

Investigating the Conditional Adaptiveness of Adolescents' Aggression from an Evolutionary
Perspective

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ABSTRACT

Growing evidence supports the evolutionary perspective characterizing aggression as a strategy to achieve proximate adaptive benefits which can indirectly and probabilistically contribute to ultimate evolutionary goals (survival and reproduction). However, aggression may only be adaptive under certain conditions. Therefore, this dissertation investigated various conditions that may affect the adaptiveness of adolescent aggression, namely aggression characteristics (aggressive form, function, and anonymity), target characteristics (power of victim relative to the perpetrator), and perpetrator characteristics (experience of victimization and gender). Study 1 used a person-oriented approach to investigate how proactive and reactive cyber aggression and concurrent experiences of cyber victimization were associated with evolutionarily relevant social advantages and disadvantages in a community sample. Study 2 examined differential associations between aggression involvement and evolutionarily relevant aggressive functions, considering variations in aggressive form, the target's power relative to perpetrator, and the perpetrator's gender in a school-based sample. Finally, in a school-based sample, Study 3 investigated (1) how the associations between anonymous perpetration and evolutionary functions of aggression varied by aggressive form and the perpetrator's gender, (2) how the target's power and the perpetrator's gender related to adolescents' use of anonymous perpetration in each aggressive form, and (3) differential associations between anonymous victimization and victims' perceptions of harm as a function of aggressive form and gender of the victim. Results suggest that adolescents' aggression was linked to evolutionarily relevant aggressive functions motivated by competitive (e.g., aggression deterrence, intrasexual competition), impression management (seeking status and mates), sadistic (enjoyment), and reactive (impulsive response to real/perceived threats) functions, and to social advantages (social

dominance, dating behaviour) for aggressors who used reactive aggression less frequently. However, aggression involvement was differentially associated with evolutionary motives based on the form, function, or anonymity of aggression, target characteristics, and perpetrator characteristics. Moreover, aggression was associated with costs, especially for cyber aggressor-victims who frequently aggressed reactively, and for victims of anonymous aggression. Thus, adolescents' aggression may be conditionally adaptive for a narrow range of functions, depending on the characteristics of the aggression, target, and perpetrator. By highlighting the conditional adaptiveness of adolescent aggression, this research may inform efforts to improve interventions addressing aggression.

Keywords: adolescence; aggression; bullying; conditional adaptiveness; evolution.

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CHAPTER 1: GENERAL INTRODUCTION

Over the past two decades, there has been an increase in research utilizing an evolutionary framework to examine a wide range of aggression and bullying subtypes in adolescence (see Ingram, 2014; Smith, 2020; Volk et al., 2012) to better understand the triggers or motives that drive specific acts of aggression and, in turn, inform intervention strategies which have demonstrated limited effectiveness in reducing adolescent aggression (e.g., Ellis et al., 2016; Gaffney et al., 2019; Yeager et al., 2015). In general, the evolutionary perspective suggests that aggressive tendencies may have evolved as adaptations to solve problems humans have encountered in the environment of evolutionary adaptation, which refers to the collection of historical contexts from which humans have evolved (Buss & Shackelford, 1997; Eisner & Malti, 2015; Smith, 2020; Symons, 1990; Volk et al., 2012). Indeed, throughout humans' evolutionary history, aggression has been utilized to solve various adaptive problems, such as obtaining access to resources, status, dominance, and mates, as well as inflicting costs on, and deterring aggression from, rivals, which can impact the likelihood of achieving ultimate evolutionary goals related to survival and reproduction (Archer, 2009; Bjorklund & Hawley, 2014; Buss & Shackelford, 1997; Vaillancourt, 2013; Volk et al., 2012). This contention has been supported by evidence obtained from various lines of research in historical and contemporary contexts, including archeological, anthropological, comparative and developmental psychological, and behavioural-genetic research (e.g., Apicella, 2014; McCall & Shields, 2008; Porsch et al., 2016; Stewart, 1987; Veldkamp et al., 2019; Volk et al., 2012; 2014). However, given that aggression and bullying are also commonly associated with maladaptive correlates, including peer problems (see Cook et al., 2010; Smith, 2020), evolutionary theory and research suggests that it is a facultative adaptation that is only

conditionally adaptive, enabling individuals with suitable traits to solve a narrow range of adaptive problems in favourable contexts. As such, this dissertation will examine adolescent aggression from an evolutionary perspective to further illuminate the personal, behavioural, and contextual conditions that may affect the adaptiveness of aggressive behaviour in contemporary school and community contexts.

In general, aggression refers to behaviours used to intentionally inflict psychological or physical harm upon others, which can be motivated by both proactive (i.e., goal-directed) and reactive (i.e., in response to provocation) functions (Eisner & Malti, 2015). In contrast, bullying is a specific subtype of proactive aggressive behaviour that is used against a vulnerable, less powerful target (Volk et al., 2014). Although much research has focused on traditional bullying and aggression in physical (e.g., hitting, pushing), verbal (e.g., name calling, threatening), and relational (e.g., spreading rumours, excluding others from peer group) forms, there is relatively less research on cyberbullying and cyber aggression, which is perpetrated through electronic technology such as cell phones and the internet (Dooley et al., 2009; Modecki et al., 2014). Cyber aggression can include behaviours typical of verbal and relational aggression, but because it occurs through electronic devices such as cell phones or the internet, it can also include unique actions like hacking or impersonating others or sharing embarrassing photos/videos of others without consent, and it is not limited to in-person settings (Kowalski et al., 2014). Meta-analytic research suggests that although around 35% of adolescents are involved in traditional bullying, either as a perpetrator or victim, only about 15% of adolescents report involvement in cyberbullying or cyber victimization (Modecki et al., 2014). However, studies assessing the prevalence of cyber aggression more generally have observed estimates ranging from 30-35% (Garaigordobil et al., 2020; Pabian et al., 2015; Ybarra et al., 2014; Ybarra & Mitchell, 2007).

Thus, it appears that a substantial minority of adolescents are likely involved in aggression of some kind.

The ubiquity of aggression and bullying poses significant problems for adolescents. Much research suggests that victims tend to experience peer problems, indicated by a greater likelihood of peer rejection (Casper et al., 2020; de Bruyn et al., 2010; Monks et al., 2009), low levels of social preference/acceptance (Casper et al., 2020; Kisfalusi et al., 2022; Pouwels et al., 2018; Sijtsema et al., 2009; Yubero et al., 2017), status (Cook et al., 2010; Pouwels et al., 2016; Rivers & Noret, 2009), and support (Casper & Card, 2017), as well as poor peer attachment/affiliation (Burton et al., 2013; Ortega Barón et al., 2018; Worsley et al., 2019; Wright et al., 2015), and friendship quality (Casper et al., 2020; Kawabata & Tseng, 2019; Marciano et al., 2020). Furthermore, victims tend to report having psychosocial difficulties, including low social competence (Antoniadou et al., 2019; Coelho & Marchante, 2021; Cook et al., 2010), and self-efficacy (Peker, 2021), as well as psychosomatic (Fisher et al., 2016; Gini & Pozzoli, 2009; Kowalski et al., 2014) and internalizing problems such as depression, anxiety, loneliness, low self-esteem, and suicidal ideation/attempts in correlational (Casper & Card, 2017; Fisher et al., 2016; Gini et al., 2017; Holt et al., 2015; Kokkinos & Antoniadou, 2019; Kowalski et al., 2014; Yang et al., 2021; Yubero et al., 2017) and longitudinal research (Coelho & Marchante, 2021; Fahy et al., 2015; Guerra et al., 2011; Marciano et al., 2020; Ozdemir & Stattin, 2011).

Similarly, bullies and aggressors are also likely to report peer problems, including low peer acceptance/social preference (Card et al., 2008; Cillessen & Mayeux, 2004; de Bruyn et al., 2010; Kisfalusi et al., 2022; Malamut et al., 2020; Paez, 2019; Peets & Hodges, 2014; Pouwels et

al., 2016; Pronk et al., 2017; Reijntjes et al., 2013a; Rodkin & Berger, 2008; Sentse et al., 2015; Wright, 2014), low perceived social support (Kowalski et al., 2014; Wang et al., 2019; Zych et al., 2018), and high peer rejection (Casper et al., 2020; de Vries et al., 2021; Ettekal et al., 2015; Sentse et al., 2015; Wright & Li, 2013). Furthermore, although some research suggests that bullies may experience poor physical and mental health (see Kretschmer et al., 2021; Smith, 2020), including psychosomatic (Gini & Pozzoli, 2009) and internalizing problems (Bonanno & Hymel, 2013; Coelho & Marchante, 2021; Cook et al., 2010; Dumas et al., 2017; Kowalski et al., 2014; Patchin & Hinduja, 2010; Peker et al., 2021), the results of this research are mixed. Indeed, some longitudinal research has shown that bullying perpetration during childhood and adolescence was not linked to poor mental or physical health outcomes in either the short-term (Espejo-Siles et al., 2020; Fahy et al., 2015; Hemphill et al., 2015) or in adulthood (Copeland et al., 2013; 2014). Additionally, correlational research demonstrates that pure bullies tend not to score as poorly as pure victims or bully-victims (i.e., both a bully and a victim) on measures of internalizing problems (Ireland, 2005; Juvonen et al., 2004; Koh & Wong, 2017; Ozdemir & Stattin, 2011; Smith, 2020; Volk et al., 2006), and life satisfaction (Nozaki, 2019). Furthermore, bullying has also been linked to high social competence/theory of mind abilities (Antoniadou et al., 2019; Caravita et al., 2009; Smith, 2020; Sutton et al., 1999; Vaillancourt et al., 2003), and social status/perceived popularity (Cillessen et al., 2014; de Bruyn et al., 2010; de Vries et al., 2021; Garandeau et al., 2010; Juvonen et al., 2004; Sijtsema et al., 2009; Thunfors & Cornell, 2008).

Because such findings contradict the common belief that bullying is the result of psychosocial difficulties, they prompted research from an evolutionary perspective to consider how aggression may be a functional behaviour that allows some individuals to achieve

evolutionarily relevant benefits that may (indirectly and probabilistically) increase chances of survival and reproduction. More specifically, evolutionary researchers have posited that aggression may be a facultative adaptation, that may be triggered by, or more useful in, certain environmental contexts (Eisner & Malti, 2015; Underwood, 1954), and conditionally adaptive for some individuals (see Volk et al., 2012). To build on research taking an evolutionary perspective, this dissertation aimed to further examine whether aggression is more likely to be associated with evolutionarily relevant benefits under certain conditions, depending on certain characteristics of the aggression (i.e., aggressive form, functions, and degree of anonymity), the target (i.e., power of target relative to perpetrator), and the perpetrator (i.e., gender, and experience of victimization), as explained in more detail below.

Aggression from an Evolutionary Perspective

As noted above, the evolutionary perspective of aggression purports that aggressive tendencies may have evolved as adaptations to solve problems in historical contexts in the environment of evolutionary adaptation (Buss & Shackelford, 1997; Eisner & Malti, 2015; Smith, 2020). Archaeological evidence suggests that the human species has a long history of violence (McCall & Shields, 2008; Pinker, 2011), and new forensic evidence demonstrates that interpersonal violence between early modern humans can be traced back 30,000 years (Kranioti et al., 2019). Moreover, there is substantial cross-cultural evidence to suggest that aggression and bullying have been observed in geographically and ethnically diverse cultures throughout human history (see Volk et al., 2012). Thus, aggression is historically ubiquitous within the human species and evolutionary theorists contend this may be because it serves evolutionarily relevant functions, such as obtaining access to resources, status, dominance, and mates, as well as inflicting costs on, and deterring aggression from, rivals, which can contribute to the

achievement of ultimate evolutionary goals related to survival and reproduction (Archer, 2009; Bjorklund & Hawley, 2014; Buss & Shackelford, 1997; Vaillancourt, 2013; Volk et al., 2012).

