 = .06$.

Discussion

The results on physiological responses indicate that the exposure to bullying and, in particular, cyberbullying elicited higher stress in comparison to the other videos. This can be derived especially by the significantly higher levels of SCL recorded in our sample while participants were watching the two videos of bullying and cyberbullying. SCL is an electrodermal measure assessing the activity of the Somatic Nervous System (SNS). Because SNS activity increases and is predominant in stressful situations, the changes in SCL are particularly useful to detect changes elicited by stress (Boucsein, 2012).

Results also support the hypothesis that cyberbullying elicits higher stress, especially in victims. This is mirrored by the values of the indexes related to HRV, which among victimized boys were significantly lower when watching cyberbullying than other videos, including bullying. HRV indexes are usually lower in people experiencing psychological stress (Delaney & Brodie, 2000; Hjortskov et al., 2004).

With regards to self-reported emotional responses, in comparison to cyberbullying bullying produced higher emotions of anger, sadness, despair, and disgust. Nevertheless, in comparison to prosocial and neutral interactions, cyberbullying caused higher emotions of anger, shame, fear (than neutral peer interactions), and disgust (than prosocial interactions).

When comparing victims to non-victims, the exposure to cyberbullying, but not to bullying, elicited higher fear and sadness in victims. Curiously, victims also reported to feel higher fear than peers during the vision of the prosocial video, maybe due to the features of video (the wild environment where the two peers were during the night, which could be potentially scaring). This finding may express a higher emotionality of the victims, but it may also express biases in victims' attribution to intents in social interactions, which elicit victims' higher negative expectations and, subsequently, emotions when watching peers interacting.

Study 2

Method

Participants

Participants were 35 young adults (60% girls, aged 20–26 years, $M = 23.20$ y., $SD = 1.61$ y.). They were all undergraduate students (majors in humanistic sciences, economic and political sciences, educational sciences and psychology), contacted during classes and at the university common areas by research assistants. Participants

were informed about the study purposes, procedure, and methods and provided active written consent.

Procedure

Procedure was the same used for the Study 1. Eye-movements (behavioral indexes for attention allocation) were also recorded while participants watching the videos.

Tools and Measures

Videos, techniques, and measures to assess physiological indexes and emotional responses were the same used for the Study 1.

Victimization. A retrospective version of the measure used in Study 1 was administered. After providing the definition of bullying, the participant was requested to respond 30 items about her/his experiences in bullying (as bully, victim, or bystander) when attending middle and high school: 15 items per each of the two school levels. One item per each school level asked whether the respondent was bullied at school, asking also to specify the frequency. Participants who answered to be bullied at least once or twice during middle and/or high school have been codified as *victims*.

Eye Movements. Eye movements while watching videos were recorded by using the eye-tracking technology. It allows analyzing individuals' visual and attentional behavior, recording gaze movements as well as watcher dilatation and contraction. We used Tobii x-120 eye-tracker and analyzed data by means of the Tobii Studio software. This tool is based on the use of infrared rays which are reflected by the human's crystalline (independently of wearing or not glasses or contact lenses), and then recorded by a CCD sensor. Calibration is run for every participant on the base of 9 different points.

Results

Physiological Reactions

The analysis strategy was the same of Study 1. Means and standard deviations of the physiological variables are reported in Table 4. The two-way and the three-way effects of type of video \times gender \times being victimized were significant for the SCL index (Table 5). Among boys, victims had lower SCL scores for the bullying and cyberbullying videos and higher for the prosocial and the neutral videos, while the contrary was true for non-victims. Victims scored lower than non-victims for the bullying and cyberbullying videos. However, none of these effects reached the statistical significance at the follow-up ANOVA tests. No significant effects emerged for the other physiological reactions.

Behavioral indexes

Repeated measures ANOVAs have been computed to explore possible differences in participants' visual behaviors (dependent variable) while watching the four videos, including the gender and the victim status as fixed factors. Mean scores and standard deviation of the different indexes are reported in Table 4.

Working with a video and not with single images, we first computed a mean score along the videos for all the considered indexes. These indexes were considered with reference to specific parts of the stimuli (called "areas of interest", AOI). In our case, the AOI were the parts of the screen where the main actions for each video happened. The indexes were: First Fixation Duration (FFD), Observation Count (OC, the number of visits and re-visits to an AOI), and Observation Length (OL, the total time in milliseconds for every time a person has looked within an AOI). The first two indexes give an indication of attention towards the actions shown in the videos,

Table 4
Study 2: Means and Standard Deviations of Physiological and Behavioral Indexes, and Emotions.

