

The third and final part of this doctoral dissertation starts with a summary of the findings of the nine original research studies included. Detailed results and discussions are provided in the manuscripts. This summary is followed by an overall discussion and conclusions, addressing how the findings across the included research studies may aid in a better understanding of cyberbullying bystander behavior, and in assessing the potential of serious digital games to promote healthy lifestyles. Some strengths and limitations of our research will be noted, before deriving its implications for research and practice, and formulating recommendations for future research.

1. Summary of main findings

1.1. Understanding cyberbullying and cyberbullying bystander behavior

The systematic review of studies investigating mental, physical and social health problems related to cyberbullying involvement, described in **chapter 1.1**, established that cyberbullying relates to a plethora of psychosocial and health issues for adolescents, and can be considered as a public health concern. Longitudinal studies revealed that some psychosocial problems are antecedents rather than consequences of cyberbullying involvement, and that for some problems, a bi-directional relationship exists. Cyberbullying thus deteriorates psychosocial and health functioning in an already vulnerable population.

A study among obese youth and their normal-weight peers, described in **chapter 1.2**, confirmed that victimization from cyberbullying relates to psychosocial problems, and that peer victimization may lead to situations further deteriorating these adolescents' health. Obese adolescents were more often the victim of cyberbullying than their normal-weight peers, and obese victims of cyberbullying had a significantly higher risk of having had suicidal thoughts than those non-victimized. Victimization from traditional bullying, but not from cyberbullying, was furthermore associated with a higher avoidance of healthy lifestyles that are needed for successful weight-loss interventions. To conclude, obese youngsters are at increased risk for being cyberbullied, and traditional and cyberbullying pose a risk to the health of these youngsters.

Chapter 1.3 explored adolescents' perceptions of bystander behavior and behavioral determinants, using a Reasoned Action Approach framework. Adolescents confirmed that bystanders play an important role in cyberbullying. They described bystander behavior in cyberbullying not as fixed roles, but as behavior that can vary depending on the context: what is the relation to and social status of the victim, what is the relation to and social status of the bully, and how clearly does this incident qualify as cyberbullying? Moral disengagement attitudes were abundant in these discussions. Youngsters perceived little encouragement from their environment to perform positive bystander behavior,

suggesting socio-ecological approaches for cyberbullying bystander research and interventions are needed.

A quantitative study was conducted to elaborate and confirm these qualitative findings, and is discussed in **chapter 1.4**. The study used a multidimensional and multilevel approach, based on a combined theoretical framework of the Reasoned Action Approach, Social Cognitive Theory and the Bystander Intervention Model. The findings showed that positive and negative bystander behavior and behavioral intentions were determined by many factors, reflecting both attitudes, skills, self-efficacy, environmental facilitators, and background elements, such as own victimization experiences or the friendship bond with the victim. There was limited evidence for a multilevel approach, only some class influences were noticed in determining the intention to perform negative bystander behavior. Findings diverged on some aspects from research on bystander behavior in traditional bullying, and suggest specific attention to cyberbullying bystander behavior in research and intervention is needed.

Chapter 1.5 examined one of the environmental barriers or facilitators in adolescents' positive bystander behavior, namely how educators respond to cyberbullying incidents. Research indicated that adolescents do not report cyberbullying to educators, since educators are considered to not appropriately handle these incidents. While recommended strategies (i.e. conversations with pupils, enlisting professionals for support, parental involvement, providing supportive victim advice) were used most often by educators, a cluster analysis revealed that the two largest educator clusters ('the referrers', and 'the disengaged') were less adept at handling cyberbullying and comprised mostly teachers, particularly indicating a need for training teachers in how to address cyberbullying.

1.2. Understanding the potential of serious digital games to promote healthy lifestyles

Three meta-analyses were conducted to understand the potential of serious digital games in promoting healthy lifestyles. In **chapter 2.1**, a first meta-analysis of 54 serious game studies for healthy lifestyle promotion confirmed that overall, serious games are effective in promoting healthy lifestyles. The effect sizes on behavior or behavioral determinants were small, and similar to those of computer-tailored interventions in other meta-analyses. Long-term effects were maintained for all outcomes, except for behavior. Serious games are best individually tailored to both socio-demographic and change need information, and benefit from a theoretical focus on gaming theories or a dual theoretical foundation in both behavioral prediction and gaming theories. They can be effective either as stand-alone or multi-component programs, and appeal to populations regardless of age and gender, or health domain. Given that the effects of games remain heterogeneous, further explorations of which game characteristics create larger effects are needed.

