Psychology of Popular Media

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Videogames, including smartphone app games, can be effective teachers. Meta-analytic reviews find that prosocial media can increase empathy and prosocial behavior. We developed a prosocial smartphone app game, Random App of Kindness (RAKi), using theoretically informed empathy-building practices, in the hopes of increasing empathy and prosocial behavior, and decreasing aggressive behaviors. RAKi includes nine mini-games that take only seconds to play (e.g., recognizing emotions, caring for a crying baby, petting a sad dog). We randomly assigned 106 preteens and teens aged 10–17 (and their parents) to play RAKi or a control app for 2 months. We assessed baseline and postintervention scores on empathy, prosocial behavior, and aggression-related outcomes in the laboratory. Participants who played RAKi (compared to a control app) felt more compassion for someone in need, behaved in empathic ways while interacting with a stranger, were less likely to endorse physical aggression, and behaved less aggressively toward a peer (if they started with lower trait empathy). However, RAKi did not significantly influence participants' trait empathy levels. Media can be used for good or ill. RAKi appears to accomplish a number of positive outcomes after only 2 months of gameplay.

> **Public Policy Relevance Statement**
> We created and tested an empathy-building app called Random App of Kindness. We found that playing the app for 2 months increased participants' (age 10–17) empathy and reduced their aggressiveness, compared to playing a control app. Thus, it is possible to use smartphones to increase prosocial outcomes in youth.

Keywords: empathy, prosocial behavior, aggression, smartphone app, adolescents

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Empathy has been described as the "glue of the social world, drawing us to help others and stopping us from hurting others" (Baron-Cohen & Wheelwright, 2004). Indeed, magazines, charities, politicians, and celebrities alike encourage their followers to be empathic. This social movement has empirical backing. Psychologists find that empathy helps to promote prosocial behavior and inhibit aggressive behavior (Batson, 2011; Jolliffe & Farrington, 2021). Given its benefits, how can we foster empathy in youth?

Scholars have described empathy as a muscle, and as such, it should be capable of growth and even regeneration with sufficient effort (Konrath et al., 2011). Following this logic, many effective empathy training programs have been designed to explicitly teach empathy, especially among university students and health professionals (meta-analytic effect sizes range from 0.46 to 1.27; Fragkos & Crampton, 2020; Ngo et al., 2022; van Berkhout & Malouff, 2016; Winter et al., 2020).

Although there is much research on broader socio-emotional learning programs in children and teens (Durlak et al., 2011), targeted empathy interventions in youth are less common (van Berkhout & Malouff, 2016). Moreover, most empathy interventions to date are delivered via in-person programs. Thus, there is a need for easily scalable empathy interventions that can reach large groups of youth, especially during critical developmental periods (Malti et al., 2016).

Types of Empathy

Scholars and laypeople use several competing definitions of empathy (Hall & Schwartz, 2019; Hall et al., 2021). A general definition that encompasses this broad literature is that empathy involves *a focus on and concern for others' perspectives and feelings* (Decety & Lamm, 2006). Scholars generally distinguish between cognitive (e.g., perspective taking) and emotional forms of empathy (Davis, 1983; Vossen et al., 2015). Cognitive empathy involves understanding others' feelings and experiences, while emotional empathy has more other-focused (empathic concern/sympathy) and more self-focused (emotional contagion/personal distress) types (see Table 1; Martingano & Konrath, 2022). Empathic concern involves feeling care and compassion for others, while more self-focused forms have overlapping (emotional contagion) or negative (personal distress) emotions in response to others' distress.

There is also an important theoretical and practical distinction between a chronic tendency toward empathy, "trait empathy" (Bryant, 1982; Davis, 1983), versus feeling empathic responses in the moment, "state empathy" (Batson, 2011). Not surprisingly, those scoring higher on trait empathy also have more empathic responses (i.e., feel more compassion) in the moment (Konrath et al., 2018). Importantly, for the cultivation of empathy, if people repeatedly engage in empathic responses when interacting with

Table 1
RAKi Mini-Games

Game	Play description	Theoretical rationale
Slidefaces	In this mini-game, each human character's face is split into three rotating sections. The goal of the game is to match the facial expression to the emotion that is written above	Emotion recognition or empathic accuracy is a skills-based type of empathy (Hall et al., 2009; Ickes, 1997)
Venus flytrap	Players must water and stop watering a Venus flytrap. This game was modeled after the go-no-go task and aims to teach players response inhibition skills	Several aspects of executive function are associated with increased empathy and prosocial behavior (Eisenberg et al., 2003, 2007; Hansen, 2011; Hinnant & O'Brien, 2007; Thoma et al., 2011)
Crying baby	A baby is crying and the player must choose from several items to soothe the baby. The correct item will correspond with the baby's facial expressions and vocal tones while crying	Theorists posit that the development of empathy is rooted within parental care and nurturance (Brown et al., 2012; Preston, 2013; Swain et al., 2012), and research finds that vulnerable targets elicit more empathy (Batson et al., 2005)
Help grandma	Players see an elderly woman with a walker trying to cross a busy street. The player must swipe the woman forward to avoid being hit by a car	This task is meant to induce perspective-taking, which is a cognitive form of empathy (Davis, 1983; Underwood & Moore, 1982). Research has also found that empathy can develop through the practice of prosocial acts (Yogev & Ronen, 1982)
Dance with me	The player is presented with a character who is dressed to dance. The user then has to press the dots in a specific pattern to make music. If the user does not press the dots in the right order, the music goes offbeat, and the dancer stumbles	Research finds that coordinated or synchronous actions between people can help to enhance rapport, build trust, and increase compassion, cooperation, and prosocial behavior (Launay et al., 2013; Reddish et al., 2014; Valdesolo & DeSteno, 2011; Valdesolo et al., 2010). Joint musical action, in particular, is a strong promoter of prosocial behavior (Kirschner & Tomasello, 2010)
Sad dog	In this game, the player is faced with an adorable, sad puppy. The player must pet the dog to make its tail wag and its facial expression change from sad to happy	This game is based on empathy research related to nurturance which suggests that a powerful driver of prosocial behavior is the desire to protect others who are young, cute, and/or vulnerable (Batson et al., 2005). Cute animals seem to help facilitate empathic responses in a similar way as babies or young children (Daly & Morton, 2009; Hyde et al., 1983; Kotrschal & Ortbauer, 2003; Tsai & Kaufman, 2009)
Singing girl	In this game, the player traces the characters' facial expressions (happiness, fear, surprise). This game is based on motor mimicry, with the expectation that the motion of tracing the emotion may elicit that in the player	Research has found that people imitate emotions even when they are exposed to pictures of emotional facial expressions at levels below their conscious awareness (Dimberg et al., 2000)
Angry man	Players are faced with an angry man who is yelling at them. Players tap on each foot on the screen to walk away from the man, and as they do, he becomes quieter, smaller, and looks further away from them	Conflict resolution skills involve finding ways to maintain positive social relationships even amid disagreement or strong negative emotions. There are many different successful conflict resolution programs, and they can help to increase empathy (Şahin et al., 2011)
Bonus round	Players are shown two balloons floating up the screen and asked, "Would you rather be…?" One is more other-oriented (e.g., forgiving, kind) and the other is more self-oriented (e.g., proud, rich). Balloon explodes with fun confetti if other-oriented selected, but deflates and falls to ground if self-oriented selected	Self-affirmation involves reflecting on values that are important to the self (Sherman & Cohen, 2006; Steele, 1988), which can help lead to lower aggression and more prosocial behavior (Thomaes et al., 2009, 2012)

Note. RAKi = Random App of Kindness.

others, over time this may lead to an increase in trait empathy. This is in line with research demonstrating that tasks that initially take much concentration can later become habitual (Ericsson, 2006; Milton et al., 2004). Thus, arousing a state of empathy repeatedly could, over time, develop into increased trait empathy.

Empathy Impacts Prosocial and Aggressive Behavior

Empathy interventions can increase prosocial behavior and reduce aggressive behavior. The *empathy–altruism hypothesis* has clear empirical support, finding that people who score high in trait empathy (Ding & Lu, 2016; Eisenberg & Miller, 1987), or who have been temporarily placed into a high-empathy state (Batson, 2011), are more likely to help others. Conversely, deficits in either trait empathy, and/or situations, practices, and institutions that prevent its arousal, can result in antisocial behavior (Jolliffe & Farrington, 2021).

There is much empirical evidence showing that experimentally inducing a *high-empathy state* can increase prosocial behavior and reduce aggression. Many different situations can arouse empathic states, such as observing others' emotional responses (Depow et al., 2021), being reminded that peers value empathy (Weisz et al., 2022), and exposure to empathic role models (Yazdi et al., 2019). Such state empathy interventions have had success in changing behavioral outcomes such as increasing helping behaviors (Sierksma et al., 2014) and decreasing bullying behaviors in teenagers (Castillo et al., 2013). Some programs have demonstrated positive effects lasting up to 2 months later (Şahin, 2012). Even much simpler perspective-taking empathy interventions that ask participants to imagine another person's experience can lead to improvements in body language toward stigmatized groups (Todd et al., 2011), a reduction in both explicit and implicit bias (Batson, Early, & Salvarani, 1997; Todd et al., 2011), and several helping behaviors such as volunteerism (Mallett et al., 2008), picking up dropped keys (Shih et al., 2009), and offering to befriend a lonely stranger (Fultz et al., 1986). Overall, arousing a high-empathy state has well-documented positive impacts on prosocial behaviors while attenuating antisocial behaviors.

Trait empathy is also associated with more prosocial and less antisocial behavior. Trait-empathic concern predicts volunteerism (Barnett et al., 1983), charitable giving (Kim & Kou, 2014), and helping behavior (Feeney & Collins, 2001). Indeed, empathic concern is so intertwined with the helping behaviors it promotes that it is sometimes categorized alongside them (Zaki & Ochsner, 2012). Trait empathy also correlates negatively with antisocial behaviors (Jolliffe & Farrington, 2021; Vachon et al., 2014). Although small, the negative relationship between aggression and empathy is consistent and occurs across several different measures (Vachon et al., 2014). For example, in one study, teachers, parents, and friends rated children's empathy, and then measured children's aggression using a puppet activity in the laboratory (Strayer & Roberts, 2004). This holistic measurement of empathy revealed a strong negative correlation with physical and verbal aggression toward the puppet.