	Bullying video				Cyberbullying video			
	Boys		Girls		Boys		Girls	
	Non-victims Mean (SD)	Victims Mean (SD)	Non-victims Mean (SD)	Victims Mean (SD)	Non-victims Mean (SD)	Victims Mean (SD)	Non-victims Mean (SD)	Victims Mean (SD)
FFD	0.33 (0.13)	0.27 (0.12)	0.18 (0.08)	0.24 (0.14)	0.54 (0.16)	0.29 (0.11)	0.25 (0.13)	0.28 (0.22)
OC	8.88 (3.01)	9.44 (1.83)	8.96 (5.52)	7.83 (4.34)	10.24 (2.31)	9.13 (1.28)	9.90 (3.93)	9.87 (3.42)
OL	10.70 (1.44)	9.60 (2.14)	9.98 (1.98)	9.24 (2.64)	10.34 (1.36)	9.95 (2.14)	10.29 (1.23)	8.60 (2.67)
SCL	2.83 (11.99)	-0.92 (1.63)	-0.46 (1.35)	-0.12 (.50)	0.36 (6.92)	-0.14 (2.36)	0.17 (1.89)	-0.20 (1.09)
BVP	0.02 (0.13)	0.02 (0.10)	0.00 (0.057)	-0.03 (0.07)	0.04 (0.05)	-0.00 (0.07)	-0.01 (0.14)	-0.01 (0.04)
PVA	-0.52 (7.33)	-3.36 (11.94)	-3.65 (7.86)	6.31 (13.20)	-2.61 (7.58)	1.96 (13.27)	6.42 (10.77)	-3.99 (14.36)
Pulse	-0.82 (1.53)	-2.52 (12.30)	3.70 (8.19)	-0.93 (5.28)	-1.70 (1.51)	-1.21 (10.92)	2.98 (5.86)	-0.94 (5.61)
Anger	4.60 (1.34)	4.56 (1.67)	4.30 (2.21)	4.82 (1.78)	3.80 (1.64)	1.44 (1.01)	3.90 (1.73)	2.55 (2.07)
Fear	1.80 (0.84)	1.11 (0.33)	1.70 (1.16)	2.18 (1.72)	2.40 (2.61)	1.00 (0.00)	1.50 (0.85)	1.00 (0.00)
Sadness	4.60 (1.95)	4.22 (2.17)	3.10 (2.08)	3.73 (1.79)	3.00 (1.58)	1.67 (1.00)	4.00 (1.83)	2.55 (2.02)
Disgust	3.40 (1.67)	4.89 (2.32)	3.30 (2.16)	3.00 (2.10)	2.80 (1.48)	1.78 (0.83)	1.90 (1.59)	1.18 (0.40)
Blame	3.00 (1.87)	1.11 (0.33)	2.40 (1.90)	2.45 (2.34)	3.20 (2.05)	1.11 (0.33)	1.10 (.32)	1.64 (1.57)
Shame	4.00 (2.83)	2.22 (1.86)	2.80 (2.04)	2.09 (1.51)	3.20 (1.92)	1.11 (0.33)	2.30 (1.77)	2.36 (1.86)
Anxiety	3.80 (2.17)	2.78 (2.11)	2.20 (1.99)	2.18 (1.40)	3.40 (2.07)	1.11 (0.33)	2.10 (1.66)	2.45 (1.81)
Despair	2.40 (2.19)	1.89 (1.36)	1.30 (0.95)	1.45 (1.21)	2.80 (2.05)	1.11 (0.33)	1.10 (0.32)	1.00 (0.45)
	Prosocial video				Neutral video			
	Boys		Girls		Boys		Girls	
	Non-victims Mean (SD)	Victims Mean (SD)	Non-victims Mean (SD)	Victims Mean (SD)	Non-victims Mean (SD)	Victims Mean (SD)	Non-victims Mean (SD)	Victims Mean (SD)
FFD	0.32 (0.14)	0.42 (0.46)	0.18 (0.12)	0.25 (0.18)	0.39 (0.10)	0.43 (0.29)	0.32 (0.15)	0.31 (0.22)
OC	7.00 (3.05)	6.18 (1.64)	7.42 (7.27)	6.44 (5.51)	9.88 (2.41)	9.69 (1.78)	10.00 (4.05)	8.60 (3.54)
OL	10.97 (1.57)	10.31 (2.18)	11.18 (3.14)	10.05 (3.70)	10.08 (1.68)	10.40 (1.38)	10.02 (1.68)	8.60 (3.29)
SCL	-1.73 (1.45)	1.05 (3.45)	-0.21 (1.89)	0.13 (2.35)	-0.46 (4.36)	0.60 (3.24)	-0.49 (1.52)	0.15 (1.65)
BVP	0.05 (0.08)	-0.03 (0.16)	0.05 (0.13)	-0.04 (0.11)	0.03 (0.07)	-0.01 (0.10)	0.02 (0.08)	-0.02 (0.10)
PVA	-5.42 (11.23)	5.28 (9.57)	1.73 (7.69)	3.19 (19.59)	-2.51 (10.91)	-1.12 (7.78)	2.33 (11.10)	-0.33 (22.32)
Pulse	0.21 (3.53)	-2.87 (11.89)	2.34 (7.57)	0.12 (5.93)	-0.35 (2.43)	-1.77 (13.22)	4.30 (6.45)	-2.30 (10.76)
Anger	1.60 (0.89)	1.00 (0.00)	1.50 (1.27)	1.27 (0.65)	1.60 (0.89)	1.22 (0.67)	1.50 (0.85)	1.55 (1.04)
Fear	1.80 (1.30)	1.11 (0.33)	1.90 (1.52)	1.36 (.92)	1.40 (0.55)	1.00 (0.00)	1.20 (0.42)	1.09 (0.30)
Sadness	4.40 (1.14)	2.89 (1.62)	3.90 (2.28)	3.00 (1.48)	2.00 (1.00)	1.67 (1.00)	1.90 (1.66)	1.64 (1.03)
Disgust	1.40 (0.89)	1.00 (0.00)	1.40 (1.26)	1.09 (0.30)	1.60 (0.55)	1.22 (0.67)	1.10 (0.32)	1.27 (0.90)
Blame	1.20 (0.45)	1.00 (0.00)	1.30 (0.95)	1.09 (0.30)	1.00 (0.00)	1.67 (2.00)	1.50 (1.27)	1.09 (0.30)
Shame	1.00 (0.00)	1.00 (0.00)	1.20 (0.63)	1.00 (0.00)	1.13 (0.52)	1.00 (0.00)	1.20 (0.45)	1.22 (0.67)
Anxiety	2.60 (1.67)	1.67 (0.71)	2.40 (1.78)	1.18 (0.40)	2.80 (2.49)	1.22 (0.44)	2.00 (1.76)	1.27 (0.90)
Despair	2.20 (1.30)	1.67 (1.12)	1.30 (0.67)	1.09 (0.30)	1.60 (1.34)	1.44 (0.73)	1.10 (0.32)	1.09 (0.30)