In support of the contention that aggression can serve these functions, anthropological evidence suggests that aggression and its related constructs have been linked to adaptive benefits in contemporary environments with some similarities to the environment of evolutionary adaptation. For example, aggression and upper-body strength have been linked to increased access to food, enhanced hunting reputation, and greater reproductive success among hunter-gatherers (Apicella, 2014; Briggs, 1970; Turnbull, 1972), and males who demonstrate evidence of fighting ability and status tend to be perceived as more attractive among females in small scale societies without formal state governance (Escasa et al., 2010). Furthermore, a substantial amount of comparative psychological evidence shows that aggression and bullying have a long history of functioning as a means to achieve dominance and resources in both humans and non-human animals, including chickens, wolves, hyenas, and primates (see Smith, 2005, pp.184-187; Stewart, 1987; Volk et al., 2012; 2014), as well as in non-animal organisms such as plants (e.g., Schwinning & Weiner, 1998) and bacteria (e.g., Hibbing et al., 2010), which suggests that aggression may be an evolutionarily conserved, heritable trait. Moreover, research on hyenas and primates suggest that the adaptive benefits obtained by dominant females were passed to their offspring (Stewart, 1987; Smith, 2005, pp.184-187).

Behaviour-genetic research further supports the plausibility of natural and sexual selection processes contributing to the propagation of historically adaptive aggressive tendencies through genetic mechanisms. In particular, it reveals that differences in genetic relatedness are linked to individual differences in aggression and bullying perpetration. More specifically,

genetic factors have been shown to explain 60-70% of the variability in bullying perpetration (Ball et al., 2008; Johansson et al., 2020; Veldkamp et al., 2019), and 50-80% of the variability in aggression perpetration (Porsch et al., 2016; Waltes et al., 2015).

Given the long history of human aggression, evidence of evolutionarily relevant advantages afforded to aggressive human and non-human animals, and behaviour-genetic findings linking aggression to genes, it is possible that some individuals may inherit predispositions or traits that probabilistically increase their willingness and ability to use aggression to achieve competitive advantages in modern contexts that are similar to those in which it has been functional in the past (e.g., competition for dominance or mates). For example, aggression may be facilitated or motivated by inherited personality traits that elicit dominance motives and selfishness, or be triggered by evolved psychological mechanisms related to emotions such as jealousy, pride, and anger (e.g., Arnocky et al., 2012; Bird et al., 2016; Johnson et al., 2012; Morgan et al., 2021; Sell, 2011; Weisfeld & Dillon, 2012). Additionally, certain evolved psychological mechanisms may facilitate adaptive self-assessments that can help an individual detect indicators of power and determine whether aggression would have a favorable cost-benefit ratio in a particular situation (e.g., Buss, 2011). Examples include mechanisms that assess social status and related threats (Liddle et al., 2012) and relative physical formidability (Sell et al., 2009). Although traits and mechanisms such as these were selected for in traditional, in-person contexts throughout humans' evolutionary history, they likely still motivate aggression in modern in-person and cyber contexts given the competitive advantages they may offer (Eisner & Malti, 2015; Smith, 2020).

Although cyberspace is a relatively new social context that did not exist in the environment of evolutionary adaptation (e.g., Li et al., 2020; Volk et al., 2012), it is still possible that evolved psychological mechanisms such as those discussed above would contribute to cyber aggression. More specifically, selection pressures that have operated on acts of indirect and verbal traditional aggression (e.g., rumor spreading, social exclusion, derogation, and uttering threats) that have occurred throughout human evolutionary history (Benenson, 2016; Volk et al., 2012) may account for propagated heritable traits and mechanisms (e.g., anger, jealousy, selfishness, pride, dominance motives) that can motivate or trigger aggression in cyberspace. In fact, previous research suggests that electronic devices can be utilized as a tool to engage in competition (e.g., Lapierre & Dane, 2020; Piazza & Bering, 2009; Wyckoff et al., 2018), and motives such as jealousy, pride, and dominance have been reported as contributors to cyber aggression perpetration in adolescents and young adults (Dennehy et al., 2020; Tanrikulu & Erdur-Baker, 2019; Varjas et al., 2010). Taken together, the archaeological, anthropological, comparative psychological and genetic evidence presented above support the contention that aggression may be an adaptation that solved adaptive problems in historical contexts, which propagated heritable traits related to aggressive tendencies to contemporary generations through the processes of natural and sexual selection.

Although aggression may have been selected as an adaptation, it is important to investigate whether it continues to be adaptive in contemporary contexts by examining whether it is still linked to the adaptive functions or benefits that it has served in historical contexts, such as facilitating competition for resources, social status, dominance, and mates, inflicting costs on rivals, as well as defending against or deterring aggression from others (Buss & Shackelford, 1997; Eisner & Malti, 2015). Thus, the term adaptive herein denotes positive associations with

this narrow range of proximate adaptive benefits which may be indirectly and probabilistically associated with the ultimate functions of evolution, namely survival and reproduction, but it does not intend to suggest that aggression is generally beneficial.

Thus far, contemporary research supports the contention that aggression can be adaptive in modern settings, as indicated by studies linking aggression and related constructs to proximate evolutionary functions or benefits, such as dominance and status, aggression deterrence, access to mates, and inflicting costs on rivals, which may be indirectly and probabilistically related to ultimate evolutionary goals of survival and reproduction in modern contexts. For example, in adolescent samples there is ample evidence linking aggression and related constructs to social dominance (Farrell & Dane, 2020; Goodboy et al., 2016; Olthof et al., 2011; Pellegrini et al., 1999; Reijntjes et al., 2013a; 2013b; Volk et al., 2019; 2021), social network centrality and prestige (Andrews et al., 2021), as well as perceived popularity and social status (Casper et al., 2020; Badaly et al., 2013; de Bruyn et al., 2010; Duffy et al., 2016; Garandeanu et al., 2014; Juvonen et al., 2004; Koh & Wong, 2017; Lee et al., 2018; Malamut et al., 2020; 2021; Peets & Hodges, 2014; Pouwels et al., 2016; 2017; 2018; Pronk et al., 2017; Reijntjes et al., 2013; Sentse et al., 2015; Thunfors & Cornell, 2008; Vaillancourt et al., 2003; van der Ploeg et al., 2020; Wegge et al., 2016; Wright, 2014). Furthermore, indicators of high resource holding power among male university students, such as their physical size, number of allies, and reputation, have been experimentally shown to deter aggression from other males (Archer & Benson, 2008), and adolescent bullies likewise tend to report decreases in victimization over time (Park & Cho, 2021).

With respect to benefits related to mating, males associated with gangs tend to have greater sexual access to females in urban societies (Palmer & Tilley, 1995), and adolescent bullies tend to report earlier and more dating/sexual involvement (Arnocky & Vaillancourt, 2012; Connolly et al., 2000; Dane et al., 2017; Farrell & Vaillancourt, 2019; Kretschmer et al., 2021; Lapierre & Dane, 2020; Lee et al., 2018; Provenzano et al., 2018; Ryjova et al., 2021; Vaillancourt, 2013; Volk et al., 2015; White et al., 2010), and more children in adulthood (Kretschmer et al., 2021). Finally, contemporary evidence suggests that aggression can function as a means to inflict costs on rivals, which may in turn affect the victim's mating prospects. Both adolescents and adults have been found to use aggression to derogate rivals as a means to make them appear less attractive to potential mates (e.g., Buss & Dedden, 1990; Campbell, 2013; Harrison & Hughes, 2021; Hoff & Mitchell, 2009; Reynolds et al., 2018; Wyckoff et al., 2018; 2019). Consistent with this intended function of aggression, research demonstrates that female victims were less likely to flirt with male peers and began dating at later ages than those who perpetrated aggression (Gallup et al., 2011). Furthermore, female victims tended to report significantly lower self-perceived attractiveness relative to peers (Gallup et al., 2011), and experimental findings demonstrate that men are likely to give significantly lower attractiveness ratings for women's images when they are paired with victimizing statements, relative to when they are not paired with victimizing statements (Fisher & Cox, 2009). Finally, according to retrospective research, males who experienced frequent victimization during adolescence tended to report fewer sexual partners in young adulthood (Gallup et al., 2009). These findings generally support the contention that aggression may function as a means to hinder the victim's ability to attract mates, and theoretically improve the aggressor's access to desirable mates by reducing the number of competitors (e.g., Buss & Shackelford, 1997; Vaillancourt, 2013). Together, this

evidence suggests that aggression may continue to be adaptive in contemporary contexts as a means to achieve several adaptive functions or benefits, as it has throughout our evolutionary history (Buss & Shackelford, 1997; Eisner & Malti, 2015).

Importantly, advantages such as these can serve as proximate evolutionary functions or benefits that can aid in the achievement of ultimate evolutionary goals of survival and reproduction. For example, although increased access to dating and sexual partners may not necessarily map onto ultimate goals related to reproduction, these proximate benefits of aggression may probabilistically increase the likelihood that an aggressor would achieve the ultimate goal of reproduction, as suggested by longitudinal research demonstrating links between bullying in adolescence and number of children in adulthood (Kretschmer et al., 2021). As such, the evolutionary relevance of some functions, such as aggression deterrence, or gaining access to resources and mating opportunities, is quite clear, however, the logic linking dominance and social status to ultimate adaptive benefits may be less obvious. Theory and research suggest that aggressive displays that increase one's social dominance or social status, at the cost of decreased likeability (Pronk et al., 2017; Volk et al., 2019; 2021), can offer priority access to desirable social and material resources through peers' fearful deference to the threat of coercion/force, and may pre-emptively deter victimization through intimidation (e.g., Olthof et al., 2011; Volk et al., 2019; Weisfeld & Dillon, 2012). Moreover, aggressive displays can facilitate intrasexual competition and intersexual selection by inflicting costs on competitors that improve one's reputation relative to the target and may induce the target to withdraw from competition (see Vaillancourt, 2013; Volk et al., 2012), as well as sending costly signals of preferred qualities, such as the ability to control resources and offer protection, to prospective mates (e.g., Dane et al., 2017; Liddle et al., 2012; Smith, 2004; Volk et al., 2012).

Similarly, having social status, such as popularity and prestige, can also contribute to the achievement of ultimate evolutionary goals by increasing one's access to social and material resources through implicit social power (e.g., Andrews et al., 2021; Lansu et al., 2022; Henrich & Gil-White, 2001; Malamut et al., 2021). More specifically, implicit social power refers to the ability to influence others by gaining their respect or admiration, which would enable high-status individuals to gain adaptive benefits through peers' deference to their goals or ideas, wherein desirable resources (including attention) are freely conferred by peers rather than taken by force (Farrell & Dane, 2020; Henrich & Gil-White, 2001). Moreover, being admired and respected may also facilitate intersexual selection by increasing an individual's perceived attractiveness to others, as highly dominant/popular adolescents tend to report the greatest involvement in sexual activity when compared to adolescents who have average and low levels of dominance/popularity (de Bruyn, et al., 2012). Finally, having implicit social power can increase an individual's ability to aggress against others, especially when using indirect forms which rely on the manipulation of the peer group (Cillessen & Mayeux, 2004; Malamut et al., 2020; Reijntjes et al., 2013a).