Yet in comparison to state empathy, it may be more difficult to shift trait empathy. Everyone is born with some empathic capacity (de Waal, 2009), just as everyone is born with muscles. Similarly, just as people have varying levels of athletic abilities, people also have varying levels of empathy (Davis, 1983). Individual differences in empathy appear fairly stable and are related to differing engagement of empathy-related brain regions (Zaki & Ochsner, 2012). Trait empathy is at least partially heritable, with between 27% and 48% of the variance in it explained by genetic factors (Abramson et al., 2020). People who exhibit more empathic tendencies at one time, also tend to show more of these tendencies between several months and several years later. Indeed, one study found that trait empathy was positively correlated across a 17-year period, from preschool to young adulthood (Eisenberg et al., 1999).

Despite the cross-temporal consistency in empathic tendencies, there is still room for individual change in trait empathy. No one is born an athlete; becoming an athlete takes time, practice, and motivation. Since genetic factors only explain up to half of the variation in trait empathy, there are likely equally powerful environmental and behavioral influences that shape trait empathy. Trait empathy can be directly taught and learned from others. For example, more other-oriented parenting styles can elicit higher trait empathy and more prosocial behaviors in children (Koestner et al., 1990; Krevans & Gibbs, 1996; Strayer & Roberts, 2004; Zhou et al., 2002). Conversely, poor socialization and rearing practices may thwart the development of empathy (Eisenberg, 2005; Hoffman, 2000; Krevans & Gibbs, 1996). Given that traits in general, including empathy, begin to crystalize with age (McCrae & Costa, 1982), youth interventions may be more effective at promoting trait empathy, compared to adult interventions.

Smartphone App as an Empathy Intervention

Most empathy interventions take place in classrooms, workplaces, or research laboratories. Although they identify effective practices, like role playing and perspective taking (see above meta-analyses and Table 1), in-person interventions are expensive and have low dissemination potential. Therefore, researchers have begun to explore how emerging technologies, such as smartphones, can be used to train empathy. "While classroom instructions might reach 30 students at a time, mobile and social media have the capacity to reach thousands of teens in that same community" (National Research Council, 2012). A smartphone empathy intervention may be a particularly effective strategy to target American young people, for whom smartphone ownership has become nearly ubiquitous. Ninety-five percent of 13–17-year-olds report smartphone access (Pew Research Center, 2022) and as their functionality continues to expand, it is no surprise that smartphones have become the most common method to access the internet (StatCounter, 2016). With internet access in their pockets, 46% of teens say they are online on a near-constant basis (Pew Research Center, 2022).

Modern media can be used as a powerful tool for social good, and indeed, much research has found that a variety of prosocial media can increase prosocial thoughts, feelings (e.g., compassion), and behaviors (Coyne et al., 2018; Greitemeyer & Mügge, 2014; Prot et al., 2014). Prosocial media not only increases empathy and prosocial behavior, but it also reduces aggressive thoughts and behaviors (Greitemeyer, 2011; Greitemeyer & Osswald, 2009; Greitemeyer et al., 2012).

Experimental research demonstrates that newer types of media and technology can also increase empathy, including video feedback (Lobchuk et al., 2016), text messages (Konrath et al., 2015), and virtual reality (Martingano et al., 2021). Longitudinal research finds that teens who report using more social media experience more

empathic growth in the following year (Vossen & Valkenburg, 2016), perhaps because of greater exposure to others' experiences and perspectives. Indeed, empathic social media messages can be used to generate prosocial behaviors (Guo et al., 2021; Harrell et al., 2022; Huertas et al., 2021) and to reduce hostile behaviors such as hate speech (Hangartner et al., 2021).

Smartphone games in particular may have a unique ability to scaffold players' experiences not only via narrative and audio-visual content, but also by the rules, principles, and objectives governing what teens can do (Koo & Seider, 2010). Experimental studies have found that playing prosocial games can increase empathy and prosocial behaviors such as helping others (Greitemeyer & Mügge, 2014; Greitemeyer & Osswald, 2010), and can produce behaviorally relevant, functional neural changes in fewer than 6 hr of gameplay in adolescents (Kral et al., 2018). In the current study, we combine effective empathy-building practices, using game-based play techniques, delivered with the accessibility of a smartphone app, in order to create a potentially powerful empathy intervention.

In the last decade, several attempts have been made to design a smartphone app to increase empathy and prosocial behaviors. Most of these attempts encourage users to share and explore emotions (Church et al., 2010; Gay et al., 2011; Morris et al., 2010; Sollenberger & Singh, 2022) but they lack a strong foundation in scientific research and theory on empathy. They also lack rigorous experimental validation. For example, the application *Aurora* encourages users to share their emotions using photographs. A pilot study asked 65 users what they thought of the app, and 65% reported they were somewhat or much more comfortable sharing emotions, while 35% indicated that they experienced explicit social support in *Aurora* (Gay et al., 2011). However, this survey did not use a control group, and it is unclear to what extent these responses are due to demand characteristics. Despite its limitations, Gay et al.'s research represent some of the most rigorous testing of empathy-inducing apps to date. Other researchers have interviewed less than 15 users about their subjective experiences with their respective apps (Church et al., 2010; Morris et al., 2010; Sollenberger & Singh, 2022).

There is a critical need to rigorously design and evaluate the potential of smartphone apps to enhance empathy and prosocial outcomes using randomized control trials. Moreover, other measures should be used in conjunction with empathy when determining an app's success, including behavioral measures (prosocial behavior, aggression) and also observer-based measures (e.g., parents, other observers). Finally, prosocial media experiments often focus on the effects of short-term usage, but longer-term experiments are needed to examine more realistic media usage over time.

The Current Study

In this study, we use evidence-based principles of effective empathy-building practices to design a game-based smartphone app for preteens and teens, Random App of Kindness (RAKi). After an iterative design and focus group testing process, we then examine the efficacy of RAKi by randomly assigning 10–17-year-olds to play it for 2 months versus a control app (Two Dots—a popular puzzle-solving game). Participants and their parents came to the lab both before and after the intervention to assess baseline and postintervention scores on a number of outcomes related to empathy, prosocial behavior, and aggression.

Method

Phase 1: App Design

Our multidisciplinary team of scholars reviewed the literature and compiled a list of key empathy-building practices. We then worked with an app development company (HabitatSeven) to develop an application, RAKi, that would target the development of each of these practices in children ages 10 and older. RAKi employs a "mini-game" approach to gameplay: nine fun and challenging mini-game options are presented to players, with each game lasting only a few seconds. The mini-games are centered around small empathy-related tasks, which are designed to exercise "empathy muscles." Mini-games include recognizing emotions correctly, attending to the needs of a crying baby, taking the perspective of an elderly woman crossing the street, and moving in synchrony with an avatar (see Table 1 for descriptions of the mini-games, iPEARlab.org for screenshots, and app stores for free downloadable game). We conducted user testing with teens throughout the process, with assistance from HopeLab and PlayScience. These sessions helped us to finetune design features based on teens' feedback.

Phase 2: Randomized Control Trial of App Efficacy

Participants

For this initial test of RAKi's efficacy, we aimed to collect data from at least 90 participants who completed both lab visits, which a power analysis determined could detect medium effects ($f = .30$; $d = .60$) at 80% power. Since we expected ~15% dropout at Time 2, we oversampled at Time 1.

We received Institutional Review Board approval from Indiana University before data collection began. Our baseline (Time 1) sample consisted of 106 preteens and teens (and one parent/caregiver) recruited from a large Midwestern city. Preteens and teens were 57.5% female, aged 13.93 on average (range 10–17), and their ethnic identification was 51.9% White, 34.9% African-American, 6.6% Asian-American, and 6.6% Hispanic-American. Participating parents/caregivers were 87.5% female, aged 45.7 on average (range 30–70), and their ethnic identification was 57.8% White, 30.8% African-American, 3.8% Asian-American, 5.8% Hispanic-American, and 1.8% Other. Ninety-two participants (87%) returned to the lab approximately 2 months later to complete Time 2 measures. Participants received $20 for the first lab session and $50 for the second lab session to thank them for their time.

Design

The study used a pre-post randomized control trial testing the effect of RAKi compared to a control app (Two Dots) on measures related to empathy, prosocial behavior, and aggression.

Procedure

During Time 1, participants and their parents completed a questionnaire battery that included measures of preteen/teen trait empathy, prosocial behaviors, and aggressive behavior (see descriptions below and Table 2). Then a research assistant directed them to a website where they were randomly assigned to install one of two apps: RAKi (treatment) or Two Dots (control). Research assistants were

Table 2

Description of Measures

Scale	When	Sample item or description	M (SD) T1	M (SD) T2	Cronbach α T1	Cronbach α T2
Trait empathy						
Self-rating	T1 and 2	*Empathic concern:* I often have tender, concerned feelings for people less fortunate than me.	3.79 (0.58)	3.84 (0.69)	.68	.77
		Perspective-taking: I try to look at everybody's side of a disagreement before I make a decision (1 = *does not describe me well*; 5 = *describes me very well*)	3.35 (0.72)	3.40 (0.76)	.75	.80
Parent rating	T1 and 2	*Empathic concern:* My child often has tender, concerned feelings for people less fortunate than him or her.	4.05 (0.73)	3.98 (0.74)	.85	.85
		Perspective-taking: My child tries to look at everybody's side of a disagreement before my child makes a decision (1 = *does not describe him or her well*; 5 = *describes him or her very well*)	3.11 (0.78)	3.09 (0.79)	.88	.87
Accomplice rating	T2 only	*Empathic concern:* He or she often has tender, concerned feelings for people less fortunate than him or her.	N/A	3.56 (0.50)	N/A	.74
		Perspective-taking: He or she tries to look at everybody's side of a disagreement before he or she makes a decision.	N/A	3.21 (0.56)	N/A	.80
		Caring: He or she is a caring person (1 = *does not describe him or her well*; 5 = *describes him or her very well*)	N/A	3.68 (0.66)	N/A	.83
State empathy			T1 Mean	T2 Mean	T1 α	T2 α
Self-reported empathic feelings	T2 only	How did you feel while listening to the radio program? (1 = *very slightly or not at all*, 5 = *extremely*)				
		Compassionate Feelings (e.g., compassionate, sympathetic)	N/A	3.86 (0.95)	N/A	.85
		Personal distress feelings (e.g., disturbed, distressed)	N/A	3.19 (0.86)	N/A	.83
Observer rating of empathic expressions	T2 only	Social interaction questions: • Describe the last time you went to the zoo. • One of you says the word, the next says a word that starts with the last letter of the word just said. Do this until you have said about 10 words in total. Any words will do—you are not making a sentence. • Who is your favorite actor of your own gender? Describe a favorite scene in which this person has acted. • What is the best TV show you have seen in the last month that your partner has not seen? Tell your partner about it. • What foreign country would you most like to visit? What attracts you to this place? • Do you think left-handed people are more creative than right-handed people?				
		For coders: After viewing the video, please make the following judgment: To what extent do you believe that this is an empathic person? (1 = *not very true of this person*, 9 = *very true of this person*)	N/A	6.18 (1.57)	N/A	.79
Prosocial behavior			T1 Mean	T2 Mean	T1 α	T2 α
Katie Banks help	T2 only	Do you have some availability in the next 2 weeks to assist Ms. Banks? (1 = *yes*, 0 = *no*)	N/A	59% help	N/A	N/A
Katie Banks help amount: Low, Med, High	T2 only	Low: up to 3 hr	N/A	49.1%	N/A	N/A
		Medium: 4–6 hr	N/A	32.1%	N/A	N/A
		High: 7 or more hours	N/A	18.9%	N/A	N/A
Self-reported app impact	T2 only	Using this app improved my social skills./Using this app made me a nicer person (1 = *do not agree*, 5 = *strongly agree*)	N/A	2.24 (1.26)	N/A	.92
Self-reported prosocial behavior	T1 and 2	*Public:* I can help others best when people are watching me.	2.48 (0.77)	2.23 (0.93)	.75	.87
		Emotional: I usually help others when they are very upset.	3.67 (0.85)	3.70 (0.92)	.83	.87
		Opportunistic: I believe that donating goods or money works best when I get some benefit.	2.19 (0.83)	2.10 (0.81)	.80	.81
		Dire: I tend to help people who are in a real crisis or need.	3.73 (0.84)	3.77 (0.86)	.68	.79
		Compliant: I never wait to help others when they ask for it.	3.82 (0.86)	3.80 (0.91)	.75	.79
		Anonymous: I think that helping others without them knowing is the best type of situation (1 = *does not describe me at all*, 5 = *describes me greatly*)	2.89 (0.86)	2.86 (0.93)	.74	.82
Parents' ratings of prosocial behavior	T1 and 2	*Public:* My child can help others best when people are watching him or her.	2.39 (0.88)	2.36 (0.96)	.84	.89
		Emotional: My child usually helps others when the other person is very upset.	3.79 (0.86)	3.82 (0.94)	.86	.91