Note. FFD: First Fixation Duration; OC: Observation Count; OL: Observation Length; SCL: Skin Conductance Level; BVP: Blood Volume Pulse; PVA: Pressure Volume Amplitude; Pulse: Pulse Frequency.

while the indexes linked to the observations inform us more about the cognitive elaboration of the presented events.

Considering the FFD index, a main effect of gender emerged, $F(1, 31)=8.91, p<.01, \eta^2=.22$ (see Table 5). The within subjects tests did not highlight any significant effect of the videos, $F(3, 93)=2.13, p=.10, \eta^2=.06$, but a planned contrast analysis (corrected with the Sidak equation) highlighted a significant difference between the video on bullying and the neutral video, $F(1, 31)=7.51, p<.01, \eta^2=.19$, and a significant interaction effect between the type of video and the victimization condition, regarding the difference between the prosocial and the cyberbullying video, $F(1, 31)=3.38, p=.05, \eta^2=.10$. The cyberbullying video captured more the early attentional reaction of those that had never been bullied, while the opposite was true for the prosocial video. Analyzing the OC, the within subjects test highlighted a main effect of the videos, $F(3, 93)=6.54, p<.001, \eta^2=.17$. A planned contrast analysis (corrected with the Sidak equation) on the same data highlighted a significant difference between neutral and the prosocial videos, $F(1, 31)=8.17, p<.01, \eta^2=.21$, and between the prosocial and the cyberbullying videos, $F(1, 31)=11.61, p<.001, \eta^2=.27$. The prosocial video had the lowest number of observations.

Emotional Responses

Whit regards to the main results, the main effect of the type of video was significant for several emotional reactions, as displayed

in Table 6. When considering the pairwise comparison tests, higher levels of anger and disgust were elicited by the bullying video in comparison to the other videos, and by the cyberbullying video in comparison to the prosocial and the neutral videos. Bullying and cyberbullying did not differ from each other for the shame and blame emotions, but elicited higher levels of these emotions than the other peer-interactions. Watching bullying situations also caused higher sadness than watching neutral peer interactions and cyberbullying, which, in turn, elicited significantly higher sadness emotion than witnessing neutral peer interactions. Bullying, but not cyberbullying, also caused higher emotional responses of anxiety than the other peer-interactions. Lastly, a marginal effect ($p=.090$) of despair appeared, which was due to the higher emotional response elicited by the bullying video in comparison to the neutral one.

Several significant main and interaction effects of being a victim during the middle or high school also appeared. First, the main effect of having been a victim was significant for the fear emotion but, partially unexpectedly, victims scored lower than non-victims for this emotion when watching peer interactions. The two way effect of type of video x having been a victim was significant for anger, and the follow-up ANOVAs showed that when watching cyberbullying the victims scored lower than non-victims, $F(1, 33)=9.86, p=.005, \eta^2=.23$.

The three-way interaction effect of video x gender x having been a victim was significant for blame and marginal for

Table 5
Study 2: Summary of ANOVA Indexes for Physiological Indexes and Eye Movements a Dependent Variables.