Although the evidence presented above suggests that aggression may be a historical adaptation that continues to serve a narrow range of evolutionarily relevant functions in contemporary contexts, theory and research suggests that it may be conditionally adaptive, such that it may be functional only in certain contexts and for certain individuals. Indeed, even though aggression can solve adaptive problems, as previously discussed, it may not be an effective solution in all contexts and for all individuals, especially because aggression in contemporary contexts may be subject to increasing social sanctions (e.g., laws and social norms) which may impact its adaptiveness, that is, the likelihood that it will achieve the adaptive functions or

benefits it has been associated with throughout our evolutionary history. Therefore, to determine whether aggression would be an adaptive strategy within a given situation, an individual would engage in cost-benefit analysis through adaptive self-assessments. These self-assessments would be facilitated through evolved psychological mechanisms, such as those to assess threats to status, physical formidability, or attachment relationships (Del Giudice, 2009; Liddle et al., 2012; Sell et al., 2009), which allow the individual to consider whether aggression would be an adaptive response for them in that particular situation (Buss, 2011; Volk et al., 2012). Based on evolutionary theory and research, at least four considerations likely impact the conditional adaptiveness of aggression: (1) the characteristics of the aggression; (2) the characteristics of the context; (3) the characteristics of the target; and (4) the characteristics of the perpetrator.

Adaptiveness and Aggression Characteristics

Certain aggressive forms have the potential to impact the adaptiveness of aggression for some individuals by reducing its costs and maximizing its benefits. For example, in contrast to the direct forms of aggression (i.e., physical and verbal) which, due to their overt nature, carry high risks such as retaliation from the victim, as well as social sanctions from bystanders and authorities, indirect forms of aggression (i.e., relational and cyber) can minimize these risks because they can be perpetrated covertly and thus be more easily hidden from individuals who would punish the behaviour (Ingram, 2014). Furthermore, in addition to the advantages gained from being indirect, cyber aggression also offers other advantages over traditional forms of aggression. For example, because cyberspace creates a disconnect between the aggressor and victim, it can reduce the likelihood that the aggressor will incur emotional costs associated with aggression, such as guilt and fear, and therefore can disinhibit aggression (Lowry et al., 2016; Varjas et al., 2010). Moreover, cyberspace offers the ability to victimize someone regardless of

location or time (Kowalski et al., 2014), allowing for more opportunities to harm others at minimal risk.

Similarly, the functions of the aggression can impact its adaptiveness. Evidence suggests that proactive aggression is more likely to be associated with adaptive benefits than reactive aggression because it is goal-directed, strategic and planful, as opposed to an impulsive response provoked by perceived threats (Hubbard et al., 2010), and can allow for the cost-benefit analysis necessary for the perpetrator to select the most advantageous aggressive form and target under the circumstances. Indeed, in comparison to reactive aggression, proactive aggression is more often associated with adaptive benefits such as popularity (Prinstein & Cillessen, 2003; van den Berg et al., 2019) and social dominance (Schwartz et al., 1998). Although reactive aggression is thought to address certain adaptive problems, such as deterring future victimization (Babcock et al., 2014) and preventing exploitation and unfair treatment (e.g., Sell, 2011; Trivers, 1971), it has been linked to increases in victimization overtime (Cooley et al., 2018; Frey & Higheagle Strong, 2017; Salmivalli & Helteenvuori, 2007), and is often associated with emotional dysregulation (Card & Little, 2006; Hubbard et al., 2010; Farrell & Dane, 2020; Poulin & Boivin, 1999; Vaillancourt & Hymel, 2006; van den Berg et al., 2019) and psychosocial problems, including internalizing problems and victimization (Card & Little, 2006; Frey & Higheagle Strong, 2018), peer rejection and low social preference (e.g., Card & Little, 2006; Evans et al., 2015; van den Berg et al., 2019), all of which can hinder cooperative relationships.

Adaptiveness and Contextual Characteristics

The context can also impact whether aggression is an adaptive response. One contextual factor that can impact the adaptiveness of aggression is the developmental period. Importantly, adolescence marks a period of sexual and social maturation (Konner, 2010), in which

adolescents become increasingly motivated to achieve status and access to dating and sex partners (de Bruyn et al., 2012; Ellis et al., 2012; Meisel et al., 2020; Pouwels et al., 2018; Sijtsema et al., 2020; Tolmann & McLelland, 2011), and more involved in social competition (Polo et al., 2018). Notably, this change in motives has been observed in the transition from childhood to adolescence (Yeager et al., 2015), when aggression tends to peak and become more consistently associated with benefits (Ettetal & Ladd, 2015). Together, these findings may partly explain why anti-bullying intervention programs are less effective for adolescents than for children, because aggression may be especially adaptive during adolescence, making it difficult to reduce in this age group. Because these developmental changes are predictable from an evolutionary perspective, the developmental period is likely an important ecological factor that can impact the adaptiveness of aggression.

The quality of the early environment is another contextual variable that may influence the frequency with which some individuals use aggression to solve adaptive problems. According to research integrating life history and attachment theories, children raised in harsh early environments characterized by uncertainty and limited resources are more likely to engage in coercive and aggressive strategies, as opposed to cooperative and prosocial strategies, to achieve adaptive benefits likely to increase reproductive fitness in the short-term, but at the risk of incurring long-term consequences (Ellis et al., 2012; Ellis & Del Giudice, 2019; Del Giudice & Belsky, 2011; Hawley, 2011). For example, recent research found that the experience of food insecurity during infancy and childhood is linked to greater risk of bullying in adolescence (Paquin et al., 2021), suggesting that harsh early environments may bias individuals toward aggressive strategies that can ensure access to resources that are perceived to be scarce.

Additionally, harsh and unpredictable environments may also negatively impact the quality of parent-child relationships by shifting parental investment strategies toward gaining access to resources and mating but investing less effort into parenting (e.g., Del Giudice & Belsky, 2011). As a result, children from harsh early environments are more likely to develop an insecure parental attachment, which contributes to generalized social and relationship problems, including a lack of trust and cooperation with others (e.g., Del Giudice & Belsky, 2011) and bullying involvement (Charalampous et al., 2018; McComb & Dane, 2019; Nocentini et al., 2019). Such changes may be facilitated by psychological mechanisms related to the attachment system, or possibly through epigenetic changes to gene expression (Ellis et al., 2012; Ellis & Del Giudice, 2019; Del Giudice & Belsky, 2011; Hawley, 2011), and therefore suggest that aggression is a facultative adaptation, as the interaction between genetic and environmental factors plays an important role in determining whether aggression would be perpetrated and adaptive in a particular situation for a given individual (Eisner & Malti, 2015; Volk et al., 2012).

Finally, the specific socio-ecological context in which aggression occurs can impact the likelihood of costs and benefits (see Volk et al., 2015). Indeed, bullying is more often perpetrated in negative school climates characterized by a lack of closeness between peers, and a lack of interventions or sanctions aimed at reducing bullying (Cook et al., 2010; Zych et al., 2018). Moreover, adolescents are more likely to engage in bullying to achieve social dominance or popularity when the classroom context is organized as a high-status hierarchy, as opposed to when the power hierarchy is egalitarian (Laninga-Wijnen et al., 2019; Pan et al., 2020). Finally, many instances of bullying are purposefully perpetrated when an audience is present to reinforce or reward the aggression (Houghton et al., 2012; Salmivalli, 2010). For example, bullying behaviour tends to increase in frequency in contexts where peers are likely to approve of or

reinforce the bully, but it tends to decrease in frequency in contexts where peers are more likely to disapprove of aggression or defend the victim (Bullo & Schulz, 2022; Salmivalli et al., 2011). Thus, social norms regarding aggression appear to play an important role in the adaptiveness of aggression by altering bystander responses and dictating whether the aggression would be rewarded or punished within a given context.

Adaptiveness and Target Characteristics

The power held by the target relative to the perpetrator is also likely to play an important role in the adaptiveness of aggressive behaviour (see Dane et al., 2017; Volk et al., 2014; 2021). Because victims of bullying tend to be socially vulnerable and unable to defend themselves, they present as easy targets that can lower the risks of incurring social costs (Sell et al., 2016; Volk et al., 2012), including retaliation from the victim (Volk et al., 2014), or loss of peer affection from bystanders (Veenstra et al., 2010). Thus, bullying may be an adaptive means for aggressively predisposed individuals to achieve benefits through coercion and the display of attractive qualities such as social dominance and resource control (Volk et al., 2021) to bystanders, at minimal risk (Volk et al., 2012).

In contrast, although riskier than bullying, adversarial aggression (i.e., aggressing against equally- or more-powerful targets; also called non-bullying aggression; Lapierre & Dane, 2020) can send a stronger costly signal to the victims and bystanders (Smith, 2004), which may impress bystanders more than bullying due to its bold and risky nature, and may be especially important to achieve certain benefits related to intrasexual competition, including inflicting costs on closely-matched or more powerful competitors (Weisfeld & Dillon, 2012). Indeed, targeting high-status victims has been linked to social advantages for the aggressor, including higher prestige/popularity, in both concurrent and longitudinal studies (Andrews et al., 2017; Peets &

Hodges, 2014), and more involvement in dating and sex for adolescents involved in both cyber aggression and cyber victimization (Lapierre & Dane, 2020). Furthermore, popular adolescent bullies who highly prioritize their popularity are likely to target victims of high status (Malamut et al., 2020), probably to maintain or increase their social standing relative to competitors.

Competitive advantages such as these may partly explain why adolescents are willing to take the risks of adversarial aggression in some cases. However, in other cases, adversarial aggression may be perpetrated out of necessity, as a pre-emptive or reactive response to a perceived threat from a rival, or as a means to inflict costs and possibly induce them to withdraw from competition or deter future attacks. Given that research differentiating between bullying and adversarial aggression is sparse (e.g., Andrews et al., 2017; Dane et al., 2022; Lapierre & Dane, 2020; Volk et al., 2021), this dissertation aimed to extend this research to examine further how power balances can impact the adaptiveness of aggression under various conditions, as discussed in greater detail below.

Adaptiveness and Perpetrator Characteristics

Characteristics of the perpetrator, including physical attributes, personality traits, experiences of victimization, and gender, may also affect the adaptiveness of aggression. As noted above, previous research suggests that bullying and aggressive tendencies have been linked to genetic factors (Ball et al., 2008; Johansson et al., 2020; Veldkamp et al., 2019), which may contribute to individual differences in evolved psychological mechanisms that can trigger aggression through emotions such as jealousy or pride, anger, and personality traits that affect dominance motives and a willingness to exploit others for personal gain (Arnocky et al., 2012; Bird et al., 2016; Johnson et al., 2012; Morgan et al., 2021; Sell, 2011; Weisfeld & Dillon, 2012). For example, there is ample evidence to suggest that both traditional and cyber forms of bullying

have been associated with heritable personality traits related to interest in status, proneness to anger, and the exploitation of others, such as callous-unemotional traits, low honesty-humility, low agreeableness, and low emotionality (Book et al., 2012; Fanti et al., 2012; Festl & Quandt, 2013; Goodboy & Martin, 2015; Kokkinos & Antoniadou, 2019; Kokkinos & Voulgaridou, 2017; Mitsopoulou & Giovazolias, 2015; Pabian et al. 2015; Pronk et al., 2021; van Geel et al., 2017; Volk et al., 2019). Notably, personality traits such as these can make some individuals more willing and able to use aggression against others and could improve the cost-benefit ratio of aggression by reducing emotional costs, such as guilt, possibly through low empathy (Kowalski et al., 2014; Zych et al., 2018).