To follow up on this, a meta-analysis (updated search for recent papers) of 58 game studies was conducted, and described in **chapter 2.2**. This meta-analysis investigated the moderating role of behavior change techniques and game-experience enhancing features in games' effectiveness. Using

more behavior change techniques did not significantly relate to game effectiveness on any outcome, whereas using more game-experience enhancing features related to a lower game effectiveness for behavior. Games were more effective at changing behavioral determinants if they had a simple challenge, or a difficult adaptive challenge, compared to a difficult, non-adaptive challenge. Games were also more effective in changing behavioral determinants if they did not use personal goal-setting and planning compared to those who did. Additional moderators of game effectiveness were found when assessing outcomes separately (e.g. knowledge, attitudes, skills), supporting the importance of designing games with the specific outcome in mind.

A third meta-analysis, described in **chapter 2.3**, examined the moderating role of user involvement, and more specifically of participatory design (PD), in the effectiveness of 58 serious digital game studies for healthy lifestyle promotion. Games developed in participatory design had a lower effectiveness on behavior than games developed only by pilot-testing a finished version among users. However, significant differences existed among PD games. More support was found for informant roles than for co-design roles. When PD was applied to game dynamics, levels and game challenge, this was associated with higher effectiveness than when applying PD to game aesthetics. Since user involvement may be important in the reach, adoption and implementation of the intervention, further research and design efforts are needed to enhance effectiveness of serious games developed with PD.

1.3. Using the Intervention Mapping Protocol in the design of a serious game to promote positive bystander behavior among adolescents

The manuscript in **chapter 3.1** described the development of a serious digital game to promote positive bystander behavior, using the Intervention Mapping Protocol. While no key success factors have yet been identified for cyberbullying intervention and prevention programs, it has been hypothesized that a theoretical underpinning in behavior change theories may aid in these programs' effectiveness. Several theories, such as the Reasoned Action Approach and Social Cognitive Theory, guided the intervention development. The Intervention Mapping protocol was used to aid in the systematic and stepwise application of these theories to create a behavior change program. This was described in the manuscript, reporting on results from systematic literature reviews, meta-analyses, focus groups, survey studies and observational research. This descriptive manuscript aimed to comply with recent demands for more thorough reporting of the intervention development. It may, furthermore, shorten the development process for other programs, by continuing from existing evidence.

2. Overall discussion and conclusions

2.1. Promoting positive bystander behavior in cyberbullying among adolescents

The studies included in **chapters 1.1 and 1.2**, demonstrated that various psychosocial and physical health problems are associated with cyberbullying involvement. A first important finding was that cyberbullying may relate to different health outcomes than traditional bullying. Some disputes exist on whether cyberbullying constitutes a different concern to public health than traditional bullying, and whether consequently a different approach is warranted for this phenomenon. These disputes are further fueled by evidence that traditional bullying programs have shown reductions in cyberbullying as well, and the opinion that a targeted approach for cyberbullying is hence unnecessary (Olweus, 2012; Salmivalli, Kärnä, & Poskiparta, 2011). Our research findings in **chapters 1.1 and 1.2** showed that victimization from traditional bullying and from cyberbullying, related to some divergent health problems. For example, cybervictimization appeared to be stronger associated with suicidal ideation than traditional victimization did, and that some factors, such as self-esteem, anxiety and substance abuse, were only antecedents of cybervictimization while a bidirectional relationship existed with traditional victimization (**chapter 1.1**). Also among obese youth (**chapter 1.2**), victims from traditional bullying experienced different psychosocial health problems (e.g. lower quality of life) than victims from cyberbullying (e.g. higher suicidal thoughts). The findings from these studies included in the dissertation thus confirm other research findings showing associations between health problems and cyberbullying involvement (Kowalski, Giumetti, Schroeder, & Lattaner, 2014; Suzuki, Asaga, Sourander, Hoven, & Mandell, 2012), but contribute to this literature by examining different patterns between cyberbullying and traditional bullying, and by reviewing longitudinal studies to establish the direction of these associations (**chapter 1.1**). Most recently summarized information drew only on cross-sectional studies (Kowalski et al., 2014), examined only one of these forms (Gini & Pozzoli, 2009; Suzuki et al., 2012), or did not single out associations by type of bullying (Arseneault, Bowes, & Shakoor, 2010). This research further contributed to literature by investigating an at-risk group of obese adolescents, where very limited and inconsistent evidence is available related to cyberbullying (**chapter 1.2**) (Puhl, Peterson, & Luedicke, 2013; Wang, Iannotti, & Luk, 2010).