	First fixation duration		Observation count		Observation length		Skin conductance level		Blood volume pulse		Pressure volume amplitude		Pulse frequency	
	<i>F</i> (<i>df</i>)	η^2	<i>F</i> (<i>df</i>)	η^2	<i>F</i> (<i>df</i>)	η^2	<i>F</i> (<i>df</i>)	η^2	<i>F</i> (<i>df</i>)	η^2	<i>F</i> (<i>df</i>)	η^2	<i>F</i> (<i>df</i>)	η^2
Video	2.134 (3, 93)	.064	6.564 (3, 93) ^{***}	.175	2.193 (3, 93)	.066	0.323 (3, 93)	.010	0.007 (3, 93)	.000	0.069 (3, 93)	.002	0.017 (3, 93)	.001
Being victim	00.001 (1, 31)	.001	0.356 (1,31)	.011	1.193 (1, 31)	.037	0.005 (1, 31)	.000	2.740 (1, 31)	.081	0.143 (1, 31)	.005	1.120 (1, 31)	.035
Gender	8.908 (1, 31) ^{**}	.223	0.028 (1, 31)	.001	1.017 (1, 31)	.032	0.126 (1, 31)	.004	0.700 (1, 31)	.022	0.066 (1, 31)	.002	0.866 (1, 31)	.027
Video x being victim	1.502 (3, 93)	.046	0.066 (3, 93)	.002	0.225 (3, 93)	.007	3.400 (3, 93) [†]	.099	0.954 (3, 93)	.030	0.299 (3, 93)	.010	0.505 (3, 93)	.016
Video x gender	0.277 (3, 93)	.009	0.246 (3, 93)	.008	0.564 (3, 93)	.018	0.700 (3, 93)	.022	0.201 (3, 93)	.006	1.224 (3, 93)	.038	0.091 (3, 93)	.003
Being victim x gender	0.812 (1, 31)	.026	0.054 (1, 31)	.002	0.169 (1, 31)	.005	0.034 (1, 31)	.001	0.002 (1, 31)	.000	1.848 (1, 31)	.056	0.287 (1, 31)	.009
Video x being victim x gender	1.321 (3, 93)	.041	0.328 (3, 93)	.010	1.262 (3, 93)	.039	3.051 (3, 93) [†]	.090	0.286 (3, 93)	.009	2.581 (3, 93) [†]	.077	0.990 (3, 93)	.031

[†] $p < .10$

* $p < .05$

** $p < .01$

*** $p < .001$

Table 6
Study 2: Summary of ANOVA Indexes for Emotions as Dependent Variables.

	Anger		Fear		Sadness		Disgust		Blame		Shame		Anxiety		Despair	
	<i>F</i> (<i>df</i>)	η^2	<i>F</i> (<i>df</i>)	η^2	<i>F</i> (<i>df</i>)	η^2	<i>F</i> (<i>df</i>)	η^2	<i>F</i> (<i>df</i>)	η^2	<i>F</i> (<i>df</i>)	η^2	<i>F</i> (<i>df</i>)	η^2	<i>F</i> (<i>df</i>)	η^2
Video	40.423 ^{***} (3, 93)	.566	1.822 (3, 93)	.056	12.388 ^{***} (3, 93)	.286	24.748 ^{***} (3, 93)	.444	5.317 ^{**} (3, 93)	.146	15.275 ^{***} (3, 93)	.330	4.333 ^{**} (3, 93)	.123	2.197 [†] (3, 93)	.066
Being victim	4.115 [*] (1, 31)	.117	5.577 [*] (1, 31)	.152	3.231 [†] (1, 31)	.094	0.561 (1, 31)	.018	2.839 (1, 31)	.084	4.869 [†] (1, 31)	.136	4.725 [*] (1, 31)	.132	2.187 (1, 31)	.066
Gender	0.518 (1, 31)	.016	0.037 (1, 31)	.001	0.042 (1, 31)	.001	3.857 [†] (1, 31)	.111	0.116 (1, 31)	.004	0.284 (1, 31)	.009	1.101 (1, 31)	.034	7.560 ^{**} (1, 31)	.196
Video x being victim	3.676 [*] (3, 93)	.106	1.346 (3, 93)	.042	1.874 (3, 93)	.057	1.804 (3, 93)	.055	1.324 (3, 93)	.041	2.225 [†] (3, 93)	.067	0.526 (3, 93)	.017	2.080 (3, 93)	.063
Video x gender	0.338 (3, 93)	.011	1.455 (3, 93)	.045	2.250 [†] (3, 93)	.068	1.099 (3, 93)	.034	1.355 (3, 93)	.042	0.766 (3, 93)	.024	1.446 (3, 93)	.045	0.647 (3, 93)	.020
Being victim x gender	1.186 (1, 31)	.037	2.389 (1, 31)	.072	0.257 (1, 31)	.008	0.186 (1, 31)	.006	2.752 (1, 31)	.082	2.198 (1, 31)	.066	1.519 (1, 31)	.047	1.744 (1, 31)	.053
Video x being victim x gender	0.090 (3, 93)	.003	0.553 (3, 93)	.018	0.235 (3, 93)	.008	1.389 (3, 93)	.043	4.043 ^{**} (3, 93)	.115	1.512 (3, 93)	.047	2.392 [†] (3, 93)	.072	1.633 (3, 93)	.050

[†] $p < .10$

* $p < .05$

** $p < .01$

*** $p < .001$

anxiety. In follow-up ANOVAs, among boys victims reported significant lower blame than non-victims when watching bullying, $F(1, 12) = 9.24, p = .01, \eta^2 = .44$, and cyberbullying, $F(1, 12) = 9.52, p < .05, \eta^2 = .44$). No significant differences emerged among girls. Lastly, cyberbullying also elicited lower levels of anxiety in victims than non-victims among boys, $F(1, 12) = 11.17, p = .01, \eta^2 = .48$.