(table continues)

Table 2 (*continued*)

Scale	When	Sample item or description	M (SD) T1	M (SD) T2	Cronbach α T1	Cronbach α T2
		Opportunistic: My child believes that donating goods or money works best when he or she gets some benefit.	2.07 (0.77)	2.12 (0.88)	.80	.87
		Dire: My child tends to help people who are in a real crisis or need.	3.88 (0.85)	3.93 (0.97)	.81	.88
		Compliant: My child never waits to help others when they ask for it.	3.83 (0.99)	3.92 (0.94)	.64	.65
		Anonymous: My child thinks that helping others without the other person knowing is the best type of situation (1 = *does not describe him or her well*; 5 = *describes him or her very well*)	3.02 (0.89)	2.93 (0.84)	.85	.86
Aggressive behavior			T1 Mean	T2 Mean	T1 α	T2 α
Competitive reaction time task	T2 only	Sound blast volume levels (from 1 to 10) averaged across 25 trials multiplied by sound blast duration (from 1 to 10 s) averaged across 25 trials.				
		Volume:	N/A	5.30 (2.27)	N/A	.96
		Duration:		5.01 (2.24)		.95
		Volume × Duration:		31.21 (22.23)		
Self-reported beliefs about aggression	T1 and 2	Suppose a guy says something bad to another guy, John. Do you think it is OK for John to hit him? (1 = *it is really wrong*, 2 = *it is sort of wrong*, 3 = *it is sort of OK*, 4 = *it is perfectly OK*)	1.82 (0.41)	1.72 (0.40)	.89	.90
Self-reported relational aggression	T1 and 2	*Proactive relational aggression:* I have intentionally ignored a person until they gave me my way about something.	1.47 (0.53)	1.41 (0.54)	.63	.75
		Reactive relational aggression: When someone does something that makes me angry, I try to embarrass that person or make them look stupid in front of his/her friends.	1.53 (0.60)	1.46 (0.52)	.72	.68
		Romantic relational aggression: I have given my romantic partner the silent treatment when my feelings were hurt in some way by him or her (1 = *not true at all*, 5 = *very true*)	1.41 (0.50)	1.41 (0.51)	.66	.70
Additional measures			T1 Mean	T2 Mean	T1 α	T2 α
App ratings	T2 only	Preteens/teens were asked to rate the app using three statements: "I would recommend this app to a friend," "I thought the app was interesting," "I enjoyed using the app"	N/A	3.47 (1.28)	N/A	.92
App usage	T2 only	How often did you play with (RAKi/Two Dots) in the past 2 months?	N/A	2.82 (0.98)	N/A	N/A
		How often did you play with other app games in the past 2 months? (0 = *never*, 1 = *a few times*, 2 = *once per week*, 3 = *2–3 times per week*, 4 = *once per day*, 5 = *more than once per day*)	N/A	2.35 (1.70)	N/A	N/A
Social desirability	T1 only	e.g., "I have never intensely disliked anyone" (true or false)	3.01	N/A	.25	N/A

Note. T1 = Time; T2 = Time 2.

blind to participant condition throughout the study. This was accomplished by asking participants to enter their participant ID, and then click on a website that randomized them to download either one of the apps without the researcher's awareness. Before leaving the lab, participants were scheduled to return approximately 2 months later ($M = 74$ days).

For the next 2 months, participants were asked to play with the app regularly (at least three times per week) until they returned to the lab for the second session. Besides their commitment to using their assigned app regularly, participants were otherwise free to engage with their phones and other devices as usual.

During Time 2, participants and their parents completed several of the same questionnaire measures as during Time 1. They also completed laboratory measures of state empathy and prosocial and aggressive behavior. Dropout rates did not differ by condition, $F(1, 103) = .99, p = .32$.

Measures

Table 2 describes the measures and when they were administered (i.e., both sessions or Time 2 only). It also includes sample items, means, and Cronbach αs for all measures.

Trait Empathy

Self-Rating

Preteens/teens completed the empathic concern and perspective taking subscales, of the Interpersonal Reactivity Index (IRI; Davis, 1983), a measure of trait empathy.

Parent Rating

Parents also rated their child's empathy using an adapted version of the IRI (empathic concern and perspective taking only; adapted from Davis, 1983).

Accomplice Rating

A member of our research team who was posing as another participant also rated participants on their empathy, using items adapted from the IRI (Davis, 1983), and also a general evaluation of participants' caring. Accomplices made this rating after interacting with the preteens/teens during the Time 2 lab session (see guided social interaction task details below).

State Empathy

Self-Reported Empathic Feelings

Preteens/teens completed the widely used Katie Banks task, to assess feelings of compassion and personal distress (Batson, Early, & Salvarani, 1997; Batson, Sager, et al., 1997; Batson et al., 1991; Coke et al., 1978; Konrath et al., 2015). This involves listening to a radio program about another high school student whose parents recently died in a car accident, leaving her as the primary guardian of her younger siblings. They then completed a questionnaire asking them how they felt while listening to the radio program.

Observer Rating of Empathic Expressions

In the Time 2 lab session, participants engaged in a guided social interaction with another "highschool student" who was actually a member of our lab. Participants and their partners took turns asking each other six questions (see Table 2) that were designed to facilitate small talk with strangers (Aron et al., 1997). The 5-min social interaction was video-recorded (with participant assent and parental consent) and later coded for empathy by two observers who were blind to participants' experimental condition (Cronbach $\alpha = .79$). The observers were asked to watch the videos and code for participants' empathic signals, without knowing which app participants had used.

Empathic signals included eye contact, smiles, leaning in, relaxed posture, nodding or other expressive body language, and bodily synchrony in movement between the participant and the other person. Lower empathy was indicated by low eye contact, few smiles, leaning back or stiff posture, lack of expressive body language, low bodily synchrony, fidgeting, or other indication of disinterest. These cues were chosen based on previous research (Brugel et al., 2015; Haase & Tepper, 1972; Richter & Kunzmann, 2011). Videos were coded on mute and rated for how empathic the person appeared on a 9-point scale (see Table 2).

To provide some validity for this coding, we examined how it was related to other empathy measures in the study. Observer empathy ratings were positively associated with participants' self-reported trait empathic concern, $r(85) = .32$, $p = .003$, and accomplice ratings of empathic concern, $r(85) = .30$, $p = .006$, perspective taking, $r(85) = .25$, $p = .03$, and caring traits, $r(85) = .36$, $p = .001$. Participants who were rated as more empathic by observers felt more empathic feelings during the Katie Banks task, $r(85) = .36$, $p = .001$, and participants who helped Katie Banks were rated as more empathic by observers ($M = 6.55$, $SD = 1.32$), compared to those who did not ($M = 5.74$, $SD = 1.87$), $F(1, 69) = 4.50$, $p = .037$. However, observer empathy ratings were not correlated with self-reported trait perspective taking, $r(85) = .12$, $p = .26$, nor with parent assessments of their children's trait empathic concern, $r(82) = .05$, $p = .64$, or perspective taking, $r(82) = -.02$, $p = .82$. Taken together this measure seems to more reliably capture affective aspects of empathy compared to cognitive aspects of it.

Prosocial Behavior

Katie Banks Help

After listening to the radio program described above, participants were asked whether they would have some availability in the next 2 weeks to help Katie Banks. The majority of participants (59%) agreed to help. For those who said *yes*, they could offer three different levels of help: *low* (up to 3 hr: 49%), *medium* (4–6 hr: 32%), and *high* (7 or more hours: 19%).

Self-Reported App Impact

Preteens/teens reported their perception on how they thought the app affected their prosocial tendencies, using items we developed for this study (e.g., "Using this app made me a nicer person"; Time 2 only; see Table 2).

Self-Reported Prosocial Behavior

Preteens/teens completed the full Prosocial Tendencies Scale at Times 1 and 2 (Carlo et al., 2003) to assess the motivation behind their prosocial behaviors.

Parent Rating of Prosocial Behavior

Parents also rated their children's prosocial behavior at Times 1 and 2, using an adapted version of the Prosocial Tendencies Scale (Carlo et al., 2003).

Aggressive Behavior

We examined actual aggressive behavior in the lab, and also used questionnaires to examine more global changes in aggression.

Competitive Reaction Time Task

Preteens/teens completed the competitive reaction time task (Taylor, 1967), which is a widely used and valid measure of laboratory aggression (Konrath et al., 2006; Warburton & Bushman, 2019). Participants were told that they would compete with their partners to see who could push a button fastest for 25 trials, and whoever was slowest would receive a noise blast. In reality, the accomplice was not involved in this task, and instead, a computer set random blasts of noise in each trial. The noise blasts ranged from 60 dB (Level 1) to 105 dB (Level 10), and participants also set the number of seconds (1–10) that their partner would have to hear if they lost each trial. Consistent with previous research (Arriaga et al., 2011), we multiplied level by number of seconds to calculate the aggressive behavior score.