Furthermore, traditional and cyber forms of bullying have been linked to traits associated with self-regulation, including low conscientiousness (Book et al., 2012; Festl & Quandt, 2013; Mitsopoulou & Giovazolias, 2015; Volk et al., 2019), and low inhibitory control or impulsivity (Fanti et al., 2012; Farrell & Vaillancourt, 2019). Finally, traditional and cyber aggression have also been associated with emotional reactivity (Kokkinos & Antoniadou, 2019; Mitsopoulou, & Giovazolias, 2015; Pellegrini et al., 1999), and hyper-competitiveness (Farrell & Vaillancourt, 2021). Given that traits such as impulsivity and emotional reactivity are conceptually and empirically linked to reactive aggression, aggression triggered by these traits may be adaptive primarily for self-defence (e.g., Babcock et al., 2014), rather than other functions, such as gaining dominance, status, or access to dates/mates (e.g., Hubbard et al., 2010; Prinstein & Cillessen, 2003; Reijntjes et al., 2013; van den Berg et al., 2019).

Finally, heritable traits such as high extraversion (Festl & Quandt, 2013; Volk et al., 2019) and physical formidability (Benítez-Sillero et al., 2021; Vaillancourt et al., 2003) have

also been positively associated with aggression, likely because these traits may offer the individual power advantages, such as popularity (Reinjtjes et al., 2013; Wolters et al., 2014), social dominance (Volk et al., 2019), or physical strength and fighting ability (Fessler & Holbrook, 2013), which may enable them to successfully aggress against or deter victimization from others. Indeed, research demonstrates that more dominant, popular, and well-liked aggressors are more likely to experience social advantages, such as perceived popularity (Vaillancourt & Hymel, 2006), dating popularity (Houser et al., 2015), and more sexual involvement (de Bruyn et al., 2012). Moreover, for young adults who are often involved in intrasexual competition, those who report higher mate value are found to be more successful in poaching mates from rivals (Arnocky, 2020), and in an experiment examining the influence of women's attractiveness on the success of their derogation of intrasexual competitors, attractive women were more effective than unattractive women in negatively influencing men's evaluations of a rivals' attractiveness through derogation (Fisher & Cox, 2009).

The experience of victimization can also impact the adaptiveness of aggression. There is ample evidence to suggest that pure bullies are more likely to achieve adaptive benefits than are bully-victims (Smith, 2020; Volk et al., 2012). These differences may be partly due to pure bullying being more consistently associated with controlled and goal-directed proactive aggression (Ang et al., 2014; Calvete et al., 2010; Camodeca & Goossens, 2005; Salmivalli & Nieminen, 2002; Sijtsema et al., 2009), whereas bullying-victimization is more consistently associated with reactive aggression, which is characterized as impulsive and emotionally dysregulated (Runions et al., 2018; Salmivalli & Nieminen, 2002).

Finally, gender is another individual characteristic that can impact the adaptiveness of aggression, especially in its interaction with aggressive form, as gender differences have been

observed in the prevalence of bullying and aggression overall, and in the use of specific forms of aggression. Indeed, previous research suggests that males tend to be more aggressive than females overall (Barlett & Coyne, 2014; Volk et al., 2012) and tend to engage more frequently in riskier direct forms of aggression, like physical and verbal bullying (Card et al., 2008; Inchley et al., 2020; Lee et al., 2018; Monks et al., 2009; National Center for Education Statistics, 2022). In fact, meta-analytic research by Card and colleagues (2008) suggests that, on average, boys tend to be significantly more directly aggressive than girls ($\bar{r} = .29$), whereas girls tend to be more indirectly aggressive than boys, although the effect was small ($\bar{r} = -.03$; negative effect size suggests higher aggression for girls; Card et al., 2008). Evolutionary researchers suggest that these gender differences in aggression may be observed, in part, due to differences in parental investment that contribute to gender differences in risk aversion (Archer, 2009; Bjorklund & Hawley, 2014; Ellis et al., 2012). For example, because males require less obligatory parental investment and experience greater variability in the number of offspring they can produce, they are more likely than females to benefit from high-risk strategies, like direct aggression, that have the potential to increase their access to mates, and ultimately increase their chances of reproduction (Archer, 2009).

Females, on the other hand, tend to be more risk averse on average, and prefer less risky, indirect forms of aggression (Campbell, 2013; Card et al., 2008; Davis et al., 2018; Lee et al., 2018; Monks et al., 2009; Vaillancourt, 2013), partly due to their greater obligatory parental investment and the fact that the survival of their offspring is highly dependent on their own (see Archer, 2009; Vaillancourt, 2013). Additionally, females' preference for indirect forms of aggression may also be due in part to the social ecology of humans' evolutionary history. Traditional societies generally functioned as a male-biased philopatry wherein females typically

migrated to their mates' community, making females more reliant than males on the social support received from non-kin for survival (Benenson, 2016; Geary et al., 2003). However, because non-kin relationships are less stable than relationships among kin, they tend to be more strongly based on reciprocal altruism, wherein all individuals are expected to equally benefit from the relationship, or the relationship would be dissolved. As a result, females likely prefer to use indirect aggression, rather than direct aggression, as a less risky means to engage in competition that reduces the risk of losing the support of important non-kin affiliations.

The theory of sexual selection can also offer important insights into how gender can impact the adaptiveness of aggression, as it contends that each sex seeks mates with qualities that would help to solve their adaptive problems (Archer, 2009; Buss, 2012; Campbell, 2013). Accordingly, because females generally prefer mates who display qualities associated with resource control (e.g., social status), and the ability to protect offspring (e.g., strength and bravery; Buss, 2012), males are more likely to benefit from direct aggression which could function as a costly signal of dominance and physical strength to potential mates to facilitate intersexual selection, as well as harm or intimidate rivals in the context of intrasexual competition (e.g., Volk et al., 2012; Wang et al., 2009). Indeed, direct forms of aggression appear to have a better cost-benefit ratio for males than for females, as male physical bullies reported having had more dating and sexual partners than did males who did not physically bully others, but this effect was not observed for females (Dane et al., 2017). Although there is some longitudinal research linking direct aggression and number of dating partners for both genders (i.e., Lee et al., 2018), other research suggests that female physical bullies tend to be disliked and unpopular amongst peers (Cillessen & Mayeux, 2004; Smith et al., 2010), and may only benefit from direct aggression when they are already advantaged in terms of popularity (e.g., Houser et

al., 2015). In contrast, indirect aggression seems have a better cost-benefit ratio for females given that it is less risky than direct aggression (Bjorklund & Hawley, 2014; Campbell, 2013; Vaillancourt, 2013), especially because it can be perpetrated anonymously (e.g., Ingram, 2014; Lowry et al., 2016). For example, female indirect aggressors are more likely than their male counterparts to report more dating and sexual partners (Dane et al., 2017; Vaillancourt, 2013; Lapierre & Dane, 2020), greater perceived popularity (Cillessen & Mayeux, 2004; Badaly et al., 2013), as well as greater liking among opposite-sex peers (Smith et al., 2010).

Social Costs of Aggression

Because aggression is a coercive and antisocial resource control strategy that signals an individual's willingness to exploit others for personal gain, it can incur social costs that hinder cooperative social relationships (e.g., Hawley, 2011). For example, some research has demonstrated that although bullying was associated with social dominance, it was not associated with alliance formation, which refers to peers' willingness to affiliate and cooperate with the individual, whereas prosocial resource control strategies have been linked to both (Farrell & Dane, 2020; Volk et al., 2021). Moreover, although aggression may be linked to social advantages in terms of status and popularity, it is also associated with social problems related to low peer acceptance and social preference, as noted above, as well as poorer relationship quality, as evidenced by insecure friendship and romantic attachments (Aoyama et al., 2011; 2013; Burton et al., 2013; Fernández-Fuertes et al., 2019; Wright et al., 2015), more conflictual and less intimate relationships (Connolly et al., 2000; Rose et al., 2004), and involvement in dating aggression (Espelage et al., 2021; Farrell & Vaillancourt, 2019; Zych et al., 2021). Finally, adolescent bullying has also been longitudinally linked to other antisocial behaviours in

adulthood, including violent behaviour (Ttofi et al., 2012), as well as increased criminality (Ttofi et al., 2011).

However, because aggression is an antisocial strategy that is used for personal gain as opposed to mutual benefit, these social costs are to be expected from an evolutionary perspective, as it violates expectations for reciprocity which is important in developing cooperative relationships (e.g., Farrell & Dane, 2020; Hawley, 2011). Indeed, some research suggests that decreases in likeability may not deter aggression perpetration because status is perceived to be the most important goal (Garandau & Lansu, 2019), especially for adolescents with low affection or communal goals (Ojanen & Findley-Van Nostrand, 2014; Sijtsema et al., 2020). Moreover, meta-analytic research demonstrates that traditional bullying and aggression are positively associated with status/power goals and antisocial goals but negatively associated with prosocial goals, such as building close relationships (Samson et al., 2012; 2022), suggesting that adolescents who perpetrate aggression may not be particularly concerned about incurring social costs that hinder cooperative relationships. Thus, antisocial strategies like aggression may only be linked to adaptive benefits related to competition but would not be linked to adaptive benefits in domains where prosocial strategies would be better suited, such as building and maintaining cooperative and secure relationships.

Overview of Current Studies

The focus of this dissertation was to further examine the conditions under which aggression may be beneficial and potentially adaptive for adolescents, as indicated by associations with proximate evolutionarily relevant benefits or functions that may contribute to the achievement of ultimate evolutionary goals. Previous research in this area has been limited with respect to the examination of how the adaptiveness of aggression may be affected by certain

conditions. For example, previous research provides limited evidence about whether relations with proximate evolutionary functions are affected by characteristics of the aggression, such as whether it is perpetrated in cyber versus traditional form or perpetrated anonymously. Furthermore, to date, the impact of target characteristics have not been systematically examined, especially regarding how the adaptiveness of aggression may depend on the perpetrator having a power advantage over the victim. Finally, from previous research, it remains unclear how the characteristics listed above may intersect with perpetrator characteristics, including the experience of victimization and gender, which previous theory and research have shown to affect the use and functionality of aggression (e.g., Bjorklund & Hawley, 2014; Smith, 2020; Volk et al., 2012). To fill these gaps in the literature, this dissertation further examines how the conditional adaptiveness of aggression is affected by aggression characteristics (i.e., aggressive form, functions, and anonymity), target characteristics (i.e., power of victim relative to perpetrator), and perpetrator characteristics (i.e., experience of victimization and gender), in a series of three studies.

Because the methods and opportunities to engage in aggression typically increase in adolescence with greater use of electronic devices, one of the main goals of this dissertation was to extend the relatively sparse evolutionary research on cyber aggression and compare it to that of traditional aggression to further examine the impact of aggressive form on the adaptiveness of aggression. Indeed, some researchers state that the average age at which youth first obtain a cell phone is 10 years old, and approximately 64% of youth sampled between the ages of 10-14 reported owning a smartphone (Moreno et al., 2019). Moreover, approximately 80% of early adolescents (aged 11-14 years) reported having at least one social media account and accessing social media between 4-6 hours per week, on average (Salomon & Spears Brown, 2019).

Between the ages of 13-17 years, most American adolescents have access to a smartphone (95%) or a home computer (88%), and most (89%) report going online at least once a day (Pew Research Center, 2018). Notably, the use of cyberspace has been positively associated with involvement in cyber aggression (Zych et al., 2018; Baldry et al., 2019; Kokkinos & Antoniadou, 2019), which in turn, has been linked to advantages such as perceived popularity (Badaly et al., 2013; Wegge et al., 2016), and dating/sexual behaviour (Lapierre & Dane, 2020). Thus, preliminary research does suggest that cyber aggression may function similarly to traditional aggression as a method of competition for social resources. However, unlike traditional aggression research, cyber aggression had not yet been examined in relation to social advantages and disadvantages in the domains of resource control and relationship quality. Study 1 aimed to fill this gap in the literature by examining the links between adolescents' involvement in cyber aggression and victimization in relation to concurrent social advantages (i.e., social dominance, involvement with dating and sexual partners) and disadvantages (i.e., lack of implicit social power, attachment avoidance and anxiety in friendships and romantic relationships). By focusing on cyber aggression, Study 1 aimed to clearly demonstrate its conditional adaptiveness by delineating its links to social advantages in competitive domains for which it is well-suited, and its links to social disadvantages in domains where prosocial strategies would be better suited, as indicated by traditional aggression research.