Discussion

SCL data derived from the young adults sample seems to be contradictory, since the victims showed lower average SCL in response to bullying and cyberbullying videos. If it is true that, as we argued before, SCL can be used as reliable index for the level of stress, it is also true that average SCL is more related to cognitive response, and maximum SCL and rising time to maximum amplitude are more related to emotional responses in young adults and adults (Lee et al., 2010). Following this line of reasoning, the fact that we used the averaged SCL values could explain the counterintuitive results. Future studies should use longer videos that allow studying differences in SCL peaks.

Behavioral data highlighted some expected results (bullying and cyberbullying videos elicited more active responses overall) but also an interesting pattern for early attentional responses. Apparently, victims tend to diverge their early attentional response from bullying and cyberbullying videos. This data is coherent with the fact that victims showed lower SCL levels – it is possible that overall, being more familiar with the situation and being able to anticipate the negative emotional reactions, victims tended to avoid focusing their attention to the key scenes early on. Studies on attention location showed that negative emotions predict early attention allocation but with incongruent stimuli (Li et al., 2014), while our videos on bullying and cyberbullying were congruent and predictable.

When considering the self-report of emotional reactions, a similar pattern related to have been victimized appeared. In comparison to non-victims, victims reported lower levels of fear, regardless the type of video, and of anger when watching cyberbullying. These results suggest that among young adults, victims may use defence and coping mechanism of avoidance to control for all negative emotions related to peer, and especially cyberbullying situations. In the overall sample, watching bullying and cyberbullying situations elicited higher levels of negative emotions than witnessing prosocial or neutral situations. But the exposure to bullying elicited higher levels of anger, disgust, and sadness than the vision of cyberbullying. It seems that off-line bullying more than cyberbullying elicits in witnesses emotions, which are negative but also potentially able to motivate to intervene, such as anger and disgust (Barhight et al., 2013).

Conclusions

This research project contributes to the literature on emotional impact of cyberbullying in victims and in young people, regardless of being victimized, by assessing emotional responses to cyberbullying situations, in comparison to bullying and other types of peer interactions. Besides self-reports, also physiological (Study 1 and 2) and behavioral (Study 2) data were collected, which are more precise measures for stress, and emotional and cognitive reactions.

Victims vs. Non-Victims

Results on physiological indexes from Study 1 indicate that, among adolescents, victims and non-victims did not differ in the levels of stress elicited by the exposure to cyberbullying and bullying. Nevertheless, watching cyberbullying situations actually

elicits higher stress than witnessing other peer interactions, including bullying, among victimized boys but not among victimized girls. When considering self-reports of emotions, i.e., the personal perception of feelings, adolescents who have been bullied, in comparison to non-victims, reported to experience higher fear and sadness when watching cyberbullying situations, whereas victims and non-victims did not differ in their emotional experience when watching bullying. Hence, cyberbullying may be felt by adolescent victims as a scaring experience. This is in line with the literature reporting that feelings of sadness and fear are more typical of cyber-victims (Giménez-Gualdo, Hunter, Durking, Arnaiz, & Maquilón, 2015). However, our results also indicate that cyberbullying is not more stressing and emotional than traditional bullying for all the victims. This outcome supports only partially the hypothesis that electronic bullying elicits higher stress in victims and can have a worse negative emotional impact than non-ICT bullying. It is likely that different clusters of victims need to be distinguished, aligned with the literature showing that the emotional impact of being bullied or cyberbullied is not identical for all the adolescents, with some adolescents who are not upset by cyberbullying or by the traditional bullying (Ortega et al., 2009). Furthermore, we did neither examine emotional reactions to the exposure to indirect bullying, i.e., bullying which is perpetrated by means of social exclusion, or relational and less explicit attacks (e.g., Ortega & Mora-Merchán, 2008), nor distinguished between victims of direct or indirect bullying. Recent literature suggests that studying the emotional impact of ICT bullying in comparison to both forms of traditional bullying (Horner, Asher, & Fireman, 2015) can be relevant, and indicates that the emotional responses to cyberbullying are more similar to the responses to the indirect forms of bullying than to the reactions to direct bullying (Ortega et al., 2009). Following this line of research, it is possible that, if examining stress and the emotional outcomes of cyberbullying in comparison to indirect and direct forms of bullying, different overlaps of the consequences elicited by these three forms of victimization can emerge.

Among young adults (Study 2), we found a different pattern of results, which may imply possible age-related differences. Also in this sample the exposure to cyberbullying did not elicit higher stress in victims, as assessed by physiological indexes, in comparison to bullying. Furthermore, adults who were victimized during their school years showed lower levels of activation, i.e., lower stress, than non-victims when watching both cyberbullying and bullying situations, and reported lower levels of negative emotions (anger, sadness and, among boys, anxiety), when watching cyberbullying situations. It may be due to the fact that these youth suffered more face to face bullying than cyberbullying at school. However, when considering that in general young adults who were victimized at school reported lower levels of emotion than peers (see Table 3), it is also possible that these youth have developed a kind of resignation to what happens in cyberbullying and bullying, and more negative expectations about the possibility of having positive interactions with peers. This explanation agrees with the literature suggesting that victims of bullying develop specific relational schemata, which would favor the anticipation that bullying will probably happen during peer interactions (Rosen, Milich, & Harris, 2007). When watching peers interacting, victims may anticipate that the situation will develop in bullying and feel low levels of emotions because they expect this outcome. Another possibility is that this outcome mirrors the associations existing between being victimized by peers and developing external locus of control mechanisms and depressive symptoms. Studies indicate that bullied children and adolescents show higher levels of externality of the locus of control, related in particular to the domain of relationships with peers (Caravita, 2007). This external locus of control may lead to developing feelings of learnt impotence in the relationships with peers, and is likely to be associated to higher