Prior to the task, participants were asked to rate the accomplice on "first impressions" after their video-recorded interaction and they were made to believe that the accomplice also rated them on these same variables. Unbeknownst to participants, the "feedback" was pre-prepared, with the accomplice rating them slightly negatively (e.g., uninteresting, ordinary, unlikable). Research finds that people are more likely to act aggressively when their egos are threatened (Baumeister et al., 1996), thus, the feedback increased the likelihood of aggressing against someone they had just met.

Self-Reported Beliefs About Aggression

Preteens/teens completed the Normative Beliefs about Aggression Scale (Guerra et al., 2003; Huesmann & Guerra, 1997; Huesmann et al., 1992), which assesses the extent to which respondents believe that aggression is acceptable (Times 1 and 2).

Self-Reported Relational Aggression

Preteens/teens completed the Self-Report of Aggression and Social Behavior Measure (Murray-Close et al., 2010), which assesses three forms of relational aggression: proactive, reactive, and romantic (Times 1 and 2).

Additional Measures

App Ratings

At Time 2 only, preteens/teens were asked to rate the app using three statements: "I would recommend this app to a friend"; "I thought the app was interesting"; and "I enjoyed using the app." The three items were averaged into a single app rating measure.

App Usage

At Time 2 only, participants were asked about the frequency of app usage, both the assigned app and other app games, in the past 2 months. For those assigned to the RAKi App condition only, the app design company provided data on participants' total number of plays of minigames, the total time played in seconds, and the percentage of time that participants won (vs. lost) the minigames. Actual usage data were not available for participants in the control (Two Dots) condition.

Social Desirability

At Time 1 only, preteens/teens completed the short (10-item) version of the Marlow-Crowne Social Desirability Scale (Strahan & Gerbasi, 1972).

Debriefing

At the end of the study, we fully debriefed participants and their parents in writing and verbally, explaining that their "partner" was a member our research lab, and that the "feedback" and noise blasts in the competitive reaction time task were simulated. Participants then met the accomplice, who affirmed that this was part of the study. After offering them mental health resources in case they were upset by any part of the study, we then gave participants the option to withdraw their data without losing their payment, but no participants chose to do so.

Results

Data Analysis

Analysis of variance (ANOVA) was used to test the effect of condition on outcomes (controlling for baseline, if measured during both study sessions). Note that we also ran all analyses using analysis of covariance (ANCOVA) controlling for participant social desirability and participant age, and found nearly identical results. Thus, we report raw results in this analysis. See the online supplemental materials for correlation table between all variables.

Trait Empathy

As can be seen from the means and ANOVA tests presented in Table 3, there were no significant effects of playing RAKi on participants' self-rated trait empathy (IRI), $ps > .29$, parent ratings of their children's trait empathy, $ps > .28$, or accomplice ratings of participants' trait empathy, $ps > .41$ (see Table 3).

State Empathy

Participants who used RAKi felt more compassionate feelings after listening to the Katie Banks radio program, $F(1, 84) = 4.39$, $p = .04$, $d = .46$, but condition did not affect feelings of personal distress, $F(1, 84) = 2.05$, $p = .16$, $d = .31$. Moreover, observers rated participants in the RAKi condition as expressing more empathy during the guided social interaction task, compared control condition participants, $F(1, 83) = 4.54$, $p = .03$, $d = .47$ (see Table 4).

Prosocial Behavior

Helping Katie Banks

Although there was no effect of condition on whether participants offered to help Katie Banks (RAKi: 63% help; control: 54% help), $\beta = 0.35$, $p = .45$, among those who did help, participants who played RAKi showed more committed helping responses, $F(1, 51) = 3.97$, $p = .05$, $d = .56$ (see Table 5). In addition, exploratory logistic regressions revealed that compassionate feelings for Katie predicted helping behavior, as expected from previous research (Batson, 2011), $\beta = 1.07$, $p = .003$. However, personal distress feelings were unrelated to helping behavior, $\beta = -0.30$, $p = .41$.

Table 3
Effect of Condition on Trait Empathy

Scale	When	Result	Effect size	RAKi	Control
Self-rating	T1 and 2	Empathic concern: $F(1, 89) = 1.89$, $p = .30$	0.21	3.89 (.07)	3.79 (.07)
		Perspective taking: $F(1, 89) = .00$, $p = .996$	0.001	3.40 (.08)	3.40 (.08)
Parent rating	T1 and 2	Empathic concern: $F(1, 85) = 1.16$, $p = .29$	0.23	4.02 (.06)	3.93 (.06)
		Perspective taking: $F(1, 85) = 1.07$, $p = .31$	0.22	3.15 (.09)	3.02 (.09)
Accomplice rating	T2 only	Empathic concern: $F(1, 84) = .23$, $p = .63$	0.10	3.54 (.08)	3.59 (.08)
		Perspective taking: $F(1, 84) = .33$, $p = .57$	0.12	3.18 (.08)	3.25 (.09)
		Caring: $F(1, 84) = .65$, $p = .42$	0.17	3.63 (.10)	3.74 (.10)

Note. Adjusted means presented, controlling for Time 1 scores, when applicable. Standard errors are in parentheses. Effect size is reported as Cohen's *d*. T1 = Time; T2 = Time 2.

Table 4

Effect of Condition on State Empathy

Scale	When	Result	Effect size	RAKi	Control
Self-reported feelings of compassion	T2	$F(1, 84) = 4.39, p = .04$	0.46	4.06 (.14)	3.64 (.15)
Self-reported feelings of personal distress	T2	$F(1, 84) = 2.05, p = .16$	0.31	3.32 (.13)	3.05 (.14)
Observer rating	T2	$F(1, 83) = 4.54, p = .03$	0.47	6.51 (.23)	5.80 (.24)

Note. Standard errors are in parentheses. Effect size is reported as Cohen's *d*. T2 = Time 2.

Self-Reported App Impact

Participants reported that playing RAKi increased their prosocial tendencies compared to the control app, $F(1, 89) = 10.31, p = .002$, $d = .68$ (see Table 5).

Self-Reported Prosocial Behavior

Participants who played RAKi did not report any differences in self-reported prosocial behavior motivations compared to those who played the control app (all $ps > .05$, see Table 5).

Parents' Ratings of Prosocial Behavior

Nor were there significant differences in parent reports of their children's prosocial behavior motivations (all $ps > .05$, see Table 5).

Aggressive Behavior

Competitive Reaction Time Task

There was no effect of condition on aggressive behavior on the competitive reaction time task, $F(1, 88) = 2.09, p = .15$ (see Table 5). However, when we ran a regression examining the effect of condition, baseline empathic concern (centered), and their interaction on behavioral aggression, we found a significant interaction between empathy and condition, $\beta = 0.34, p = .02$ (see Figure 1). In order to interpret this interaction, we split empathy at the median, and examined how condition affected behavioral aggression for higher versus lower empathy participants. More empathic participants were low in aggressive behavior regardless of condition—RAKi = 28.18; control = 25.23, $F(43) = .27$, $p = .61$, but among less empathic participants, playing RAKi reduced aggression levels—RAKi = 28.07; control = 42.44, $F(43) = 4.02, p = .05, d = .61$.

Consistent with previous research, we also found that participants who felt more compassion during the Katie Banks task (i.e., state empathy) were less likely to behave aggressively toward their peer on this task, $r(85) = -.29, p = .006$.

Self-Reported Beliefs About Aggression

After playing RAKi, participants had less aggressive beliefs, that is, they were less likely to agree that aggression is sometimes okay, $F(1, 89) = 6.77, p = .01, d = .55$.

Self-Reported Relational Aggression

There were no differences in proactive, reactive, or romantic relational measures of aggression for those who played RAKi compared to the control app, $ps > .16$.

Table 5

Effect of Condition on Behavior

Scale	When	Result	Effect size	RAKi	Control
Prosocial behavior					
Katie Banks help: Yes = 1, No = 0	T2	$\beta = 0.35, p = .45$	See β	62.8% help	54.3% help
Katie Banks help amount: low, med, high	T2	$F(1, 51) = 3.97, p = .05$	0.56	1.89 (.14)	1.48 (.15)
Self-reported app impact	T2	Condition, $F(1, 89) = 10.31, p = .002$	0.68	2.63 (.17)	1.81 (.18)
Self-reported prosocial behavior	T1 and 2	Public: $F(1, 89) = .48, p = .98$	0.01	2.23 (.10)	2.23 (.11)
		Emotional: $F(1, 89) = 2.50, p = .12$	0.33	3.81 (.09)	3.59 (.09)
		Opportunistic: $F(1, 89) = .06, p = .81$	0.05	2.11 (.07)	2.09 (.07)
		Dire: $F(1, 89) = .18, p = .52$	0.14	3.72 (.10)	3.82 (.10)
		Compliant: $F(1, 89) = 1.17, p = .28$	0.23	3.87 (.11)	3.70 (.12)
		Anonymous: $F(1, 89) = .08, p = .78$	0.06	2.84 (.11)	2.88 (.12)
Parent's ratings of prosocial behavior	T1 and 2	Public: $F(1, 84) = 3.10, p = .08$	0.38	2.21 (.11)	2.51 (.12)
		Emotional: $F(1, 84) = .57, p = .45$	0.16	3.87 (.09)	3.77 (.10)
		Opportunistic: $F(1, 84) = .51, p = .25$	0.24	2.03 (.09)	2.19 (.10)
		Dire: $F(1, 84) = 1.44, p = .23$	0.25	4.02 (.11)	3.83 (.11)
		Compliant: $F(1, 84) = .19, p = .67$	0.09	3.98 (.13)	3.90 (.13)
		Anonymous: $F(1, 84) = .07, p = .80$	0.05	2.92 (.09)	2.96 (.10)
Aggressive behavior					
Competitive reaction time task	T1 and 2	$F(1, 88) = 2.09, p = .15$ (Moderated by trait empathic concern)	0.32	28.13 (3.16)	34.89 (3.45)
Self-reported beliefs about aggression	T1 and 2	$F(1, 89) = 6.77, p = .011$	0.55	1.65 (.04)	1.79 (.04)
Self-reported aggression and social behavior	T2	Proactive relational aggression: $F(1, 89) = .29, p = .59$	0.11	1.44 (.07)	1.38 (.07)
		Reactive relational aggression: $F(1, 89) = 1.96, p = .17$	0.29	1.41 (.05)	1.51 (.06)
		Romantic relational aggression: $F(1, 85) = .37, p = .54$	0.13	1.43 (.05)	1.38 (.06)

Note. Adjusted means presented, controlling for Time 1 scores, when applicable. Standard errors are in parentheses. Effect size is reported as Cohen's *d*. T1 = Time; T2 = Time 2.