The functions of aggression are another characteristic that may impact the adaptiveness of aggression but have been understudied from an evolutionary perspective. Although there is research linking both cyber and traditional forms of bullying and aggression to various proactive and reactive motives (e.g., Ang et al., 2014; Fluck, 2017; Runions et al., 2017; 2018; Sijtsema et al., 2009; Smeets et al., 2017; Thomson & Centifanti, 2018), only traditional forms of proactive

and reactive aggression have been examined in relation to evolutionarily relevant social advantages and disadvantages (Hubbard et al., 2010; van den Berg et al., 2019). Therefore, to extend this line of research, Study 1 differentiated between proactive and reactive cyber aggression to examine whether these aggressive functions similarly impact the adaptiveness of aggression in cyberspace, as indicated by their relations to the various social advantages and disadvantages noted above.

Notably, however, previous research examining aggressive functions has been limited in some important ways. Firstly, the aggressive functions assessed in previous research have been limited in scope, not measuring evolutionary functions such as negotiating dominance hierarchies, facilitating intrasexual competition and intersexual selection, imposing costs on rivals, and pre-emptively deterring aggression from rivals (Buss & Shackelford, 1997; Dane et al., 2022). Secondly, previous research has not considered adolescent perspectives on whether they use aggression for specific evolutionarily relevant functions, including those listed above, even though aggression is more likely to be utilized if it is perceived as a tool to accomplish certain goals (e.g., Crick & Dodge, 1994). To address these limitations, Studies 2 and 3 utilized an adapted measure of aggressive functions to examine adolescents' perceptions of the utility of aggression to achieve four evolutionary functions: (1) competitive functions, which are characterized as proactive aggression aiming to instill fear in others in order to compete for dominance, impose costs on competitors, and deter aggression from others; (2) impression management functions, which encompass proactive aggression that aims to gain attention and admiration from others as a means to achieve access to resources, social status, and facilitate intersexual selection; (3) sadistic functions entail proactive aggression enacted for the proximate goal of enjoyment; and (4) reactive functions which encompass impulsive and emotionally-

driven aggression. Therefore, to determine how aggressive form may impact the use of aggression to pursue various evolutionarily relevant functions, adolescents' involvement in traditional (i.e., direct and relational) and cyber aggression was investigated in relation to the aforementioned evolutionary aggressive functions in Studies 2 and 3. In doing so, these studies could illuminate whether the frequency of adolescents' involvement in certain forms of aggression was related to the pursuit of particular evolutionary aggressive functions, due to the fit between form and function. For example, some aggressive forms may function better as a means to signal dominance to bystanders, whereas others may better hide the aggression to avoid negative sanctions from bystanders.

Anonymity is another understudied aggression characteristic that may impact its adaptiveness across indirect aggressive forms. Indeed, previous research suggests that anonymity can improve the cost-benefit ratio of indirect aggression (e.g., Bjorklund & Hawley, 2014; Ingram, 2014; Lowry et al., 2016). Not only can anonymity reduce the risk of retaliation or punishment from peers and authorities (Lowry et al., 2016), but it can also inflict greater harm on victims (Hoff & Mitchell, 2009; Smith et al., 2008; Sourander et al., 2010; Sticca & Perren, 2012), likely because they are unable to defend themselves against an unknown aggressor. Although both traditional (i.e., relational) and cyber forms of indirect aggression can be perpetrated anonymously (Ingram, 2014; Lowry et al., 2016), most of the previous research examining the use and impact of anonymous aggression has focused on cyber aggression. As a result, it remains unclear how differences between traditional, in-person and cyber forms of aggression impact the adaptiveness of anonymous aggression to achieve evolutionary aggressive functions for which it may be best suited. Therefore, Study 3 investigated adolescents' use of

anonymous aggression in relational and cyber forms to determine how anonymous perpetration was related to evolutionary aggressive functions in both forms of indirect aggression.

Another understudied condition that may impact the adaptiveness of aggression is the characteristics of the target. Although it is well established that bullying a vulnerable peer can minimize the risks associated with aggression (Volk et al., 2012), riskier aggression directed toward targets of equal or greater power has been adaptive for some individuals. Indeed, preliminary research suggests targeting victims of equal or greater power has been associated with social advantages (e.g., Andrews et al., 2017; Lapierre & Dane, 2020; Peets & Hodges, 2014; Volk et al., 2021), potentially because adversarial aggression may be an effective means for some individuals to induce rivals into withdrawing from competition. However, it remains unclear whether aggression against certain targets is differentially associated with the intention to use aggression for evolutionary relevant functions, and whether this varies by form. To address this gap in the literature, Study 2 separately examined adolescents' involvement in bullying and adversarial aggression to compare their relations to the evolutionary aggressive functions discussed above and investigated whether the associations differed based on aggressive form (i.e., direct, relational, and cyber). Furthermore, the links between target characteristics and anonymous perpetration had yet to be examined but were of interest given that anonymity can nullify unfavorable power balances, maximize harm inflicted on the victim, and further improve the cost-benefit ratio of aggression, especially when used against high-powered rivals. Therefore, in Study 3, anonymous aggression perpetration was differentiated from bullying and adversarial aggression to examine how anonymity was associated with the perpetrator's perceptions of using aggression for evolutionarily relevant functions, and whether it was related to harm or costs experienced by victims, beyond that of aggression by known perpetrators.

Finally, experiences of victimization and gender were studied to extend research on how the adaptiveness of aggression is affected by perpetrator characteristics. Because previous research suggests that the adaptiveness of adolescents' aggression depends on whether the perpetrator also experienced victimization (e.g., Smith, 2020; Volk et al., 2012), all three studies assessed victimization alongside aggression to examine how the form, balance of power, and degree of anonymity in aggressive-victimization involvement may impact its associated costs and benefits (Study 1) and functionality (Studies 2 & 3). Although traditional aggression research suggests that perpetrators who experience victimization are more likely to experience social disadvantages as opposed to advantages (Marini et al., 2006), there is evidence to suggest that some victims are of high status (Andrews et al., 2016; Dawes & Malamut, 2018), and those also involved in traditional bullying or cyber aggression have been found to experience social advantages in terms of dating/sexual behaviour (Dane et al., 2017; Gallup et al., 2011; Lapierre & Dane, 2020). Therefore, in Study 1, cyber victimization was investigated alongside proactive and reactive cyber aggression to examine whether the experience of cyber victimization would alter how proactive and reactive cyber aggression were related to evolutionarily relevant social advantages and disadvantages.

Moreover, because both low- and high-status adolescents are at risk for victimization (Andrews et al., 2016; Dawes & Malamut, 2018), various forms of bullying victimization and adversarial victimization were separately examined in relation to evolutionarily relevant aggressive functions to determine whether the balance of power in victimization experiences is related to the evolutionarily relevant functions pursued through aggression. Finally, although previous research suggests that anonymous victimization is often perceived as more harmful than identifiable victimization (e.g., Hoff & Mitchell, 2009; Smith et al., 2008; Sourander et al., 2010;

Sticca & Perren, 2012), this has yet to empirically determined. Therefore, Study 3 investigated whether anonymous victimization in each aggressive form contributes to victims' perceptions of harm beyond that associated with bullying victimization and adversarial victimization, and whether this depends on the victim's gender. If anonymous victimization uniquely contributes to the victim's perceived harm beyond the harm associated with victimization by known perpetrators, it would suggest that anonymous perpetration can be an adaptive strategy to improve the cost-benefit ratio of indirect aggression, inflicting costs on targets by damaging their reputation or reducing their wherewithal to compete while simultaneously minimizing the costs to the perpetrator (e.g., Bjorklund & Hawley, 2014; Ingram, 2014; Lowry et al., 2016).

With respect to the impact of the perpetrator's gender on the adaptiveness of aggression, gender differences in aggression have been well established in evolutionary theory and research. In particular, consistent with females' tendency to be more risk averse on average, due to greater obligatory parental investment and greater reliance on social relations and resources (Archer, 2009; Benenson, 2016; Bjorklund & Hawley, 2014; Ellis et al., 2012; Geary et al., 2003), there is ample evidence to suggest that females prefer and benefit more from indirect forms as opposed to direct forms of aggression, likely because indirect forms can mitigate potential costs (e.g., Badaly et al., 2013; Card et al., 2008; Dane et al., 2017; Lapierre & Dane, 2020; Smith et al., 2010; Vaillancourt, 2013). In contrast, males tend to engage more frequently in riskier direct forms of aggression (Card et al., 2008; Lee et al., 2018; Monks et al., 2009), likely because they require less obligatory parental investment and are therefore more likely to benefit from high-risk strategies (Archer, 2009; Bjorklund & Hawley, 2014; Dane et al., 2017; Ellis et al., 2012). However, despite these well-known differences, it is unclear whether links between the perpetration of different forms of aggression and evolutionarily relevant aggressive functions

would vary by gender. To fill this gap in the literature, Study 2 examined whether involvement in different forms of bullying and adversarial aggression were differentially linked to evolutionary aggressive functions for male and female participants. To further build on this research and investigate whether gender would affect the use and impact of anonymous aggression, Study 3 investigated whether gender moderated the relations between: (1) anonymous indirect aggression involvement and evolutionary aggressive functions; (2) the target's power relative to the perpetrator and anonymous indirect aggression perpetration; and (3) the experience of anonymous victimization and the victims' perceptions of harm.

In summary, these three studies were conducted with the over-arching goal of extending research studying adolescents' aggression from an evolutionary perspective by assessing whether aggression characteristics (i.e., aggressive form, function, and anonymity), target characteristics (i.e., power of victim relative to the perpetrator), and perpetrator characteristics (i.e., gender and experience of victimization) related to the adaptiveness of aggression. More specifically, Study 1 used a person-oriented approach to investigate how cyber aggression with proactive and reactive functions and concurrent experiences of cyber victimization was associated with evolutionarily relevant social advantages and disadvantages. Study 2 examined differential associations between adolescents' aggression involvement and evolutionarily relevant aggressive functions, considering variations in aggressive form (direct, relational, and cyber), the target's power relative to perpetrator, and the perpetrator's gender. Finally, Study 3 investigated (1) how the associations between anonymous perpetration and evolutionary functions of aggression varied by aggressive form (relational and cyber) and the perpetrator's gender; (2) how the target's power relative to the perpetrator and the perpetrator's gender related to adolescents' use of anonymous perpetration in each aggressive form; and (3) differential associations between anonymous

victimization and victims' perceptions of harm as a function of aggressive form and gender of the victim. In completing this research, I hoped to extend research investigating the conditional adaptiveness of aggression to illuminate the various conditions that relate to aggression and its use for personal gain, which in turn may inform intervention efforts aimed at reducing aggression and victimization among adolescents.

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CHAPTER 2: STUDY 1

Social Advantages and Disadvantages Associated with Cyber Aggression-Victimization: A Latent Class Analysis¹

With increased use of electronic communication technologies in recent years, cyber aggression has become quite prevalent and problematic (see Kowalski, Giumetti, Schroeder, & Lattanner, 2014). Cyber aggression can be defined as ‘intentional behaviour aimed at harming another person ... through computers, cell phones, and other electronic devices, and perceived as aversive by the victim’ (Schoffstall & Cohen, 2011, p. 588). Cyber aggression subsumes the more specific form called cyberbullying, which is defined more strictly by requiring that the perpetrator has a power advantage over the victim (Schoffstall & Cohen, 2011; Volk, Dane, & Marini, 2014). Although much research has focused on cyberbullying, cyber aggression has been found to be more prevalent (Wolak, Mitchell, & Finkelhor, 2007); approximately 1 in 6 adolescents report involvement in cyberbullying (Modecki, Minchin, Harbaugh, Guerra, & Runions, 2014), whereas roughly 1 in 3 adolescents perpetrate cyber aggression (Pabian, De Backer, & Vandebosch, 2015; Ybarra & Mitchell, 2007). Furthermore, cyber aggression tends to co-occur with cyber victimization (Ybarra & Mitchell, 2007), which adds to the problematic nature of these experiences.