Although more longitudinal research on both traditional and cyberbullying is needed, these potentially different antecedents and outcomes may imply that different target groups and psychosocial warning signals should be identified for cyberbullying and for traditional bullying. Cybervictimization, furthermore, had its own unique contribution to negative health outcomes, and thus warrants specific attention in research and interventions. It may, however, still be recommended to address both cyberbullying and traditional bullying in one integrated program (Pearce, Cross, Monks, Waters, & Falconer, 2011) to avoid a shift from one bullying type to another (Elledge et al., 2013).

A second important finding of the studies included in this dissertation was the potential to address cyberbullying by increasing positive bystander behavior (**chapters 1.3, 1.4, 3.1**). As stipulated in the Intervention Mapping Protocol, the development of a health promotion intervention should focus on restating a problem situation (bullying) into risk-reducing or health-promoting behaviors, which may not necessarily be the negation of the problem situation (e.g. not bullying). The descriptive paper on the development of the Friendly Attac game showed that to reach the desired health and quality-of-life outcomes for adolescents, addressing bystander behavior may be a viable approach (**chapter 3.1**). In traditional bullying, meta-analyses demonstrated that bystander behavior can be changed (Polanin, Espelage, & Pigott, 2012), but that anti-bullying programs should include peer interventions in a whole-school program to be effective (Ttofi & Farrington, 2011).

At the onset of our project, to our knowledge, no research among adolescents existed on what determines bystander behavior in cyberbullying. Our qualitative research findings (**chapter 1.3**) confirmed that bystander behavior does play a role in cyberbullying. These focus groups, moreover, showed bystander behavior is not a fixed role and is context-dependent, as has been suggested in some research on bystander behavior in traditional bullying (Espelage, Green, & Polanin, 2012; Espelage & Swearer, 2003; Gini, Albiero, Benelli, & Altoè, 2007; Salmivalli & Voeten, 2004). This has important implications for intervention programs. Rather than applying a personal deficit model, and assuming that with sufficient empathic or social skills adolescents will always defend, our findings show that a broader set of contextual factors needs to be considered. For example, even those nominated as defenders, may not defend loners, since everyone mostly stands up for their own friends.

A fourth finding showed the relative importance of attributes in predicting bystander behavior, which also has important implications for interventions (**chapter 1.4**). Since we executed this qualitative study, a few other studies on adolescent bystander behavior in cyberbullying have been published, each focusing on a limited set of determinants (Barlińska, Szuster, & Winiewski, 2013; Barlińska, Szuster, & Winiewski, 2015; Bastiaensens et al., 2014; Bastiaensens et al., 2015a; Bastiaensens et al., 2015b; Holfeld, 2014; Machackova, Dedkova, Sevcikova, & Cerna, 2013; Obermaier, Fawzi, & Koch, 2014; Olenik-Shemesh, Heiman, & Eden, 2015; Price et al., 2014; Van Cleemput, Vandebosch, & Pabian, 2014). The study in **chapter 1.4** used a multidimensional model, which examined a broad set of behavioral determinants and included context variables. This multidimensional model, based on behavior change theories, fit well in explaining positive and negative bystander behavior. The study contributed to literature by establishing the predictive value of factors that had not been studied in previous quantitative studies (e.g. moral disengagement attitudes, self-efficacy to end cyberbullying, coping skills, and parental monitoring of Internet activities), and by including a broad set of predictors, which allowed to control for the influence of predictors that would only explain behavior via shared predictive power. These findings can provide directions in intervention development, since influencing