Figure 1

Effect of Baseline Trait Empathy and Condition on Aggressive Behavior in the Lab
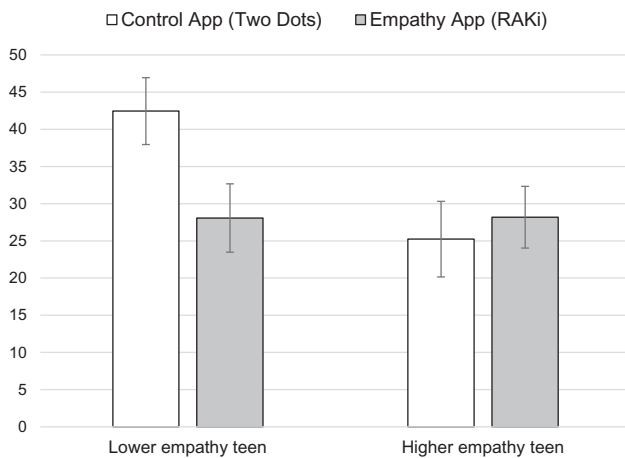
App Ratings

Participants reported that they liked the control app more ($M = 3.95$, $SD = 1.08$) than the RAKi app ($M = 3.03$, $SD = 1.30$), $F(1, 89) = 13.34$, $p < .001$, $d = .77$. But participants liked both apps and rated them above the midpoint. Exploratory analyses revealed that among participants assigned to play RAKi, age was unrelated to liking RAKi, $r(48) = -0.23$, $p = .12$, and boys and girls liked RAKi equally, $F(1, 46) = 0.36$, $p = .55$. However, there were race/ethnicity differences such that White participants liked RAKi the least ($M = 2.47$, $SD = 1.24$) and Black participants liked it the most ($M = 3.54$, $SD = 1.28$), with other participants in the middle ($M = 3.08$, $SD = 0.17$), $F(2, 45) = 4.16$, $p = .02$. In addition, participants with higher trait empathic concern liked RAKi more, $r(48) = 0.33$, $p = .02$.

Importantly, when we reran all analyses controlling for app liking, the results remained similar, with one exception: the condition effect on behavioral aggression was now significant, $F(1, 84) = 4.13$, $p = .045$, $d = .35$. In addition, when we examined whether app liking moderated the results, only two significant interactions emerged: with parent ratings of their children's emotional prosocial behavior, $\beta = 0.29$, $p = .02$, and with parent ratings of their children's trait perspective taking, $\beta = -0.38$, $p = .004$. Both variables were significantly associated with app liking in the control condition only, albeit in opposite directions (prosocial behavior: $\beta = -0.23$, $p = .03$; perspective taking: $\beta = 0.24$, $p = .03$). However, there was no significant relationship between these variables and app liking in the RAKi condition, $ps > .07$. Because these relationships were not predicted and were inconsistent, we report them for transparency, but otherwise do not discuss them further. Overall, app liking appears to play a minimal role in the results.

App Usage

Participants reported that they played with the control app more frequently ($M = 3.12$, $SD = 1.04$; 2–3 times per week) than the RAKi app ($M = 2.55$, $SD = 0.85$; between 1 and 3 times per week) in the past 2 months, $F(1, 87) = 7.92$, $p = .006$, $d = .59$. The RAKi ($M = 2.37$, $SD = 1.70$) and control conditions ($M =$

2.33, $SD = 1.71$) did not differ in the frequency of playing with other apps in the same time period, $F(1, 90) = .01$, $p = .91$. Note that when we reran all analyses controlling for subjective play frequency, the results remained similar.

Participants in the RAKi condition played an average of 248 minigames across the 2-month period (about four minigames per day), for an average of 2,249 s total (about 9 s per minigame). Participants won an average of 53.2% of the games that they played.

Among RAKi participants, subjective game play frequency had small positive correlations with an objective total number of plays, $r(47) = .28$, $p = .060$, total time played, $r(47) = .28$, $p = .056$, and the percentage of wins, $r(47) = .29$, $p = .046$.

Discussion

In this study, we created and tested an empathy app called RAKi in children aged 10–17 years old. Overall, we found that after 2 months, playing RAKi facilitated increased states of empathy during our laboratory activities, and led to small behavioral changes in the laboratory (e.g., more time helping; less aggressive behavior among lower empathy participants). However, participants' trait empathy and other general behaviors (e.g., self-reported and parent-reported prosocial behavior; relational aggression) appear to have been unchanged.

In the laboratory, participants were put into two empathy-arousing situations. The first involved a radio show about Katie Banks. Participants reported feeling more compassion for Katie Banks if they had played RAKi compared to the control app. Consistent with the empathy–altruism hypothesis (Batson, 2011), this heightened state of empathy predicted more prosocial behavior toward Katie Banks. The second situation placed preteens/teens in a social interaction with an accomplice. In this situation, participants who had played RAKi were rated by researchers as expressing more empathy toward the accomplice. Also consistent with previous research (Vachon et al., 2014), these empathic responses predicted less aggression toward the accomplice as part of the later competitive reaction time task. These two laboratory results are complementary and demonstrate that an app can at times facilitate preteens' and teens' empathic responses in the moment, when immersed in relevant social situations.

Finally, we found no overall differences in aggressive behavior for RAKi versus control app users, which may not be surprising given that a meta-analysis found relatively weak empathy-aggression links overall (Vachon et al., 2014). However, we identified a potential moderator that may help to understand when empathy interventions might affect aggression. Specifically, RAKi reduced aggressive behavior only among lower empathy participants. These lower empathy individuals showed high aggression in the control group, but the RAKi app appeared to function as a targeted intervention for lower empathy individuals.

Despite these promising situational results, there was limited evidence that the positive impact of RAKi generalizes outside of these situations. Of course, it is possible that when faced with similar social situations in the real world (a peer in need, or competing with a peer) that RAKi players would respond with empathic feelings. However, preteens/teens and parents did not report changes in trait empathy, nor global changes in prosocial or aggressive behavior following RAKi, with two exceptions. First, when asked specifically about how RAKi impacted their behavior, preteens/teens reported that it increased their prosocial behavior. However,

given the likelihood of this result being impacted by demand characteristics, we report it with healthy skepticism. Potentially of more interest, after playing RAKi, participants reported less endorsement of aggressive social norms compared to control participants. However, we did not see these self-reported measures of behavior corroborated by other self-reports or parent ratings of behavior.

Taken together, this pattern of trait, state, and behavioral results suggests that the RAKi app changed participants' responses in the moment during actual social situations, however, it did not change their chronic, stable views of themselves, nor others' stable views of them. Overall, preteens/teens who played RAKi showed more appropriate and prosocial feelings and skills, although they did not necessarily internalize these in terms of seeing themselves as more empathic or prosocial people. We call this pattern of results "social empathy," or using empathy when it matters. Although ideally interventions would impact young people in terms of them internalizing an empathic identity, one step in the right direction is acting in a caring way during social situations. However, we caution readers that these results are based on a lab-based setting, and future research needs to examine the app's impact in more naturalistic settings, ideally when participants are not aware that they are being observed.

Implications

We see a number of implications of this project, both in terms of its theoretical contributions and its potential real-world applications. Theoretically, it helps to reinforce the distinction between trait versus state empathy, which are often treated as synonymous but can act differently, as seen in this study. This study confirms that there are many different forms and implications of empathy, and they do not always respond similarly to interventions.

The largest contribution of this article is practical, in the sense that it is the most rigorous known study that both creates and evaluates an empathy-building smartphone app. As such, this fits within the emerging positive technology literature that demonstrates the potential power of applying scientific principles to improve people's health and well-being (Konrath, 2015). Moreover, it is one additional demonstration in media effects research that content matters: exposure to a prosocial gamified app over time can increase preteen/teens' empathic and prosocial responses, compared to a control app.

Strengths, Limitations, and Future Research

This study reports the design and creation of an empathy app using empirically backed empathy-building practices and a single-blind (researchers) randomized control design to evaluate the app's impact. Our evaluation of the app included self-report, parent-report, and observer-report, thus giving a comprehensive evaluation of participants' empathy, prosocial behavior, and aggression. We considered the potential confounding factor of social desirability both by measuring it directly and by having others evaluate preteens/teens. In addition, we included behavioral outcomes using socially relevant situations. Overall, these strengths make us feel confident in the study's conclusion that state empathy was impacted, but not trait empathy.

However, we were also limited by a relatively small sample size and budget constraints that allowed us to design a working prototype of an app, rather than a fully budgeted commercial version that would have additional design features and larger scale efficacy testing. Although there is robust support for many in-person empathy-building interventions (Fragkos & Crampton, 2020; Ngo et al., 2022; van Berkhout & Malouff, 2016; Winter et al., 2020), it is not always possible to teach empathy in person, and using an app can be a practical solution, or can complement existing in-person lessons.

We note that our sample includes a large age range, encompassing several developmental periods from middle/late childhood to different stages of adolescence. Although controlling for age did not change our results, we recommend that future researchers more systematically examine whether apps such as this one are more effective during specific developmental periods. For example, future research could test whether RAKi and other prosocial apps can increase trait empathy in younger children.

We also note that participants liked the RAKi app less than the control app (Two Dots), and also used RAKi less frequently, though they still played about four minigames per day, on average. Although additional analyses determined that liking and frequency of usage had a relatively low impact on the results, we suggest that future designers and researchers consider ways to increase and sustain user interest and engagement (e.g., social game board, avatar customization, additional levels, push notifications). In particular, since we found that higher empathy preteens and teens liked RAKi more, it is possible that in the real world, they would be more likely to download and play with the app, thus reducing the intervention opportunity amongst lower empathy individuals. Prosocial media producers should consider how to tailor and market their products to a broader audience, including those lower in empathy.

Another limitation of using the app to foster empathy is that it is one small influence in a sea of other influences in the lives of preteens and teens. Given the powerful roles of family context, school, peers, other media usage, and neighborhoods, among other influences, it is remarkable that we found any results at all in our study. Yet, this study can be considered a case in point: it is possible to use an app to prompt empathy in youth—at least some types of empathy.