depressive symptoms (Klomek, Marrocco, Kleinman, Schonfeld, & Gould, 2007). Suffering more from depressive symptoms, victims are also likely to be less emotionally reactive. This mechanism may be evident in adults (Study 2) and not in adolescents (Study 1), because adolescents are still facing bullying and may have not fully developed these feelings and symptoms, which, on the contrary, may appear in adults.

Considering the higher externality of the locus of control that is typical of victims, the feeling that the situation is unchangeable is associated to higher use of emotion-focused coping (Olafssen & Johansdottir, 2004; Zapf & Gross, 2001), such as avoidance coping. Accordingly, we found that bullying and cyberbullying videos elicited more cognitively active responses, but adult victims had lower cognitive processing and especially delayed attentional allocation when watching bullying and cyberbullying videos. This behavior may mirror a tendency of victims to distance from the bullying situations. When starting to witness episodes of potential bullying or cyberbullying, the cognitive schemata of the victims (Rosen et al., 2007) anticipate the development of the situation and the victims tend to diverge from a direct confrontation with the situation by diverging their attention. Lastly, the reduced emotional response of victims in the adult sample might also mirror resilience processes (e.g., Schwartz, Proctor, & Chien, 2001), which may have helped victims of bullying, at least to some extent, to develop better emotion regulation mechanisms over time than the ones expressed by the adolescent victims.

Emotional Impact of Type of Video on Youth

Partially according to our hypothesis, regardless of the role of involvement in bullying, in both studies the cyberbullying and the bullying videos elicited higher levels of physiological activation, behavioral attention (Study 2), and negative emotions than other peer interactions. Nevertheless, cyberbullying did not cause higher stress or negative emotional responses than bullying. It may have happened because face-to-face bullying is perceived as more serious than cyberbullying and may also mirror easier use of moral disengagement mechanisms (e.g., Caravita, Sijtsema, Rambaran, & Gini, 2014), such as minimizing seriousness of the action consequences or blaming the victim for cyberbullying situations than bullying situations. Such moral disengagement mechanisms can also work for bystanders (Obermann, 2011), and may lead witnesses to empathize less with the victim of cyberbullying than the victim of face-to-face bullying, because negative consequences of bullying and victim's pain are more explicit in the case of traditional bullying.

Limitations and Future Directions

There are some limitations in this research project. First, samples sizes were appropriate for testing differences across groups for the physiological and the behavioral indexes (e.g. Barhight et al., 2013), but lead to interpret the results for the self-report measures more cautiously. Nevertheless, some significant differences in self-reported emotions appeared, thus supporting the strengths of these effects. A second limitation was due to the retrospective nature of Study 2. The decision to involve a young adult sample was mainly due to the technical characteristics of the eye-tracker we used, which is recommended to be used with adults for better accuracy. Future studies testing eye movements with adolescent samples may confirm our results. Another limitation was that due to the size of the samples we could not distinguish among groups of victims, based on being victimized in cyberspace, face-to-face, or both ways. Lastly, the emotional reactions to cyberbullying could only be tested by exposing victims and non-victims to

videos representing such peer interactions. This method was dictated by the impossibility to assess physiological indexes and eye movements in actual cyberbullying and bullying situations, and it assumes that participants identified with the situations represented in the videos and reacted accordingly. However, the use of a similar methodology in at least another study on bullying (Barhight et al., 2013) gives some support to the appropriateness of this choice. Besides these limitations, this study is the first to investigate the emotional impact of cyberbullying by directly assessing psychophysiological and behavioral indexes, (i.e., one of the most precise assessment of distress, and cognitive and emotional reactions). Findings from this study clearly indicate that being exposed to cyberbullying causes stress and negative emotions in witnesses, and in adolescent victims of bullying, providing some evidence that cyberbullying is a possible risk factor for the health of youth who are exposed to this form of aggression.

Conflict of Interest

The authors of this article declare no conflict of interest.