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Both cyber aggression and cyber victimization have been associated with depression, anxiety, loneliness, suicidal ideation, and low life satisfaction and self-esteem (Bonanno & Hymel, 2013; Kowalski et al., 2014). However, Kowalski and colleagues (2014) found that internalizing problems are more strongly related to cyber victimization than to cyberbullying. Moreover, adolescents involved in both cyberbullying and victimization (i.e., cyberbully-victims) have reported levels of suicidal ideation roughly two times greater than cyberbullies or cyber victims (Bonanno & Hymel, 2013).

Evolutionary Perspectives on Aggression

Although aggression and bullying have been linked to a variety of social disadvantages, including the negative correlates previously discussed, evolutionary psychologists have posited that aggression has provided solutions to various problems in humans' evolutionary history, including procuring resources, obtaining/maintaining status and power, and competing with intrasexual rivals (Buss & Shackelford, 1997). Thus, aggression and bullying can be utilized as tools to facilitate and maintain access to evolutionarily relevant social advantages in the domains of resource control, reputation, and reproduction (see Volk et al., 2012). Consistent with the evolutionary psychological perspective, traditional aggression and bullying have been found to serve adaptive functions, insofar as bullying has been linked with social advantages such as social dominance and status (Juvonen et al., 2004; Pellegrini et al., 1999; Reijntjes et al., 2013b; Vaillancourt et al., 2003), as well as perceived popularity (Cillessen & Mayeux, 2004; de Bruyn, et al., 2010; Juvonen et al., 2013; Thunfors & Cornell, 2008; Reijntjes et al., 2013a). Moreover, bullies also engage in dating and sexual behavior earlier and more often than uninvolved peers (Arnocky & Vaillancourt, 2012; Connolly et al., 2000; Vaillancourt, 2013; Volk, et al., 2015).

This research suggests that traditional aggression and bullying occurs in the context of intrasexual competition for social resources.

Because cyber aggression is a relatively new form of aggression, evolutionary research is sparse in this area. However, preliminary research suggests that cyber aggression has been used to derogate evolutionarily preferred traits in same-sex peers, particularly physical appearance and sexual fidelity in females, and sexual orientation, achievements, and physical ability in males (Hoff & Mitchell, 2009; Wyckoff et al., 2018), and thus may be a vehicle for intrasexual competition strategies similar to those perpetrated with traditional verbal and relational aggression. Cyber aggression also predicts increases in perceived popularity (for females only: Badaly et al., 2013; both sexes: Wegge et al., 2016), and has been cross-sectionally linked with more dating and sex partners for adolescents involved in both cyber aggression and victimization (Lapierre & Dane, 2019). This evidence suggests that evolutionary theory may be applicable to this relatively new form of aggression.

Evolutionary perspectives also argue that antisocial strategies such as aggression have cost-benefit trade-offs (see Volk et al., 2012). In this vein, resource control theory (Hawley, 2007) states that antisocial or coercive strategies incur social costs, especially hindering cooperative relationships, that offset the benefit of gaining resources, reputational benefits, and opportunities for reproduction. These trade-offs are evident in research showing that although bullies and aggressors tend to have high perceived popularity (e.g., Juvonen et al., 2013; Wegge et al., 2016; Wright, 2014) and social dominance/status amongst peers (e.g., Juvonen et al., 2004; Vaillancourt et al., 2003), they also tend to experience social disadvantages such as being disliked by peers (Cillessen & Mayeux, 2004; de Bruyn et al., 2010; Reijntjes et al., 2013a; Rodkin & Berger, 2008; Wright, 2014), and being less able to form alliances than youth using

prosocial strategies (Farrell & Dane, 2019). Moreover, although bullies and aggressors report more involvement in dating and sex (Arnocky & Vaillancourt, 2012; Volk et al., 2015), they also report more peer conflict (Rose et al., 2004), insecure attachment to peers (Wright et al., 2015) and romantic partners (Wright, 2015), as well as more aggression, and less affection, intimacy, commitment, and equity in dating relationships (Connolly et al., 2000).

However, it is important to note that the costs or social disadvantages associated with aggression may be buffered when aggression is utilized alongside prosocial strategies of resource control (Hawley, 2015). For example, in the case of bistrategic controllers, individuals who use both aggressive and prosocial resource control strategies in a planful and controlled way, some research suggests that their strategic use of prosocial resource control strategies, such as cooperation and reciprocation, can offset the costs/disadvantages of strategic aggression by minimizing the loss of affection or esteem from peers (e.g., Hawley, 2003). However, there is also evidence to the contrary, suggesting that bistrategic controllers experience social disadvantages/costs, as evidenced by low social preference (Reijntjes et al., 2017). In general, this research suggests that more planful approaches to resource control might minimize the social costs/disadvantages relative to impulsive or reactive approaches.

Given that adolescence marks the age when bullying and aggression typically peak (see Volk et al., 2012) and intrasexual competition for social resources becomes prevalent (e.g., Polo et al., 2018), it is important to examine how adolescents' use of cyber aggression is related to both social advantages and disadvantages. Identifying the social advantages linked to cyber aggression can illuminate why cyber aggression continues to be a problem amongst adolescents despite the risk of incurring social disadvantages and the implementation of school-based anti-cyberbullying interventions intended to reduce this behavior (Gaffney et al., 2019).

Social Advantages and Disadvantages in Traditional Bullying-Victimization Status Groups

Previous person-oriented research has shown different costs and benefits to be associated with traditional bullying-victimization status groups, including bullies, victims, and bully-victims (both a bully and a victim). In comparison to uninvolved peers, bullies report more externalizing problems, whereas victims report more internalizing problems (Lovegrove & Cornell, 2014). Bully-victims, on the other hand, report more externalizing and internalizing problems than bullies, victims, and uninvolved peers. Moreover, victims and bully-victims report more peer disadvantages than do bullies and uninvolved peers (Marini et al., 2006). These results generally support the contention that bully-victims are the most psychosocially maladjusted group (see Schwartz et al., 2001; Volk et al., 2012).

In contrast, several studies have found evidence of social advantages linked to bully-victim status. According to cross-sectional research, female relational bully-victims and physical aggressor-victims of both sexes report more dating behaviors than uninvolved peers (Dane et al., 2017; Gallup et al., 2011). Similarly, adolescents had more dating and sexual partners when their involvement in cyber aggression and victimization was high (Lapierre & Dane, 2019). A possible explanation is that adolescents who have procured adaptive benefits are viewed as intrasexual rivals (i.e., competitor effect; Dane et al., 2017; Lapierre & Dane, 2019). In line with this contention, traditional victimization is more likely to be experienced by adolescents involved in dating or sexual behavior (Gallup et al., 2009; Leenaars et al., 2008; McComb & Dane, 2019) and by females who are physically attractive or provocatively dressed (Leenaars et al., 2008; Vaillancourt & Sharma, 2011). Furthermore, both cyber aggression and cyber victimization have been linked to adolescent girls' frequency of taking sexualized selfies, but not to their frequency of taking selfies overall (Stuart & Kurek, 2017). These behaviors and traits may be indicators

that mark intrasexual rivals (e.g., Fink et al., 2014), which could elicit jealousy and trigger victimization (Vaillancourt & Sharma, 2011). Within the context of intrasexual competition, adolescents would likely victimize rivals to reduce their status over time (Arnocky et al., 2012; Arnocky & Vaillancourt, 2012; Dane et al., 2017), rather than victimize vulnerable peers who are uninvolved and ineffective in intrasexual competition.

Cyber Aggression: Latent Class Groupings and Aggressive Functions

Empirical person-oriented research has shown that cyberbullying-victimization status groups are different from those identified in traditional aggression research, in that adolescents were either uninvolved or involved in both cyber aggression and victimization to varying degrees (i.e., cyberbully-victims; Festl et al., 2017; Schultze-Krumbholz et al., 2015). These findings are consistent with research suggesting that cyber aggression and victimization are more highly correlated than their traditional counterparts (Bauman et al., 2013, Varjas et al., 2009), possibly because cyberspace affords anonymity and reduces the salience of power balances between perpetrators and victims (Kowalski et al., 2014), which makes cyber aggression and victimization more likely to occur as a reciprocal cycle rather than as pure cyber aggression or cyber victimization. Thus, “pure” cyberbully and cyber victim categories have not yet been found with empirical methods of assessment, albeit in research that has used only frequency and form of cyber aggression as indicators.

There are theoretical and empirical grounds for suggesting that person-oriented analyses using measures of aggressive (proactive versus reactive) function may reveal different groups of cyber aggressor-victims than analyses that focused only on frequency and form of cyber aggression. Proactive aggression is defined as goal-directed and unprovoked, whereas reactive aggression is an impulsive and defensive response to a perceived threat or frustration (Hubbard

et al., 2010). Consistent with the goal-directedness of bullying (see Volk et al., 2014), proactive aggression has been related more strongly and consistently to being a traditional bully (Camodeca & Goossens, 2005; Salmivalli & Nieminen, 2002; Sijtsema et al., 2009) and a cyberbully (Ang et al., 2013; Calvete et al., 2010) than has reactive aggression. In contrast, reactive aggression has been more consistently related to being a bully-victim (Salmivalli & Nieminen, 2002), and bully-victims exhibit more reactive aggression than do bullies (Runions et al., 2018; Salmivalli & Nieminen, 2002). However, other research suggests that both bullies and bully-victims engage in proactive and reactive aggression (e.g., Camodeca et al., 2002). According to person-oriented research, traditional aggressors tend to engage in both proactive and reactive aggression; some individuals use both to similar degrees, whereas others are more highly involved in reactive than proactive aggression (Smeets et al., 2017; Thomson & Centifanti, 2018). Likewise, other research suggests that adolescents are motivated to engage in cyber aggression for both proactive and reactive reasons (Law et al., 2012; Runions et al., 2017; Shapka & Law, 2013).

Goals and Predictions

Therefore, in the current study, we investigated whether including proactive and reactive functions of cyber aggression as indicators in an empirical person-centered analysis would distinguish cyber aggressive-victims involved in both functions of cyber aggression to similar degrees (i.e., mixed cyber aggressor-victims) from those who are more reactively cyber aggressive (i.e., highly reactive cyber aggressive-victims). This distinction may be important because these groups likely experience different social advantages and disadvantages.

Based on theory and empirical evidence in traditional aggression research, we expected that highly reactive cyber aggressive-victims would be likely to experience more social

disadvantages and fewer social advantages than mixed cyber aggressive-victims. In comparison to reactive aggression, proactive aggression is more effective for attaining goals because it is strategic, goal-directed, and linked to greater self-efficacy and the expectation of positive outcomes (Hubbard et al., 2010). Accordingly, proactive aggression has been associated with higher levels of, and increases in perceived popularity (van den Berg et al., 2019; Prinstein & Cillessen, 2003), and bullying has been linked to social dominance (Reijntjes et al., 2013b). Although social advantages may mark adolescents as intrasexual rivals (e.g., Fink et al., 2014; Vaillancourt & Sharma, 2011), research suggests that victimization is less likely to reduce powerful adolescents' social advantages or harm their cooperative relationships (Hunter et al., 2007; Vaillancourt & Hymel, 2006; Ybarra et al., 2014).