We do not yet know why there were no effects on trait empathy, but perhaps as with any skill, it would take more time to internalize empathy rather than just seeing it as a socially appropriate response. Perhaps it is unreasonable to expect trait-like changes to occur after only 2 months of exposure. Thus, future research should explore potential longer-term effects of smartphone-based empathy interventions. Although the current study was limited to a 2-month period, one study found that a 2-week empathy-building text message program lasted up to 6 months later (Konrath et al., 2015). Such longer-term follow-up periods are critical because trait empathy may become more crystalized throughout adolescence. Designers of long-term programs should attend to the critical importance of sustaining user engagement and retention.

Conclusion

After using RAKi, we found evidence within a lab-based setting that children felt more compassion for someone in need, behaved in ways that appeared empathic while interacting with a stranger, were less likely to endorse physical aggression, and behaved less aggressively toward a peer (if they started with lower trait empathy). Future research should examine whether these results generalize to more naturalistic settings. If there is indeed more evidence in the future that exposure to a prosocial app can increase preteens' and teens'

empathic responses, we would hope that future media and technology designers would create and test more prosocial digital technologies.

References

Abramson, L., Uzefovsky, F., Toccaceli, V., & Knafo-Noam, A. (2020). The genetic and environmental origins of emotional and cognitive empathy: Review and meta-analyses of twin studies. *Neuroscience & Biobehavioral Reviews*, *114*, 113–133. https://doi.org/10.1016/j.neubiorev.2020.03.023

Aron, A., Melinat, E., Aron, E. N., Vallone, R. D., & Bator, R. J. (1997). The experimental generation of interpersonal closeness: A procedure and some preliminary findings. *Personality and Social Psychology Bulletin*, *23*(4), 363–377. https://doi.org/10.1177/0146167297234003

Arriaga, P., Monteiro, M. B., & Esteves, F. (2011). Effects of playing violent computer games on emotional desensitization and aggressive behavior 1. *Journal of Applied Social Psychology*, *41*(8), 1900–1925. https://doi.org/10.1111/j.1559-1816.2011.00791.x

Barnett, M. A., Feighny, K. M., & Esper, J. A. (1983). Effects of anticipated victim responsiveness and empathy upon volunteering. *The Journal of Social Psychology*, *119*(2), 211–218. https://doi.org/10.1080/00224545.1983.9922823

Baron-Cohen, S., & Wheelwright, S. (2004). The empathy quotient: An investigation of adults with Asperger syndrome or high functioning autism, and normal sex differences. *Journal of Autism and Developmental Disorders*, *34*(2), 163–175. https://doi.org/10.1023/B:JADD.0000022607.19833.00

Batson, C. D. (2011). Altruism in humans. Oxford University Press.

Batson, C. D., Batson, J. G., Slingsby, J. K., Harrell, K. L., Peekna, H. M., & Todd, R. M. (1991). Empathic joy and the empathy–altruism hypothesis. *Journal of Personality and Social Psychology*, *61*(3), 413–426. https://doi.org/10.1037/0022-3514.61.3.413

Batson, C. D., Early, S., & Salvarani, G. (1997). Perspective taking: Imagining how another feels versus imaging how you would feel. *Personality and Social Psychology Bulletin*, *23*(7), 751–758. https://doi.org/10.1177/0146167297237008

Batson, C. D., Lishner, D. A., Cook, J., & Sawyer, S. (2005). Similarity and nurturance: Two possible sources of empathy for strangers. *Basic and Applied Social Psychology*, *27*(1), 15–25. https://doi.org/10.1207/s15324834basp2701_2

Batson, C. D., Sager, K., Garst, E., Kang, M., Rubchinsky, K., & Dawson, K. (1997). Is empathy-induced helping due to self-other merging? *Journal of Personality and Social Psychology*, *73*(3), 495–509. https://doi.org/10.1037/0022-3514.73.3.495

Baumeister, R., Smart, L., & Boden, J. M. (1996). Relation of threatened egotism to violence and aggression: The dark side of high self-esteem. *Psychological Review*, *103*(1), 5–33. https://doi.org/10.1037/0033-295X.103.1.5

Brown, S., Brown, R., & Preston, S. (2012). The human caregiving system: A neuroscience model of compassionate motivation and behavior. In S. L. Brown, R. M. Brown, & L. A. Penner (Eds.), *Moving beyond self interest* (pp. 75–88). Oxford University Press.

Brugel, S., Postma-Nilsenová, M., & Tates, K. (2015). The link between perception of clinical empathy and nonverbal behavior: The effect of a doctor's gaze and body orientation. *Patient Education and Counseling*, *98*(10), 1260–1265. https://doi.org/10.1016/j.pec.2015.08.007

Bryant, B. K. (1982). An index of empathy for children and adolescents. *Child Development*, *53*(2), 413–425. https://doi.org/10.2307/1128984

Carlo, G., Hausmann, A., Christiansen, S., & Randall, B. A. (2003). Sociocognitive and behavioral correlates of a measure of prosocial tendencies for adolescents. *The Journal of Early Adolescence*, *23*(1), 107–134. https://doi.org/10.1177/0272431602239132

Castillo, R., Salguero, J. M., Fernández-Berrocal, P., & Balluerka, N. (2013). Effects of an emotional intelligence intervention on aggression and empathy among adolescents. *Journal of Adolescence*, *36*(5), 883–892. https://doi.org/10.1016/j.adolescence.2013.07.001

Church, K., Hoggan, E., & Oliver, N. (2010, October 16–20). *A study of mobile mood awareness and communication through MobiMood* [Paper presentation]. NordiCHI'10: 6th Nordic conference on human-computer interaction: Extending boundaries, Reykjavik, Iceland.

Coke, J. S., Batson, C. D., & McDavis, K. (1978). Empathic mediation of helping: A two-stage model. *Journal of Personality and Social Psychology*, *36*(7), 752–766. https://doi.org/10.1037/0022-3514.36.7.752

Coyne, S. M., Padilla-Walker, L. M., Holmgren, H. G., Davis, E. J., Collier, K. M., Memmott-Elison, M. K., & Hawkins, A. J. (2018). A meta-analysis of prosocial media on prosocial behavior, aggression, and empathic concern: A multidimensional approach. *Developmental Psychology*, *54*(2), 331–347. https://doi.org/10.1037/dev0000412

Daly, B., & Morton, L. (2009). Empathic differences in adults as a function of childhood and adult pet ownership and pet type. *Anthrozoos: A Multidisciplinary Journal of the Interactions of People & Animals*, *22*(4), 371–382. https://doi.org/10.2752/089279309X12538695316383

Davis, M. (1983). Measuring individual differences in empathy: Evidence for a multidimensional approach. *Journal of Personality and Social Psychology*, *44*(1), 113–126. https://doi.org/10.1037/0022-3514.44.1.113

Decety, J., & Lamm, C. (2006). Human empathy through the lens of social neuroscience. *The Scientific World Journal*, *6*, 1146–1163. https://doi.org/10.1100/tsw.2006.221

Depow, G. J., Francis, Z., & Inzlicht, M. (2021). The experience of empathy in everyday life. *Psychological Science*, *32*(8), 1198–1213. https://doi.org/10.1177/0956797621995202

de Waal, F. (2009). Darwin's last laugh. *Nature*, *460*(7252), Article 175. https://doi.org/10.1038/460175a

Dimberg, U., Thunberg, M., & Elmehed, K. (2000). Unconscious facial reactions to emotional facial expressions. *Psychological Science*, *11*(1), 86–89. https://doi.org/10.1111/1467-9280.00221

Ding, F., & Lu, Z. (2016). Association between empathy and prosocial behavior: A systematic review and meta-analysis. *Advances in Psychological Science*, *24*(8), Article 1159. https://doi.org/10.3724/SP.J.1042.2016.01159

Durlak, J. A., Weissberg, R. P., Dymnicki, A. B., Taylor, R. D., & Schellinger, K. B. (2011). The impact of enhancing students' social and emotional learning: A meta-analysis of school-based universal interventions. *Child Development*, *82*(1), 405–432. https://doi.org/10.1111/j.1467-8624.2010.01564.x

Eisenberg, N. (2005). The development of empathy-related responding. In C. Gustavo & C. P. Edwards (Eds.), *Moral motivation through the life span* (pp. 73–117). University of Nebraska Press.

Eisenberg, N., Fabes, R. A., Shepard, S. A., Guthrie, I. K., Murphy, B. C., & Reiser, M. (1999). Parental reactions to children's negative emotions: Longitudinal relations to quality of children's social functioning. *Child Development*, *70*(2), 513–534. https://doi.org/10.1111/1467-8624.00037

Eisenberg, N., Michalik, N., Spinrad, T. L., Hofer, C., Kupfer, A., Valiente, C., Liew, J., Cumberland, A., & Reiser, M. (2007). The relations of effortful control and impulsivity to children's sympathy: A longitudinal study. *Cognitive Development*, *22*(4), 544–567. https://doi.org/10.1016/j.cogdev.2007.08.003

Eisenberg, N., & Miller, P. A. (1987). The relation of empathy to prosocial and related behaviors. *Psychological Bulletin*, *101*(1), 91–119. https://doi.org/10.1037/0033-2909.101.1.91

Eisenberg, N., Zhou, Q., Losoya, S. H., Fabes, R. A., Shepard, S. A., Murphy, B. C., Reiser, M., Guthrie, I. K., & Cumberland, A. (2003). The relations of parenting, effortful control, and ego control to children's emotional expressivity. *Child Development*, *74*(3), 875–895. https://doi.org/10.1111/1467-8624.00573

Ericsson, K. A. (2006). The influence of experience and deliberate practice on the development of superior expert performance. In K. A. Ericsson, N. Charness, R. R. Hoffman, and P. J. Feltovich (Eds.), *The Cambridge handbook of expertise and expert performance* (pp. 683–703). Cambridge University Press.

Feeney, B. C., & Collins, N. L. (2001). Predictors of caregiving in adult intimate relationships: An attachment theoretical perspective. *Journal of Personality and Social Psychology, 80*(6), 972–994. https://doi.org/10.1037/0022-3514.80.6.972

Fragkos, K. C., & Crampton, P. E. (2020). The effectiveness of teaching clinical empathy to medical students: A systematic review and meta-analysis of randomized controlled trials. *Academic Medicine, 95*(6), 947–957. https://doi.org/10.1097/ACM.0000000000003058

Fultz, J., Batson, C. D., Fortenbach, V. A., McCarthy, P. M., & Varney, L. L. (1986). Social evaluation and the empathy altruism hypothesis. *Journal of Personality and Social Psychology, 50*(4), 761–769. https://doi.org/10.1037/0022-3514.50.4.761

Gay, G., Pollak, J., Adams, P., & Leonard, J. P. (2011). *Pilot study of Aurora, a social, mobile-phone-based emotion sharing and recording system*. SAGE Publications.