References

- Antonietti, A., Colombo, B., & Di Nuzzo, C. (2015). Metacognition in self-regulated multimedia learning: Integrating behavioural, psychophysiological and introspective measures. *Learning, Media And Technology*, 40, 187–209.
- Antonietti, A., Colombo, B., & Lozotsev, Y. (2008). Undergraduates' metacognitive knowledge about the psychological effects of different kinds of computer-supported instructional tools. *Computers in Human Behavior*, 24, 2172–2198.
- Barhight, L. R., Hubbard, J. A., & Hyde, C. T. (2013). Children's physiological and emotional reactions to witnessing bullying predict bystander intervention. *Child Development*, 84, 375–390.
- Boucsein, W. (2012). *Electrodermal activity*. New York: Springer.
- Brunstein Klomek, A., Marrocco, F., Kleinman, M., Schonfeld, I. S., & Gould, M. S. (2007). Bullying, Depression, and Suicidality in Adolescents. *Journal of the American Academy of Child & Adolescent Psychiatry*, 46, 40–49. <http://dx.doi.org/10.1097/01.chi.0000242237.84925.18>
- Caravita, S. C. S. (2007). Locus of control e autostima in bambini italiani di scuola primaria autori e oggetto di prevaricazioni. *Rassegna di Psicologia*, 14, 77–94.
- Caravita, S. C. S., Fabio, R. A., & Pagnin, A. (2003). Bullying and cognitive elaboration of television stimuli. Poster communication at Xlth European Conference on Developmental Psychology, 27th–31st of August.
- Caravita, S. C. S., Sijtsema, J. J., Rambaran, J. A., & Gini, G. (2014). Moral disengagement development: Peer influences on cognitive self-justification mechanisms of social transgression. *Journal of Youth and Adolescence*, 5, 193–207. <http://dx.doi.org/10.1007/s10964-013-9953-1>
- Colombo, B., Antonietti, A., Sala, R., & Caravita, S. C. S. (2013). Blog Content and Structure, Cognitive Style and Metacognition. *International Journal of Technology And Human Interaction*, 9(3), 1–17. <http://dx.doi.org/10.4018/jthi.2013070101>
- Colombo, B., Di Nuzzo, C., & Mazzucchelli, N. (2010). The role of visual and audio code in the cognitive elaboration of multimedia emotional stimuli. In J. Sanchez & K. Zhang (Eds.), *Proceedings of World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education 2010* (pp. 1666–1671). Chesapeake, VA: AACE.
- Colombo, B., Di Nuzzo, C., Missaglia, S., Mordente, A., Antonietti, A., Casolo, F., & Taviano, D. (2013). Exploring the positive involvement of primary motor cortex in observing motor sequences with music: a pilot study with tDCS. *Sport Sciences for Health*, 9, 89–96. <http://dx.doi.org/10.1007/s11332-013-0149-6>
- Colombo, B., Grati, L., Di Nuzzo, C., & Antonietti, A. (2013). The role of individual creativity levels in the cognitive and emotive evaluation of complex multimedia stimuli. A study on behavioural data and psycho-physiological indices. In A. Antonietti, B. Colombo, & D. Memmert (Eds.), *Psychology of creativity: Advances in theory, research and application* (pp. 195–216). Hauppauge, NY: Nova Science Publishers.
- Delaney, J. P., & Brodie, D. A. (2000). Effects of short-term psychological stress on the time and frequency domains of heart-rate variability. *Perceptual and Motor Skills*, 91, 515–524.
- Ekman, P., Sorenson, E. R., & Friesen, W. V. (1969). Pan-cultural elements in facial displays of emotion. *Science*, 164(3875), 86–88.
- Fenaughty, J., & Harré, N. (2013). Factors associated with young people's successful resolution of distressing electronic harassment. *Computers & Education*, 61, 242–250. <http://dx.doi.org/10.1016/j.compedu.2012.08.004>
- Giménez-Gualdo, A. M., Hunter, S. C., Durkin, K., Arnaiz, P., & Maquilón, J. J. (2015). The emotional impact of Cyberbullying: Differences in perceptions and experiences as a function of role. *Computer & Education*, 82, 228–235. <http://dx.doi.org/10.1016/j.compedu.2014.11.013>
- Graham, S., & Juvonen, J. (2001). An attributional approach to peer victimization. In J. Juvonen & S. Graham (Eds.), *Peer harassment in school: The plight of the vulnerable and victimized* (pp. 49–72). New York: Guilford.