In contrast, reactive aggression is associated with distrust and a tendency to aggress in response to real or perceived provocation (Hubbard et al., 2010). As a result, it is associated with emotional dysregulation and social disadvantages that impair cooperative relationships, including the formation of more conflictual and less supportive and satisfying friendships amongst boys (Poulin & Boivin, 1999). Reactive aggression has also been linked to low implicit social power, which refers to the ability to obtain social resources and positive perceptions freely conferred by peers, including positive attention, admiration, liking, and support from allies (Farrell & Dane, 2019; Vaillancourt & Hymel, 2006). For example, reactive aggression has been linked to peer rejection and low social preference (Card & Little, 2006; van den Berg et al., 2019), as well as teacher ratings of uncooperativeness (Price & Dodge, 1989). Furthermore, in comparison to proactive aggression, reactive aggression has been more strongly linked to victimization (Card & Little, 2006), which is associated with low alliance formation ability (Farrell & Dane, 2019). Social disadvantages are likely both antecedents and consequences of reactive aggression,

making highly reactive adolescents provocative and vulnerable to a cycle of victimization and retaliation, as well as ineffective in achieving social benefits (see Hubbard et al., 2010).

This study aimed to (1) use proactive and reactive cyber aggression, and cyber victimization, as indicators to empirically identify cyber aggressive-victimization status groups, and (2) assess how cyber aggression-victimization status groups are differentially linked to evolutionarily relevant social advantages and disadvantages in the domains of resource control (i.e., social dominance), reputation (i.e., implicit social power), and reproduction (i.e., number of dating and sexual partners, and friendship and relationship attachment anxiety and avoidance). Based on previous empirical, person-oriented research on cyber aggression-victimization (Festl et al., 2017; Schultze-Krumbholz et al., 2015) and traditional proactive and reactive aggression (Smeets et al., 2017; Thomson & Centifanti, 2018), we expected to identify three different groups of adolescents: (1) a group not involved in either proactive or reactive cyber aggression, nor cyber victimization; (2) a group of mixed cyber aggressor-victims who use proactive and reactive cyber aggression to similar degrees and experience cyber victimization in the context of intrasexual competition; and (3) a group of highly reactive cyber aggressor-victims who predominately engage in reactive cyber aggression in response to cyber victimization.

Because proactive aggressors have achieved more social advantages than reactive aggressors and non-aggressors in past research (Farrell & Dane, 2019; Reijntjes et al., 2013b), we predicted that mixed cyber aggressor-victims would report more social dominance and dating and sexual partners than would highly reactive cyber aggressor-victims and uninvolved peers. Furthermore, given that aggressive strategies involve a trade-off between social benefits and social costs, we expected both cyber aggressor-victim groups to report more social disadvantages, including less implicit social power and more friendship and relationship

attachment anxiety and avoidance, when compared to that of uninvolved peers. However, because social disadvantages have been linked more strongly with reactive than proactive aggression (Card & Little, 2006; Hubbard et al., 2010), we predicted that highly reactive cyber aggressor-victims would report more social disadvantages than mixed cyber aggressor-victims.

Method

Participants

A sample of 400 participants (232 females) between the ages of 12 to 18 ($M = 14.72$, $SD = 1.68$) was recruited from community groups in Southern Ontario, Canada, including athletic organizations, extracurricular organizations, youth and church groups. Within the sample, approximately 81% of participants identified as White, while the remaining 19% included individuals of Asian, Black, Native Canadian, and mixed ethnicities.

Materials

Proactive and reactive cyber aggression. This measure (Lapierre & Dane, 2019; McComb & Dane, 2019) was adapted from previous measures of traditional and cyber bullying and aggression (Book et al., 2012; Raine et al., 2006; Marsee et al., 2011; Runions et al., 2017; Runions et al., 2018; Shaw et al., 2013) to assess the frequency of proactive and reactive cyber aggression. Consistent with recent theory and research (e.g., Marsee et al., 2011; Raine et al., 2006; Runions et al., 2017; Runions et al., 2018), proactive cyber aggression was measured using items that addressed goal-directed, appetitive (i.e., reward-oriented) aggression, whereas reactive aggression items exemplified impulsive, unplanned, and emotional aggression. Three proactive items referred to evolutionary functions not measured in previous scales, including intrasexual competition, intersexual displays to facilitate intersexual selection or mate choice, and deterrence of rivals' aggression, because previous research has shown that these are key functions of

aggressive behavior (Archer, 2009; Archer & Benson, 2008; Buss & Shackelford, 1997; Dane et al., 2017; Vaillancourt, 2013; Volk et al., 2012; Pinker, 2011).

As a first step, respondents were asked how often they used the internet or a cell phone to perpetrate nine aggressive acts, including spreading rumours, threatening others, and sending or posting embarrassing information, pictures or videos, though this measure of the overall frequency of cyber aggression was not used in this study. Next, respondents completed 14 items in total to assess how often they had engaged in these acts of cyber aggression for proactive and reactive reasons. To establish that proactive and reactive cyber aggression were distinct subscales within these items, we conducted a Principal Component Analysis (PCA) with Varimax rotation on the 14 items to find that the two-factor solution had the best fit and accounted for 62.88% of the total variance. Thus, two subscales were utilized, the first of which included 10 items asking how often respondents had engaged in acts of cyber aggression for proactive reasons (rotated component matrix loadings ranged from .40 to .84; $\alpha = .88$; e.g., ‘to be cool or popular, or to feel powerful or respected’), and a subscale of four items assessing how often they used acts of cyber aggression in a reactive manner (rotated component matrix loadings ranged from .72 to .88; $\alpha = .91$; e.g., ‘someone made me angry and I reacted without thinking’). Responses were on a 5-point Likert-type scale, ranging from ‘never’ to ‘almost always’. To reduce skew in reactive cyber aggression subscales, this score was winsorized to its respective upper third standard deviation.

Cyber victimization. This self-report measure (Lapierre & Dane, 2020; McComb & Dane, 2019) examines how frequently respondents had been cyber victimized (9 items, $\alpha = .91$), during the last 12 months. Example items include ‘Others spread rumours or gossip about me,

using the internet or a cell phone’, and ‘Someone used the internet or a cell phone to send or post embarrassing information, pictures, or videos of me’. Respondents were asked to rate how frequently in the past 12 months they had experienced cyber victimization on a 5-point Likert-type scale, ranging from ‘never’ to ‘almost always’. To reduce skew in this measure, scores were winsorized to the upper third standard deviation.

Dating and sexual behaviour. Using open-ended questions, participants were asked to report how many different partners they had dated in the past (e.g. ‘How many different people have you gone on dates with, just the two of you?’) and the number of sexual partners the respondents have had (e.g. ‘How many different partners have you had a voluntary sexual experience with [i.e., more than kissing or making out] since the age of 12?’). As these questions were open-ended, the responses winsorized to their respective upper third standard deviation to reduce skew.

Relationship quality. The experiences in close relationships-relationships structures (ECR-RS) questionnaire was revised by Fraley, Heffernan, Vicary, and Brumbaugh (2011) to examine attachment anxiety and avoidance across relationship contexts; only dating/partner and friend-related attachment scales were included in this study. For each relationship context there were 9 items in total; the attachment-related avoidance subscale consisted of 6 items (partner-related $\alpha = .87$; friend-related $\alpha = .88$; e.g., ‘I don’t feel comfortable opening up to this person’), and the attachment-anxiety subscale consisted of the remaining 3 items (partner-related $\alpha = .94$; friend-related $\alpha = .93$; e.g., ‘I often worry that this person doesn’t really care for me’). Responses were rated on a 7-point Likert-type scale ranging from ‘strongly disagree’ to ‘strongly agree’.

Social power. To assess implicit social power and social dominance, we adapted a measure used by Farrell and Dane (2019); we used items from the previous research to assess

social dominance, and expanded the items tapping implicit social power, adding items derived from literature on social attention holding power (Gilbert, 2000; Gilbert et al., 1995) to those that Farrell and Dane (2019) used to assess the ability to form cooperative alliances with peers. Conceptually, these two forms of power can be differentiated based on the method in which the power was achieved. Social dominance is obtained through aggressive/coercive tactics, and the instillation of fear. In contrast, implicit social power involves gaining respect, admiration, positive attention and alliances, social resources that are freely given by peers (Farrell & Dane, 2019; LaFreniere & Charlesworth, 1983; Vaillancourt & Hymel, 2006). Based on the results of a PCA with varimax rotation, a two-factor solution had the best fit and explained 60.28% of the variance to support the use of two subscales, including the social dominance subscale (5 items; rotated component matrix loadings ranged from .60 to .89; $\alpha = .87$; e.g., ‘I am able to make others do what I want’), and the implicit social power subscale (16 items; rotated component matrix loadings ranged from .55 to .84; $\alpha = .95$; e.g., ‘I get a lot of positive attention from others’, and ‘Others usually side with me’). Participants responded on a 5-point Likert-type scale, ranging from ‘never’ to ‘almost always true’.

Plan of Analysis

To examine how adolescents’ cyber aggression perpetration and victimization separate into distinguishable subgroups, a latent class analysis (LCA) was executed using Mplus, version 8. Latent class indicators included frequency variables for proactive cyber aggression, reactive cyber aggression, and cyber victimization, as well as respondent sex and age as control variables. Numerous statistical criteria were considered to determine an appropriate number of groups identified by the data, including (1) interpretability of the classes and consistency with past research, (2) the Bayesian information criterion (BIC), where smaller values indicate a better

model fit, (3) the Lo-Mendell-Rubin Adjusted Likelihood Ratio Test (LMR-LRT) and/or the Bootstrap Likelihood Ratio Test (BLRT) to compare model fit to a model with fewer classes (p-value significance for a particular model indicates better fit than the model with fewer classes), (4) classes have adequate sample size (e.g., larger than 5% of the total sample, although there is no set cut-off criterion for sample size of classes), (5) average latent class posterior probabilities that are close to 1.00 (Nylund et al., 2007), and (6) the entropy is greater than .80 to indicate confidence in individuals' class placement and differentiation of separate classes (although there is no set cut-off criterion for entropy; Jung & Wickrama, 2008). Following identification of latent classes using LCA, one-way ANOVAs and post-hoc tests (i.e., Tukey's HSD and Games-Howell) were run to compare classes across psychosocial correlates.

Results

Preliminary Analyses

Table 2.1 displays the means, standard deviations, and inter-correlations between the study variables for the whole sample. Consistent with an evolutionary perspective, both proactive and reactive cyber aggression, and cyber victimization were all positively correlated, albeit weakly, to number of dating partners, whereas only reactive cyber aggression and cyber victimization were positively related to number of sex partners. Similarly, both proactive and reactive cyber aggression were weakly, but positively correlated to social dominance. In terms of social disadvantages, both reactive cyber aggression and cyber victimization were negatively correlated with implicit social power. Furthermore, proactive and reactive cyber aggression and cyber victimization were all positively correlated to friendship anxiety, proactive cyber aggression was weakly positively correlated with friendship avoidance, and cyber victimization was positively correlated with partner anxiety.

Primary Analyses

Extraction of latent classes. Controlling for age and respondent sex, latent class analyses were conducted for 1 to 4 class models, and the three-class model had the best fit (see Table 2.2). The four-class model was not selected due to a small class count and non-significant LMR-LRT indicating worse model fit compared to the three-class model. In support of the three-class model, the drop in the BIC value between classes 3 and 4 was smaller relative to the drop between classes 2 and 3, there were no classes with less than 5% of the sample, the average latent class posterior probabilities were close to 1.00 (ranged from .986 to .994) and the entropy value was very high (.982) indicating high confidence that individuals were correctly classified and clear delineation of the classes. Moreover, since previous research supports a three-class model describing involvement in cyber aggression and victimization (Schultze-Krumbholz et al., 2015), the three-class model was preferred.