Greitemeyer, T. (2011). Effects of prosocial media on social behavior when and why does media exposure affect helping and aggression? *Current Directions in Psychological Science, 20*(4), 251–255. https://doi.org/10.1177/0963721411415229

Greitemeyer, T., Agthe, M., Turner, R., & Gschwendtner, C. (2012). Acting prosocially reduces retaliation: Effects of prosocial video games on aggressive behavior. *European Journal of Social Psychology, 42*(2), 235–242. https://doi.org/10.1002/ejsp.1837

Greitemeyer, T., & Mügge, D. O. (2014). Video games do affect social outcomes: A meta-analytic review of the effects of violent and prosocial video game play. *Personality and Social Psychology Bulletin, 40*(5), 578–589. https://doi.org/10.1177/0146167213520459

Greitemeyer, T., & Osswald, S. (2009). Prosocial video games reduce aggressive cognitions. *Journal of Experimental Social Psychology, 45*(4), 896–900. https://doi.org/10.1016/j.jesp.2009.04.005

Greitemeyer, T., & Osswald, S. (2010). Effects of prosocial video games on prosocial behavior. *Journal of Personality and Social Psychology, 98*(2), 211–221. https://doi.org/10.1037/a0016997

Guerra, N. G., Rowell Huesmann, L., & Spindler, A. (2003). Community violence exposure, social cognition, and aggression among urban elementary school children. *Child Development, 74*(5), 1561–1576. https://doi.org/10.1111/1467-8624.00623

Guo, Y., Shachat, J., Walker, M. J., & Wei, L. (2021). Viral social media videos can raise pro-social behaviours when an epidemic arises. *Journal of the Economic Science Association, 7*(2), 120–138. https://doi.org/10.1007/s40881-021-00104-w

Haase, R. F., & Tepper, D. T. (1972). Nonverbal components of empathic communication. *Journal of Counseling Psychology, 19*(5), 417–424. https://doi.org/10.1037/h0033188

Hall, J. A., Andrzejewski, S., & Yopchick, J. (2009). Psychosocial correlates of interpersonal sensitivity: A meta-analysis. *Journal of Nonverbal Behavior, 33*(3), 149–180. https://doi.org/10.1007/s10919-009-0070-5

Hall, J. A., & Schwartz, R. (2019). Empathy present and future. *The Journal of Social Psychology, 159*(3), 225–243. https://doi.org/10.1080/00224545.2018.1477442

Hall, J. A., Schwartz, R., & Duong, F. (2021). How do laypeople define empathy? *The Journal of Social Psychology, 161*(1), 5–24. https://doi.org/10.1080/00224545.2020.1796567

Hangartner, D., Gennaro, G., Alasiri, S., Bahrich, N., Bornhoft, A., Boucher, J., Demirci, B. B., Derksen, L., Hall, A., Jochum, M., Munoz, M. M., Richter, M., Vogel, F., Wittwer, S., Wüthrich, F., Gilardi, F., & Donnay, K. (2021). Empathy-based counterspeech can reduce racist hate speech in a social media field experiment. *Proceedings of the National Academy of Sciences, 118*(50), Article e2116310118. https://doi.org/10.1073/pnas.2116310118

Hansen, S. (2011). Inhibitory control and empathy-related personality traits: Sex-linked associations. *Brain and Cognition, 76*(3), 364–368. https://doi.org/10.1016/j.bandc.2011.04.004

Harrell, S., Simons, A. M., & Clasen, P. (2022). Promoting blood donation through social media: Evidence from Brazil, India and the USA. *Social Science & Medicine, 315*, Article 115485. https://doi.org/10.1016/j.socscimed.2022.115485

Hinnant, J. B., & O'Brien, M. (2007). Cognitive and emotional control and perspective taking and their relations to empathy in 5-year-old children. *The Journal of Genetic Psychology, 168*(3), 301–322. https://doi.org/10.3200/GNTP.168.3.301-322

Hoffman, M. (2000). *Empathy and moral development. Implications for justice and caring*. Cambridge University Press.

Huertas, M. K. Z., Cavalcanti, P. S. F., & Urdan, A. T. (2021). Does emotional media content increase donations for rejected groups? *Social Responsibility Journal, 18*(7), 1270–1284. https://doi.org/10.1108/SRJ-11-2020-0466

Huesmann, L. R., & Guerra, N. G. (1997). Children's normative beliefs about aggression and aggressive behavior. *Journal of Personality and Social Psychology, 72*(2), 408–419. https://doi.org/10.1037/0022-3514.72.2.408

Huesmann, L. R., Guerra, N. G., Miller, L., & Zelli, A. (1992). The role of social norms in the development of aggression. In H. Zumkley & A. Fraczek (Eds.), *Socialization and aggression* (pp. 139–152). Springer.

Hyde, K. R., Kurdek, L., & Larson, P. (1983). Relationships between pet ownership and self-esteem, social sensitivity, and interpersonal trust. *Psychological Reports, 52*(1), Article 110. https://doi.org/10.2466/pr0.1983.52.1.110

Ickes, W. (1997). *Empathic accuracy*. The Guilford Press.

Jolliffe, D., & Farrington, D. P. (2021). Empathy and offending, aggression, and bullying: Taking stock and moving forward. In D. Jolliffe & D. P. Farrington (Eds.), *Empathy versus offending, aggression, and bullying* (pp. 239–254). Routledge.

Kim, S. J., & Kou, X. (2014). Not all empathy is equal: How dispositional empathy affects charitable giving. *Journal of Nonprofit & Public Sector Marketing, 26*(4), 312–334. https://doi.org/10.1080/10495142.2014.965066

Kirschner, S., & Tomasello, M. (2010). Joint music making promotes prosocial behavior in 4-year-old children. *Evolution and Human Behavior, 31*(5), 354–364. https://doi.org/10.1016/j.evolhumbehav.2010.04.004

Koestner, R., Franz, C., & Weinberger, J. (1990). The family origins of empathic concern: A 26-year longitudinal study. *Journal of Personality and Social Psychology, 58*(4), 709–717. https://doi.org/10.1037/0022-3514.58.4.709

Konrath, S. (2015). Positive technology: Using mobile phones for psychosocial interventions. In Z. Yan (Ed.), *Encyclopedia of mobile phone behavior* (pp. 871–897). IGI Global. https://doi.org/10.4018/978-1-4666-8239-9.ch072

Konrath, S., Bushman, B., & Campbell, W. K. (2006). Attenuating the link between threatened egotism and aggression. *Psychological Science, 17*(11), 995–1001. https://doi.org/10.1111/j.1467-9280.2006.01818.x

Konrath, S., Falk, E., Fuhrel-Forbis, A., Liu, M., Swain, J., Tolman, R., Cunningham, R., & Walton, M. (2015). Can text messages increase empathy and prosocial behavior? The development and initial validation of text to connect. *PLoS ONE, 10*(9), Article e0137585. https://doi.org/10.1371/journal.pone.0137585

Konrath, S., Meier, B. P., & Bushman, B. J. (2018). Development and validation of the single item trait empathy scale (SITES). *Journal of Research in Personality, 73*, 111–122. https://doi.org/10.1016/j.jrp.2017.11.009

Konrath, S., O'Brien, E. H., & Hsing, C. (2011). Changes in dispositional empathy in American college students over time: A meta-analysis. *Personality and Social Psychology Review, 15*(2), 180–198. https://doi.org/10.1177/1088868310377395

Koo, G., & Seider, S. (2010). Video games for prosocial learning. In K. Schrier & D. Gibson (Eds.), *Ethics and game design: Teaching values through play* (pp. 16–33). IGI Global.

Kotrschal, K., & Ortbauer, B. (2003). Behavioral effects of the presence of a dog in a classroom. *Anthrozoos: A Multidisciplinary Journal of the*

Interactions of People & Animals, *16*(2), 147–159. https://doi.org/10.2752/089279303786992170

Kral, T. R., Stodola, D. E., Birn, R. M., Mumford, J. A., Solis, E., Flook, L., Patsenko, E. G., Anderson, C. G., Steinkuehler, C., & Davidson, R. J. (2018). Neural correlates of video game empathy training in adolescents: A randomized trial. *npj Science of Learning*, *3*(1), Article 1. https://doi.org/10.1038/s41539-017-0017-2

Krevans, J., & Gibbs, J. C. (1996). Parents' use of inductive discipline: Relations to children's empathy and prosocial behavior. *Child Development*, *67*(6), 3263–3277. https://doi.org/10.2307/1131778

Launay, J., Dean, R. T., & Bailes, F. (2013). Synchronization can influence trust following virtual interaction. *Experimental Psychology*, *60*(1), 53–63. https://doi.org/10.1027/1618-3169/a000173

Lobchuk, M., Halas, G., West, C., Harder, N., Tursunova, Z., & Ramraj, C. (2016). Development of a novel empathy-related video-feedback intervention to improve empathic accuracy of nursing students: A pilot study. *Nurse Education Today*, *46*, 86–93. https://doi.org/10.1016/j.nedt.2016.08.034

Mallett, R. K., Huntsinger, J. R., Sinclair, S., & Swim, J. K. (2008). Seeing through their eyes: When majority group members take collective action on behalf of an outgroup. *Group Processes & Intergroup Relations*, *11*(4), 451–470. https://doi.org/10.1177/1368430208095400

Malti, T., Chaparro, M. P., Zuffianò, A., & Colasante, T. (2016). School-based interventions to promote empathy-related responding in children and adolescents: A developmental analysis. *Journal of Clinical Child & Adolescent Psychology*, *45*(6), 718–731. https://doi.org/10.1080/15374416.2015.1121822

Martingano, A. J., Hererra, F., & Konrath, S. (2021). Virtual reality improves emotional but not cognitive empathy: A meta-analysis. *Technology, Mind, and Behavior*, *2*(1), 1–15. https://doi.org/10.1037/tmb0000034

Martingano, A. J., & Konrath, S. (2022). How cognitive and emotional empathy relate to rational thinking: Empirical evidence and meta-analysis. *The Journal of Social Psychology*, *162*(1), 143–160. https://doi.org/10.1080/00224545.2021.1985415

McCrae, R. R., & Costa, P. T. (1982). Self-concept and the stability of personality: Cross-sectional comparisons of self-reports and ratings. *Journal of Personality and Social Psychology*, *43*(6), 1282–1292. https://doi.org/10.1037/0022-3514.43.6.1282

Milton, J. G., Small, S. S., & Solodkin, A. (2004). On the road to automatic: Dynamic aspects in the development of expertise. *Journal of Clinical Neurophysiology*, *21*(3), 134–143. https://doi.org/10.1097/00004691-200405000-00002

Morris, M. E., Kathawala, Q., Leen, T. K., Gorenstein, E. E., Guilak, F., Labhard, M., & Deleeuw, W. (2010). Mobile therapy: Case study evaluations of a cell phone application for emotional self-awareness. *Journal of Medical Internet Research*, *12*(2), Article e10. https://doi.org/10.2196/jmir.1371

Murray-Close, D., Ostrov, J. M., Nelson, D. A., Crick, N. R., & Coccaro, E. F. (2010). Proactive, reactive, and romantic relational aggression in adulthood: Measurement, predictive validity, gender differences, and association with Intermittent Explosive Disorder. *Journal of Psychiatric Research*, *44*(6), 393–404. https://doi.org/10.1016/j.jpsychires.2009.09.005

National Research Council. (2012). *Communications and technology for violence prevention: Workshop summary*. National Academies Press.