- Hinduja, S., & Patchin, J. W. (2008). Cyberbullying: An exploratory analysis of factors related to offending and victimization. *Deviant Behavior*, 29, 129–156. <http://dx.doi.org/10.1080/01639620701457816>
- Hjortskov, N., Rissen, D., Blangsted, A. K., Fallentin, N., Lundberg, U., & Sogaard, K. (2004). The effect of mental stress on heart rate variability and blood pressure during computer work. *European Journal of Applied Physiology*, 92, 84–89.
- Horner, S., Asher, Y., & Fireman, G. D. (2015). The impact and response to electronic bullying and traditional bullying among adolescents. *Computers in Human Behavior*, 49, 288–295. <http://dx.doi.org/10.1016/j.chb.2015.03.007>
- Kim, Y. S., & Leventhal, B. (2008). Bullying and suicide. A review. *International Journal of Adolescent Medicine and Health*, 20, 133–154.
- Kowalski, R. M., Giumetti, G. W., Schroeder, A. N., & Lattanner, M. R. (2014). Bullying in the Digital Age: A Critical Review and Meta-Analysis of Cyberbullying Research Among Youth. *Psychological Bulletin*, 140, 1073–1137. <http://dx.doi.org/10.1037/a0035618>
- Lang, P. J., Bradley, M. M., & Cuthbert, B. N. (1997). *International affective picture system (IAPS): Technical manual and affective ratings*. Gainesville, FL: NIMH Center for the Study of Emotion and Attention.
- Lee, S. J., Yang, J. W., Kim, J. H., Choi, M. H., Mun, K. L., Kim, H. S., & Chung, S. C. (2010). Analysis of skin conductance level for cognitive and emotional responses associated with unexpected situation during driving. *Journal of the Ergonomics Society of Korea*, 29, 869–874.
- Li, W., Jiang, Z., Liu, Y., Wu, Q., Zhou, Z., Jorgensen, N., & Li, C. (2014). Positive and negative emotions modulate attention allocation in color-flanker task processing: Evidence from event related potentials. *Motivation and Emotion*, 38, 451–461. <http://dx.doi.org/10.1007/s11031-013-9387-9>
- Neath, K. N., & Itier, R. J. (2014). Facial expression discrimination varies with presentation time but not with fixation on features: A backward masking study using eye-tracking. *Cognition and Emotion*, 28, 115–131. <http://0-dx.doi.org.sbdapac.unicatt.it/10.1080/02699931.2013.812557>
- Nocentini, A., Calmaestra, J., Schultze-Krumbholz, A., Scheithauer, H., Ortega, R., & Menesini, E. (2010). Cyberbullying: Labels, Behaviours and Definition in Three European Countries. *Australian Journal of Guidance & Counselling*, 20(2), 129–142.
- Obermann, M. L. (2011). Moral Disengagement Among Bystanders to School Bullying. *Journal of School Violence*, 10, 239–257. <http://dx.doi.org/10.1080/15388220.2011.578276>
- Olafssen, R., & Johansdottir, H. (2004). Coping with bullying in the workplace: the effect of gender, age and type of bullying. *British Journal of Guidance and Counselling*, 32, 319–333.
- Olweus, D. (1991). Bully-Victim Problems among School Children: Basic Effects of a School Based Intervention Program. In D. Pepler & K. Rubin (Eds.), *The Development and Treatment of Childhood Aggression* (pp. 411–448). Hillsdale, NJ: Erlbaum.
- Ortega, R., Elipe, P., Mora-Merchán, J. A., Calmaestra, J., & Vega, E. (2009). The Emotional Impact on Victims of Traditional Bullying and Cyberbullying. *Journal of Psychology*, 217, 197–204. <http://dx.doi.org/10.1027/0044-3409.217.4.197>
- Ortega, R., & Mora-Merchán, J. A. (2008). Las redes de iguales y el fenómeno del acoso escolar: explorando el esquema dominio-sumisión. *Infancia y Aprendizaje*, 31, 515–528.
- Patchin, J. W., & Hinduja, S. (2006). Bullies Move Beyond the Schoolyard: A Preliminary Look at Cyberbullying. *Youth Violence and Juvenile Justice*, 4, 148–169.
- Reijntjes, A., Kamphuis, J. H., Prinzie, P., & Telch, M. J. (2010). Peer victimization and internalizing problems in children: A meta-analysis of longitudinal studies. *Child Abuse, Neglect*, 34, 244–252. <http://dx.doi.org/10.1016/j.chabu.2009.07.009>
- Rodríguez-Hidalgo, A. J., Ortega-Ruiz, R., & Monks, C. P. (2015). Peer-victimisation in multi-cultural contexts: A structural model of the effects on self-esteem and emotions. *Psicología Educativa*, 21, 3–9. <http://dx.doi.org/10.1016/j.pse.2015.02.002>
- Rosen, P. J., Milich, R., & Harris, M. J. (2007). Victims of Their Own Cognitions: Implicit Social Cognitions, Emotional Distress, and Peer Victimization. *Journal of Applied Developmental Psychology*, 28, 211–226.
- Schmid, P. C., Schmid Mast, M., Bombardi, D., Mast, F. W., & Lobmaier, J. S. (2011). How mood states affect information processing during facial emotion recognition: An eye tracking study. *Swiss Journal of Psychology/Schweizerische Zeitschrift für Psychologie/Revue Suisse De Psychologie*, 70, 223–231. <http://dx.doi.org/10.1024/1421-0185/a000060>
- Schwartz, D., Proctor, L. J., & Chien, D. H. (2001). The aggressive victim of bullying: Emotional and behavioural dysregulation as a pathway to victimization by peers. In J. Juvonen, & S. Graham (Eds.), *Peer harassment in school: The plight of the vulnerable and victimized* (pp. 147–174). New York: Guilford.
- Smith, P. K., Mahdavi, J., Carvalho, M., Fisher, S., Russell, S., & Tippett, N. (2008). Cyberbullying: its nature and impact in secondary school pupils. *Journal of Child Psychology and Psychiatry*, 49, 376–385. <http://dx.doi.org/10.1111/j.1469-7610.2007.01846.x>
- Smith, P. K., & Sharp, S. (Eds.). (1994). *School bullying: Insights and perspectives*. London: Routledge.
- Solberg, E. M., & Olweus, D. (2003). Prevalence Estimation of School Bullying With the Olweus Bully/Victim Questionnaire. *Aggressive Behavior*, 29, 239–268.
- Zapf, D., & Gross, C. (2001). Conflict escalation and coping with workplace bullying. In D. Zapf & S. Einarsen (Eds.), *Recent trends in research on workplace bullying. Special issue of the European Journal of Work and Organizational Psychology*. Hove: Psychology Press.