the strongest predictors among the modifiable determinants is most likely to result in a change in the target behavior (Bartholomew, Parcel, Kok, Gottlieb, & Fernández, 2011). Few current cyberbullying programs have targeted bystander behavior (Van Cleemput, in preparation), and no evidence yet exists on effective components of interventions to change bystander behavior, neither from cyberbullying, nor from traditional bullying (Polanin et al., 2012). These research findings can, therefore, aid in future evidence-based interventions to change bystander behavior in cyberbullying. Prevention and intervention programs to increase positive bystander behavior should therefore focus on the outcome expectations of benefiting the victim and supporting also those who are not good friends, and on increasing intentions to act as a positive bystander by increasing social skills, attitudes supporting positive behavior and condemning negative behavior, maternal awareness of Internet activities, coping skills and self-efficacy (**chapter 1.4**).

A last finding from both the quantitative and qualitative study on bystander behavior in this dissertation (**chapters 1.3 and 1.4**), showed the need for support from parents and educators for positive bystander behavior, and emphasized the importance of a socio-ecological perspective in studying cyberbullying bystander behavior. A socio-ecological perspective of health behavior recognizes interacting influences of both personal and environmental factors, and interventions based on these perspectives may yield larger community effects (Sallis, Owen, & Fisher, 2008). Qualitative findings described in **chapter 1.3**, indicated that apart from the peer context, support from parents and educators mattered, and was perceived to be largely lacking for positive bystander behavior. The quantitative study on bystander behavior (**chapter 1.4**) confirmed that maternal awareness of Internet activities was a significant predictor of the intention for positive bystander behavior. This study employed a multilevel analysis, which is the first study on bystander behavior in cyberbullying to do so. This analysis showed an influence of the class that adolescents belonged to on their intention to act as a negative bystander, which may relate to class norms and should be addressed at this class level by educators. The study among educators (**chapter 1.5**) confirmed the perceptions of adolescents in the qualitative study (**chapter 1.3**), that educators are ill-equipped to handle cyberbullying. Especially teachers less often used recommended strategies, such as talking with pupils about cyberbullying, and felt less capable to handle cyberbullying. The perceived lack of competence in handling cyberbullying among teachers was consistent with other research (Cassidy, Brown, & Jackson, 2012; Eden, Heiman, & Olenik-Shemesh, 2013; Huang & Chou, 2013; Li, 2008; Stauffer, Heath, Coyne, & Ferrin, 2012; Vandebosch, Poels, & Deboutte, 2014), but the study reported in **chapter 1.5** extended existing research by exploring other behavioral determinants, such as attitudes and outcome expectations. Findings showed that more transfer is needed between principals and school counselors to teachers on how to handle cyberbullying. Having a school policy may also provide a firmer ground for educators to intervene in cyberbullying, as shown in traditional bullying research (Bauman, Rigby, & Hoppa, 2008). Although some recommendations exist in papers (see e.g. Pearce et al., 2011), little directions are provided for school

staff on how to intervene in cyberbullying in current evidence-based cyberbullying prevention and intervention programs (Van Cleemput et al., in preparation). This component needs to be strengthened in future anti-cyberbullying programs as a facilitator of positive bystander behavior. Also for these environmental agents' behavior, most significant and changeable determinants need to be identified in order to effectively address these in a cyberbullying program (Bartholomew et al., 2011). These have been reported in the descriptive paper on the Friendly Attac game development (**chapter 3.1**).

In sum, cyberbullying related to some different health outcomes than traditional bullying, and may warrant specific attention in research and interventions. The Intervention Mapping Protocol encourages an analysis of which behaviors can improve these health outcomes. Promoting positive bystander behavior can be a viable approach to address cyberbullying and its health outcomes. Bystander behavior is context-dependent, and influenced by adolescents' relation with peers, and support from parents and educators. Educators, and especially teachers, are in need of training to suitably support adolescents in their positive bystander behavior, and reduce intentions for negative bystander behavior. Bystander behavior is determined by a multitude of factors. A multidimensional model, grounded in behavior change theories and corresponding with a socio-ecological framework, aided in explaining bystander behavior in adolescents. Behavior change theories were also applied to explaining educator and parental behavior, and described in change matrices following the approach posited in the Intervention Mapping Protocol. These findings provided directions for programs to intervene at several levels of the socio-ecological model.