Ngo, H., Sokolovic, N., Coleman, A., & Jenkins, J. M. (2022). Teaching empathy to mental health practitioners and trainees: Pairwise and network meta-analyses. *Journal of Consulting and Clinical Psychology*, *90*(11), 851–860. https://doi.org/10.1037/ccp0000773

Pew Research Center. (2022). *Teens, social media and technology*. https://www.pewresearch.org/internet/2022/08/10/teens-social-media-and-technology-2022/

Preston, S. D. (2013). The origins of altruism in offspring care. *Psychological Bulletin*, *139*(6), 1305–1341. https://doi.org/10.1037/a0031755

Prot, S., Gentile, D. A., Anderson, C. A., Suzuki, K., Swing, E., Lim, K. M., Horiuchi, Y., Jelic, M., Krahé, B., Liuqing, W., Liau, A. K., Khoo, A., Petrescu, P. D., Sakamoto, A., Tajima, S., Toma, R. A., Warburton, W., Zhang, X., & Lam, B. C. (2014). Long-term relations among prosocial-media use, empathy, and prosocial behavior. *Psychological Science*, *25*(2), 358–368. https://doi.org/10.1177/0956797613503854

Reddish, P., Bulbulia, J., & Fischer, R. (2014). Does synchrony promote generalized prosociality? *Religion, Brain & Behavior*, *4*(1), 3–19. https://doi.org/10.1080/2153599X.2013.764545

Richter, D., & Kunzmann, U. (2011). Age differences in three facets of empathy: Performance-based evidence. *Psychology and Aging*, *26*(1), 60–70. https://doi.org/10.1037/a0021138

Şahin, F. S., Serin, N. B., & Serin, O. (2011). Effect of conflict resolution and peer mediation training on empathy skills. *Procedia - Social and Behavioral Sciences*, *15*, 2324–2328. https://doi.org/10.1016/j.sbspro.2011.04.101

Şahin, M. (2012). An investigation into the efficiency of empathy training program on preventing bullying in primary schools. *Children and Youth Services Review*, *34*(7), 1325–1330. https://doi.org/10.1016/j.childyouth.2012.03.013

Sherman, D. K., & Cohen, G. L. (2006). Advances in experimental social psychology. *Advances in Experimental Social Psychology*, *38*, 183–242. https://doi.org/10.1016/S0065-2601(06)38004-5

Shih, M., Wang, E., Trahan Bucher, A., & Stotzer, R. (2009). Perspective taking: Reducing prejudice towards general outgroups and specific individuals. *Group Processes & Intergroup Relations*, *12*(5), 565–577. https://doi.org/10.1177/1368430209337463

Sierksma, J., Thijs, J., & Verkuyten, M. (2014). Children's intergroup helping: The role of empathy and peer group norms. *Journal of Experimental Child Psychology*, *126*, 369–383. https://doi.org/10.1016/j.jecp.2014.06.002

Sollenberger, D. J., & Singh, M. P. (2022). *Connecting youth through affective, mobile games*. https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.157.5074&rep=rep1&type=pdf

StatCounter. (2016). *Mobile and tablet internet usage exceeds desktop for first time worldwide*. https://gs.statcounter.com/press/mobile-and-tablet-internet-usage-exceeds-desktop-for-first-time-worldwide

Steele, C. M. (1988). The psychology of self-affirmation: Sustaining the integrity of the self. *Advances in Experimental Social Psychology*, *21*(2), 261–302. https://doi.org/10.1016/S0065-2601(08)60229-4

Strahan, R., & Gerbasi, K. C. (1972). Short, homogeneous versions of the Marlow-Crowne Social Desirability Scale. *Journal of Clinical Psychology*, *28*(2), 191–193. https://doi.org/10.1002/1097-4679(197204)28:2<191::AID-JCLP2270280220>3.0.CO;2-G

Strayer, J., & Roberts, W. (2004). Empathy and observed anger and aggression in five-year-olds. *Social Development*, *13*(1), 1–13. https://doi.org/10.1111/j.1467-9507.2004.00254.x

Swain, J. E., Konrath, S., Brown, S. L., Finegood, E. D., Akce, L. B., Dayton, C. J., & Ho, S. S. (2012). Parenting and beyond: Common neurocircuits underlying parental and altruistic caregiving. *Parenting*, *12*(2-3), 115–123. https://doi.org/10.1080/15295192.2012.680409

Taylor, S. (1967). Aggressive behavior and physiological arousal as a function of provocation and the tendency to inhibit aggression. *Journal of Personality*, *35*(2), 297–310. https://doi.org/10.1111/j.1467-6494.1967.tb01430.x

Thoma, P., Zalewski, I., von Reventlow, H. G., Norra, C., Juckel, G., & Daum, I. (2011). Cognitive and affective empathy in depression linked to executive control. *Psychiatry Research*, *189*(3), 373–378. https://doi.org/10.1016/j.psychres.2011.07.030

Thomaes, S., Bushman, B. J., de Castro, B. O., Cohen, G. L., & Denissen, J. J. (2009). Reducing narcissistic aggression by buttressing self-esteem: An experimental field study. *Psychological Science*, *20*(12), 1536–1542. https://doi.org/10.1111/j.1467-9280.2009.02478.x

Thomaes, S., Bushman, B. J., de Castro, B. O., & Reijntjes, A. (2012). Arousing "gentle passions" in young adolescents: Sustained experimental effects of

value affirmations on prosocial feelings and behaviors. *Developmental Psychology*, *48*(1), 103–110. https://doi.org/10.1037/a0025677

Todd, A. R., Bodenhausen, G. V., Richeson, J. A., & Galinsky, A. D. (2011). Perspective taking combats automatic expressions of racial bias. *Journal of Personality and Social Psychology*, *100*(6), 1027–1042. https://doi.org/10.1037/a0022308

Tsai, Y.-F. L., & Kaufman, D. M. (2009). The socioemotional effects of a computer-simulated animal on children's empathy and humane attitudes. *Journal of Educational Computing Research*, *41*(1), 103–122. https://doi.org/10.2190/EC.41.1.e

Underwood, B., & Moore, B. (1982). Perspective-taking and altruism. *Psychological Bulletin*, *91*(1), 143–173. https://doi.org/10.1037/0033-2909.91.1.143

Vachon, D. D., Lynam, D. R., & Johnson, J. A. (2014). The (non)relation between empathy and aggression: Surprising results from a meta-analysis. *Psychological Bulletin*, *140*(3), 751–773. https://doi.org/10.1037/a0035236

Valdesolo, P., & DeSteno, D. (2011). Synchrony and the social tuning of compassion. *Emotion*, *11*(2), 262–266. https://doi.org/10.1037/a0021302

Valdesolo, P., Ouyang, J., & DeSteno, D. (2010). The rhythm of joint action: Synchrony promotes cooperative ability. *Journal of Experimental Social Psychology*, *46*(4), 693–695. https://doi.org/10.1016/j.jesp.2010.03.004

van Berkhout, E. T., & Malouff, J. M. (2016). The efficacy of empathy training: A meta-analysis of randomized controlled trials. *Journal of Counseling Psychology*, *63*(1), 32–41. https://doi.org/10.1037/cou0000093

Vossen, H. G., Piotrowski, J. T., & Valkenburg, P. M. (2015). Development of the adolescent measure of empathy and sympathy (AMES). *Personality and Individual Differences*, *74*, 66–71. https://doi.org/10.1016/j.paid.2014.09.040

Vossen, H. G., & Valkenburg, P. M. (2016). Do social media foster or curtail adolescents' empathy? A longitudinal study. *Computers in Human Behavior*, *63*, 118–124. https://doi.org/10.1016/j.chb.2016.05.040

Warburton, W. A., & Bushman, B. J. (2019). The competitive reaction time task: The development and scientific utility of a flexible laboratory aggression paradigm. *Aggressive Behavior*, *45*(4), 389–396. https://doi.org/10.1002/ab.21829

Weisz, E., Chen, P., Ong, D. C., Carlson, R. W., Clark, M. D., & Zaki, J. (2022). A brief intervention to motivate empathy among middle school students. *Journal of Experimental Psychology: General*, *151*(12), 3144–3153. https://doi.org/10.1037/xge0001249

Winter, R., Issa, E., Roberts, N., Norman, R. I., & Howick, J. (2020). Assessing the effect of empathy-enhancing interventions in health education and training: A systematic review of randomised controlled trials. *BMJ Open*, *10*(9), Article e036471. https://doi.org/10.1136/bmjopen-2019-036471

Yazdi, N. A., Bigdeli, S., Arabshahi, S. K. S., & Ghaffarifar, S. (2019). The influence of role-modeling on clinical empathy of medical interns: A qualitative study. *Journal of Advances in Medical Education & Professionalism*, *7*(1), 35–41. https://doi.org/10.30476/JAMP.2019.41043

Yogev, A., & Ronen, R. (1982). Cross-age tutoring: Effects on tutors' attributes. *The Journal of Educational Research*, *75*(5), 261–268. https://doi.org/10.1080/00220671.1982.10885392

Zaki, J., & Ochsner, K. N. (2012). The neuroscience of empathy: Progress, pitfalls and promise. *Nature Neuroscience*, *15*(5), 675–680. https://doi.org/10.1038/nn.3085

Zhou, Q., Eisenberg, N., Losoya, S. H., Fabes, R. A., Reiser, M., Guthrie, I. K., Murphy, B. C., Cumberland, A. J., & Shepard, S. A. (2002). The relations of parental warmth and positive expressiveness to children's empathy-related responding and social functioning: A longitudinal study. *Child Development*, *73*(3), 893–915. https://doi.org/10.1111/1467-8624.00446