2.2. The potential of serious digital games to promote healthy lifestyles

Several systematic reviews suggested that serious digital games may be effective in promoting healthy lifestyles. The meta-analysis in **chapter 2.1** was the first to confirm that, on average, serious digital games are effective in promoting healthy lifestyles. Large differences between the game studies, however, existed. Several moderators, hypothesized in earlier reviews, were explored to explain these differences (**chapters 2.1, 2.2 and 2.3**). The meta-analyses provided the first validation of these hypotheses.

The theoretical foundation of the game development was examined in relation to game effectiveness (**chapter 2.1**). The first meta-analysis showed that games developed when using a gaming theory, with or without a behavior change theory, were more effective, whereas games developed solely based on behavior change theories were least effective. This may conflict with the findings of the second meta-analysis (**chapter 2.2**), where the role of game-experience enhancing features in effectiveness was explored. Using more 'gaming' features assumed to increase immersion related to lower effectiveness. Applying a gaming theory can thus contribute to game effectiveness, but should not result in a stacking

of highly immersive gaming features. Highly immersive games may increase cognitive load, and consequently reduce effectiveness (Schrader & Bastiaens, 2012). Many gaming theories focus on player motivation and on maintaining an optimal balance between mastery and curiosity (Kapp, 2012). Possibly, these theories aided in a better selection of gaming features, to avoid cognitive overload and maintain a sense of control for the player. The combined findings of these meta-analyses underline the need for a gaming theoretical grounding of the choice of gaming features.

A higher effectiveness of games that used fewer gaming features (**chapter 2.2**), and more particularly that had simpler challenges or consisted of only one level, may also suggest that serious digital games do not require all the ‘whistles and bells’ from commercial games to be effective. This would lend support to a gamification approach (Deterding, Dixon, Khaled, & Nacke, 2011; Deterding, 2012), where a few game elements, such as a simple challenge and rewards or feedback, are applied to a non-game intervention (e.g. mobile applications or ‘apps’, real-life activity). These simpler games may, moreover, present a more cost-effective approach, if their development requires fewer resources. To our knowledge, no cost-effectiveness study on this topic has yet been undertaken.

Only applying behavior change theories related to lower game effectiveness (**chapter 2.1**). This demonstrates differences between serious digital games and other digital health promotion programs, such as computer-tailoring interventions, where these theories were associated with moderately high effectiveness (Webb, Joseph, Yardley, & Michie, 2010). Similarly, some behavior change techniques (BCT), such as personal goal-setting and planning were found to be highly effective in other health promotion interventions (Dusseldorp, van Genugten, van Buuren, Verheijden, & van Empelen, 2014; Michie, Abraham, Whittington, McAteer, & Gupta, 2009), but related to lower effectiveness in serious digital games (**chapter 2.2**).

Several hypotheses can be formulated to explain the relatively low importance of behavior change theories and BCTs in serious game effectiveness. First, since techniques and theories were derived from reports in the game study papers, it is unclear if the behavior change theories and techniques were correctly applied. Techniques and behavior change theories are known to be incorrectly interpreted and applied, which can cause variety between interventions’ effectiveness (Michie et al., 2011). Moreover, this correct application may have been further complicated by the game context. Digital serious games are assumed to partially derive their value from being fun (Prensky, 2007), which implies that using theoretical concepts and BCTs also needs to guarantee an enjoyable game experience. This may have resulted in an adjustment of BCTs to less optimal conditions for their effects. For example, for feedback to be effective, it should be immediate, specific, and positive (Baranowski, Bower, Krebs, Lamoth, & Lyons, 2013). In games, however, feedback that meets all theory-based principles is assumed to break the ‘flow’ and increase player fatigue (Lyons, 2015). Whether the standard feedback provided in games

that shows players how they are performing, e.g. via visual or auditory cues, can attain the same outcomes as feedback meeting theory-based recommendations, was raised as a question for future research (Lyons, 2015). More research is needed on how to select and translate behavior change techniques in a game, while retaining both their effectiveness and the enjoyable game experience. During the serious game development in the Friendly Attac project, a lack of direction was experienced in the Intervention Mapping Protocol on how to use BCTs in specific applications, such as serious digital games (**chapter 3.1**). More detailed descriptions and evaluations are needed of how BCTs were integrated with gaming theories and features, to identify application-specific considerations when using the Intervention Mapping Protocol. The descriptive manuscript (**chapter 3.1**) included in this dissertation aims to add to this beginning literature. Second, it is possible that certain combinations of BCTs may relate to game effectiveness, whereas individual BCTs or other combinations would not be effective. This was demonstrated for other types of health promotion programs (Dusseldorp et al., 2014; van Genugten, Dusseldorp, Webb, & van Empelen, 2015), and would need further investigation for serious digital games.

Conversely, the effectiveness of BCTs and immersive game features differed by specific target outcome, such as behavior, behavioral intentions, knowledge, attitudes, skills or self-efficacy (**chapter 2.2**). Serious games should therefore be designed with the specific target outcome in mind. Behavior change theories are needed to establish which outcomes to target, in order to attain the desired health and quality-of-life outcomes (Bartholomew et al., 2011). Despite a lower effectiveness of only using behavior change theories in current serious game design (**chapter 2.1**), these findings in **chapter 2.2** indicate behavior change theories are needed in serious game design, to guide the selection of BCTs and gaming features for an optimal fit with the behavior and behavioral determinants to be changed.

A behavior change technique that did relate to game effectiveness was individual tailoring (**chapter 2.1**). Tailoring of the content to users' (socio-demographic) characteristics related to higher game effectiveness, as in non-game interventions (Bridle et al., 2005; Krebs, Prochaska, & Rossi, 2010; Noar, Benac, & Harris, 2007). Personalization of the looks of the game to user characteristics, however, related to lower effectiveness on some outcomes. Similarly, involving users in the design of the looks related to lower game effectiveness, whereas their involvement in design of the content (e.g. challenge) did relate to higher game effectiveness (**chapter 2.3**). Although the meta-analyses did not investigate the role of graphics and visuals in game effectiveness, the findings suggest that matching these features to user traits is not beneficial. We may also hypothesize that visuals and graphics are, in general, less strongly associated with game effectiveness. This is in line with a meta-analysis on educational serious games, which showed that games with more realistic visuals were less effective than simple text or cartoon-like games (Wouters, van Nimwegen, van Oostendorp, & van der Spek, 2013). Involving users in these irrelevant aspects may therefore not benefit game effectiveness. The Intervention Mapping

Protocol emphasizes the importance of user and stakeholder involvement throughout the planning and implementation process (Bartholomew et al., 2011). Benefits of this involvement lie not only in the intervention's effectiveness, but also in the reach and adoption of the intervention during implementation (Bartholomew et al., 2011). In the Friendly Attac game (**chapter 3.1**), users and stakeholders were involved from the start. Although our meta-analytic findings indicated that only pilot-testing a finalized version of the game is more effective than involving users as informants or co-designers during design (**chapter 2.3**), users were still actively involved in the design of the Friendly Attac game, since this may be of value in later project stages, during implementation. The meta-analytic insights, nevertheless, aided in choosing a specific approach of user involvement (e.g. users involved as informants, in game decisions on challenge and levels) which, when using active user involvement, related to higher effectiveness (**chapters 2.3 and 3.1**). Since early user involvement is important to achieve reach, adoption, and sustained implementation of a health-promotion intervention (Compennolle et al., 2014), it is essential to optimize the effectiveness of active user involvement in serious games, as all these elements together (see e.g. RE-AIM framework) determine the public health impact of health-promoting interventions (Glasgow, Vogt, & Boles, 1999; Glasgow, Lichtenstein, & Marcus, 2003).

In sum, serious digital games can be effective to promote healthy lifestyles. Several moderators of game effectiveness were identified, that can aid in future evidence-based serious game design. These meta-analyses were the first to validate certain hypotheses for variability in game effectiveness formulated in literature. In this relatively novel area of health promotion interventions, however, many hypotheses on the effective mechanisms of serious digital games remain to be explored in future research.

3. Strengths and limitations

In this section, the major strengths and limitations of the original research studied included in this doctoral thesis will be discussed, relating to study design and methodology.

3.1. Strengths

- The intervention design used a systematic theory- and evidence-based approach, and was informed by a multidimensional and socio-ecological model. The multidimensional model, based on behavior change theories, allowed to assess relative weights of predictors and to set priorities for the factors on which to intervene first. Research was conducted among groups at several layers of the socio-ecological model (bystander, parent, educator), rather than only assessing educator and parental influences as perceived by the bystander. To change the environmental influences into a supportive context, determinants of their behavior need to be assessed as well, and used as starting points to address environmental influences in a multilevel intervention. This information was still

largely lacking in research until now. Since current cyberbullying interventions that pay attention to the environment, did not describe the basis for these components and are often limited to awareness raising (Van Cleemput et al., in preparation), the multidimensional and socio-ecological approach in our studies provide a sound basis for a multilevel intervention, which may have a higher chance of yielding larger community effects (Sallis et al., 2008).

- The research among bystanders first used a qualitative approach, to inform the design of the quantitative study, as recommended when designing health promotion interventions (Bartholomew et al., 2011).
- We chose not to use peer nominations of bystander roles. Although self-reported bystanding behavior may result in more socially desirable answers, as shown by higher defending rates in studies using self-reports than when using peer nominations (Nickerson, Mele, & Princiotta, 2008; Salmivalli, Lappalainen, & Lagerspetz, 1998), self-reported behavior allowed adolescents to take on several roles, depending on the context. This was in line with our findings from the qualitative study. Furthermore, using peer nominations was reported to only reflect the 'extremes': pupils are considered to fall in a particular role category, when the number of nominations they have received lies above an (arbitrary) cut-off point (Solberg & Olweus, 2003).
- The meta-analysis was able to test the most prevailing hypotheses in literature on variability in game effectiveness at the time of the study, thanks to a large sample of game studies and total number of respondents. The meta-analysis was the first on this topic, and advanced research on serious health game effectiveness by substantiating or disproving certain hypotheses, and formulating new directions for research. Only rigorous methodological designs using a control condition were included, to provide strong support for the meta-analytic findings. Several sensitivity analyses were conducted to rule out influences of methodological differences between studies.

3.2. Limitations

- Our study provided limited insights in the class characteristics that influenced bystander behavior. We could therefore not explain what caused these class influences on bystander behavioral intention. Research from traditional bullying suggests that class pro-bullying norms (Pozzoli, Gini, & Vieno, 2012) or lack of teacher support for positive bystander behavior (Hektner & Swenson, 2012) contributes to class influences in bystander behavior. This warrants further research for cyberbullying.
- It has been suggested that a comprehensive list of behavior change techniques should be used to reflect intervention content (Michie et al., 2009). Our meta-analyses only used a small list, representing what was most prevalent in serious health game literature. While a more extensive list

of behavior change techniques may be recommended in future meta-analytic research, its practical use remains limited by the BCTs sufficiently reported in papers, to allow moderator analyses. Alternatively, more elaborate design papers describing BCTs, or a playable version allowing an in-vivo coding, would be warranted to allow the investigation of an extensive set of BCTs.

- The Friendly Attac serious game against cyberbullying was developed following a systematic evidence- and theory-based approach. This procedure increases the chance that the intervention will be effective, but this cannot be assumed until confirmed in a (group-) randomized-controlled trial.

4. Implications for research and practice

Based on the study findings in this dissertation, the following research and practice recommendations were made:

- When studying bystander behavior in cyberbullying, the variations in bystander behavior and intentions based on context characteristics should be taken into account. Peer nominations resulting in strict role categories thus do not reflect the complex reality. Findings, furthermore, showed that adolescents would always defend their good friends, which implies that someone with more friends will be more often designated as a defender, while this may not reflect their behavior when a ‘loner’ is cybervictimized. This loner may, however, be more in need of defending. Given these limitations, peer nominations resulting in strict role categories, may not be a recommended approach when studying bystander behavior in cyberbullying.
- A personal deficit model in interventions to promote positive bystander behavior is not recommended, since bystander behavior is influenced by a multitude of factors that surpass a lack of skills. Similarly, investigating a small set of predictors in relation to bystander behavior may give biased results due to shared variance with other, stronger, predictors. Interventions promoting positive bystander behavior should incorporate the following components: outcome expectations of benefiting the victim, support for those who are not good friends, social skills, attitudes supporting positive behavior and condemning negative behavior, maternal awareness of Internet activities, coping skills and self-efficacy to show positive bystander behavior.
- Interventions to promote positive bystander behavior should moreover create a facilitating environment, by improving educator self-efficacy, attitudes, outcome expectations and use of appropriate strategies in dealing with cyberbullying. This, in turn, needs to be facilitated by a school policy and transfer of knowledge from principals and counselors to teachers. Also parental support for positive bystander behavior needs to be increased by e.g. emphasizing the importance of a positive class climate for their children’s development rather than a protective perspective.
- Serious digital game development for healthy lifestyle promotion should be founded on gaming theories, complemented with behavior change theories that aid in selecting outcome-specific

features and correct translations of BCTs, such as individual tailoring and immediate feedback. Simple games, that are low in immersive features, are preferred. Certain BCTs, such as personal goal setting and planning, are less advised in serious digital games and warrant further investigation on how to increase their effectiveness in a serious game context.

- Users should be involved in competence-related areas, such as the game dynamics, challenge and levels, and not in visual aspects of character design or the game world. Involving users as informants may be more beneficial than as co-designers.

5. Directions for future research

Since both bystander behavior in cyberbullying and serious games for health promotion are relatively novel research areas, this dissertation also raised many questions that may be addressed in future research. Listed below are some suggestions based on this dissertation's findings that may further advance research on these topics.

- Parental support for positive bystander behavior was reported by adolescents to be low, and our findings indicated an influence of maternal awareness of cyber-activities on bystander behavioral intention. In traditional bullying, positive bystander behavior was associated with the open and warm relation adolescents had with their mother. Indeed, merely increasing supervision and monitoring in an authoritarian manner may not yield the desired effect. The mediating role that parenting and communication styles, and family attachment have in the link between awareness and positive bystander behavior should be explored in further research. These insights could provide directions for the parental component in interventions, in particular on how to promote awareness and communication on cyber-activities with their adolescent child.
- When comparing predictors of bystander behavior in cyberbullying to findings from traditional bullying bystander behavior, several emotional correlates, such as empathy, were less important for cyberbullying. This may indicate that bystanders are less emotionally disturbed by cyberbullying than by traditional bullying, and could relate to the online physical distance and lower availability of social cues from the victim. Further research is needed to confirm this, and to assess ways to increase this emotional involvement for bystanders in interventions.
- Research on the role of bystander interventions in ending cyberbullying or decreasing its harm is currently based on qualitative, self-reported information by the adolescents. Studies are needed that can single out the influence of bystander interventions on reductions in cyberbullying, cybervictimization and its associated health problems, in cross-sectional and longitudinal quantitative studies.
- More research is needed on class influences on positive bystanding, such as the role of class norms and teacher support.

- Future meta-analyses on the role of game characteristics in its effectiveness should investigate the synergetic or cumulative effects of these features, with a larger set of BCTs, in as much as is allowed by reports in design papers, or by in-vivo coding of the game.
- Only few papers in our meta-analysis measured game experience or enjoyment with a validated scale that would allow comparison across studies. The use of validated game experience and enjoyment questionnaires in studies assessing serious health game effectiveness, should be advocated. This would allow to assess the moderating role of game experience in game effectiveness.
- The meta-analysis on participatory design provided information on moderating influence of the area in which users were involved, and the role they were assigned, but did not study the specific approach for user involvement. Detailed process descriptions of active user involvement in the development of serious digital games should be made available to distill the approaches of user involvement, which may be more effective in future research.
- More research is needed on how BCTs may have been ‘watered down’ to fit within an entertainment approach of games, and how this affects the effectiveness of the change techniques. On the other hand, certain BCTs, such as personal goal-setting and action planning, may need to be adjusted to incorporate a fun element, in order to be effective in a game context. Guidelines on game applications of these techniques that maintain an optimal balance of theoretical fidelity and game experience are needed.
- Since simpler ‘gamified’ applications may relate to higher effectiveness and may require less resources to create, a cost-effectiveness study on serious digital games is warranted.
- While the Friendly Attac game was designed using an evidence-based and theory-based approach, its effectiveness in increasing positive bystander behavior, and reducing cyberbullying, cybervictimization and psychosocial harm, is yet to be investigated.

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