In further assessing the three-class model, the results indicated that 79.4% of the sample were placed in class 1 ('uninvolved'; $n = 318$); these individuals reported never being involved in proactive or reactive cyber aggression or cyber victimization during the past year. Class 2 ('mixed cyber aggressor-victims'; $n = 51$) included 13.1% of the sample, and these individuals reported moderate involvement in both proactive and reactive cyber aggression and cyber victimization relative to the uninvolved class. Finally, class 3 ('highly reactive cyber aggressor-victims'; $n = 30$) included 7.4% of the sample, and on average, these individuals reported moderate involvement in proactive cyber aggression and cyber victimization similar to mixed cyber aggressor-victims but greater involvement in reactive cyber aggression relative to the mixed cyber aggressor-victims, during the past year. The identified groups did not differ statistically in terms of gender composition, however, significant age differences were observed,

$F(2, 396) = 5.55, p = .004$, such that older adolescents were significantly more likely to be classified in the highly reactive group (25.8% of group were ages 17-18) than in the uninvolved group (13.2% of this group were ages 17-18).

Class differences on associated social advantages and disadvantages. Significant group differences were found for social dominance, implicit social power, number of dating partners, number of sexual partners, and friendship-related anxiety (see Table 2.3). Follow-up post-hoc analyses (Tukey's HSD for social dominance, implicit social power, and friendship-related anxiety, and Games-Howell for number of dating partners and number of sexual partners) were conducted to identify significant group differences in relation to the dependent variables of interest.

According to post-hoc analyses, mixed cyber aggressor-victims reported significantly more social dominance than the uninvolved group. Highly reactive cyber aggressor-victims did not significantly differ from either the uninvolved group or mixed cyber aggressor-victims in terms of social dominance, however, they did report significantly less implicit social power and more friendship-related anxiety than both the mixed cyber aggressor-victims and uninvolved peers, who did not differ in this regard. There were no significant group differences in terms of partner-related anxiety or avoidance, or friendship-related avoidance. With regard to reproductively relevant behaviour, the post-hoc analyses indicate that mixed cyber aggressor-victims reported more dating partners than the uninvolved group. Highly reactive cyber aggressor-victims did not statistically differ from either the uninvolved group or the mixed cyber aggressor-victims in reported number of dating, however, they did report more sexual partners than the uninvolved group.

Table 2.1

Means, Standard Deviations, and Intercorrelations of Study Variables

| | M(SD) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|----------------------|-------------|--------|-------|-------|--------|--------|-------|------|-------|--------|-------|-------|-------|
| 1. Sex (M=1, F=2) | 1.58(.49) | | | | | | | | | | | | |
| 2. Age | 14.72(1.68) | -.07 | | | | | | | | | | | |
| 3. Proactive CA | 1.16(.31) | -.09 | .13** | | | | | | | | | | |
| 4. Reactive CA | 1.28(.54) | .05 | .18** | .60** | | | | | | | | | |
| 5. CV | 1.34(.50) | .09 | .18** | .49** | .49** | | | | | | | | |
| 6. # Dating Partners | 1.14(1.69) | -.15** | .41** | .21** | .17** | .29** | | | | | | | |
| 7. # Sex Partners | .69(1.55) | -.06 | .48** | .10 | .23** | .28** | .60** | | | | | | |
| 8. Soc. dominance | 2.64(.81) | -.03 | .10* | .21** | .14** | .08 | .22** | .07 | | | | | |
| 9. Imp. soc. power | 3.38(.70) | .06 | -.04 | -.00 | -.17** | -.17** | .06 | -.02 | .48** | | | | |
| 10. Partner anxiety | 2.61(1.78) | -.05 | .19** | .10 | .09 | .19** | .18** | .14* | -.03 | .18** | | | |
| 11. Partner avoid. | 2.42(1.31) | -.04 | -.10 | .05 | -.01 | .05 | -.01 | -.00 | -.03 | -.12* | .43** | | |
| 12. Friend. anxiety | 2.26(1.62) | -.02 | .13** | .21** | .17** | .19** | .07 | .01 | -.07 | -.31** | .47** | .34** | |
| 13. Friend. avoid. | 2.22(1.22) | -.32** | .04 | .11* | .04 | .01 | -.02 | .09 | -.09 | -.22** | .16** | .34** | .48** |

Note. CA = Cyber Aggression. CV = Cyber Victimization. Soc = Social. Imp = Implicit. Avoid = Avoidance. Friend = Friendship.

* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 2.2

Fit Indices for Latent Class Analysis

| | 1 | 2 | 3 | 4 |
|-----------|---------|------------|------------|-------------|
| BIC | 3602.92 | 895.42 | 644.27 | 547.36 |
| Entropy | - | 0.969 | 0.982 | 0.985 |
| Class <5% | No | No | No | Yes |
| LMR-LRT | - | $p < .001$ | $p = .001$ | $p = .1733$ |
| BLRT | - | $p < .001$ | $p < .001$ | $p < .001$ |

Notes. BIC = Bayesian information criterion. LMR-LRT = Lo-Mendell-Rubi Adjusted Likelihood Ratio Test and BLRT = Bootstrap Likelihood Ratio Test.

Table 2.3

Significant Differences Among Classes - Means and Standard Deviations

| | DF1 | DF2 | F | <i>p</i> | η^2 | Uninvolved (n=318) | Mixed cyber agg-vic (n=51) | Highly reactive cyber agg-vic (n=30) |
|------------------------------------------|-----|-----|---------|----------|----------|-------------------------|----------------------------------|--------------------------------------------|
| Characteristics of Latent Classes | | | | | | | | |
| Proactive cyber aggression | 2 | 391 | 102.26 | <.001 | .34 | 1.07(.16) ^a | 1.42(.40) ^b | 1.65(.57) ^b |
| Reactive cyber aggression | 2 | 391 | 2529.40 | <.001 | .93 | 1.04(.11) ^a | 1.88(.25) ^b | 2.84(.22) ^c |
| Cyber victimization | 2 | 395 | 73.23 | <.001 | .37 | 1.21(.36) ^a | 1.75(.61) ^b | 2.01(.66) ^b |
| Psychosocial correlates | | | | | | | | |
| Number of dating partners | 2 | 360 | 8.12 | <.001 | .04 | .95(1.54) ^a | 1.82(1.91) ^b | 1.69(1.97) ^{a, b} |
| Number of sexual partners | 2 | 344 | 8.81 | <.001 | .05 | .50(1.33) ^a | 1.16(1.83) ^{a, b} | 1.50(2.13) ^b |
| Social dominance | 2 | 394 | 5.74 | .003 | .03 | 2.58(.81) ^a | 2.98(.77) ^b | 2.75(.83) ^{a, b} |
| Implicit social power | 2 | 394 | 4.33 | .014 | .02 | 3.39(.71) ^a | 3.51(.61) ^a | 3.04(.74) ^b |
| Partner anxiety | 2 | 354 | 2.14 | .119 | .01 | 2.50(1.71) ^a | 2.86(1.89) ^a | 3.11(2.11) ^a |
| Partner avoidance | 2 | 354 | .004 | .996 | .00 | 2.41(1.31) ^a | 2.42(1.31) ^a | 2.43(1.39) ^a |
| Friendship anxiety | 2 | 389 | 6.29 | .002 | .03 | 2.16(1.57) ^a | 2.18(1.50) ^a | 3.23(1.88) ^b |
| Friendship avoidance | 2 | 389 | 2.71 | .068 | .01 | 2.22(1.21) ^a | 1.95(1.13) ^a | 2.58(1.19) ^a |

Notes. Means in the same row with different superscripts are significantly different at $p < .05$. Higher scores indicate greater levels of variable of interest; agg-vic – ‘aggressor-victim’.

Discussion

The first goal of this study was to use empirical methods to identify cyber aggression-victimization status groups, using proactive and reactive functions of cyber aggression as indicators to expand on previous person-oriented research. Consistent with empirical research on cyber aggression and victimization (Festl et al., 2017; Schultze-Krumholz et al., 2015), this study identified two groups of adolescents involved in both cyber aggression and cyber victimization but did not find any evidence of pure cyber aggressor or cyber victim groups despite using different indicators for latent class groupings. Rather, the cyber aggressor-victim groups differed in their use of reactive cyber aggression; mixed cyber aggressor-victims engaged in both proactive and reactive cyber aggression to similar degrees, whereas highly reactive cyber aggressor-victims were more highly involved in reactive than proactive cyber aggression. These patterns are consistent with person-oriented research on traditional proactive and reactive aggression (Smeets et al., 2017; Thomson & Centifanti, 2018). Finally, most adolescents (79.4%) were uninvolved in cyber aggression and victimization, which is similar to rates of uninvolved found in previous research (range from 70-83%; Festl et al., 2017; Schultze-Krumholz et al., 2015).

From this research it is evident that involvement in cyber aggression and victimization differs from traditional involvement; the status groups identified within this and previous studies (Festl et al., 2017; Schultze-Krumholz et al., 2015) contrast with those in traditional empirical research (Jenson et al., 2013; Lovegrove & Cornell, 2014; Lovegrove et al., 2012) because pure cyber aggressors and cyber victims have not been identified. Cyber aggression-victimization status groups likely differ from their traditional counterparts due to contextual differences in interactions that occur in cyberspace versus in-person. Given that cyber aggression is indirect

and potentially anonymous (Kowalski et al., 2014), aggression and victimization can more easily occur in a reciprocal cycle of victimization and retaliation through cyber media where traditional power is less salient (Lapierre & Dane, 2020; Young et al., 2018). For example, because physical power cannot be directed against a victim through an electronic device, cyber victims may be less likely to fear physical retribution for retaliating against cyber aggressors. This likely changes the power dynamics in the cyber context and the diminished likelihood of being harmed through retribution may increase the willingness of cyber victims to respond to cyber aggression with sarcasm or reactive aggression (Young et al., 2018). This contention is supported by research that suggests cyber aggression and victimization co-occur to a greater degree than does traditional aggression and victimization (Bauman et al., 2013; Varjas et al., 2009).

The second goal of this study was to extend previous research by examining how the identified cyber aggression-victimization status groups were differentially related to social advantages and disadvantages predicted on the basis of evolutionary perspectives of aggression. In terms of social advantages associated with cyber aggression-victimization, in comparison to the uninvolved group, mixed cyber aggressor-victims reported more social dominance and more dating partners, whereas highly reactive cyber aggressor-victims reported more sexual partners. These results are consistent with our prediction and previous evolutionary research linking traditional and cyber forms of aggression and bullying to social advantages including social dominance (e.g., de Bruyn et al., 2012; Juvonen et al., 2004), perceived popularity (e.g., Juvonen et al., 2013; Wegge et al., 2016), as well as dating and sex (e.g., Lapierre & Dane, 2020; Volk et al., 2015). Moreover, the results were similar to findings in previous variable-oriented research demonstrating that aggressor-victims also experience social advantages, like greater involvement in dating and sex, rather than being a purely maladapted group (e.g., Dane et al., 2017; Lapierre

& Dane, 2020). Finally, by virtue of this group having social advantages that mark them as intrasexual rivals, they likely experience victimization at the hands of jealous peers.

Although highly reactive cyber aggressor-victims did report more sexual partners than uninvolved peers, they showed fewer social advantages than did the mixed cyber aggression-victimization group, as expected. Despite using a level of proactive aggression similar to that of the mixed cyber aggression-victimization group, social advantages may not have been associated with the highly reactive group because they had less prestige or implicit social power, a factor previously shown to affect the likelihood of aggression yielding benefits (Vaillancourt & Hymel, 2006). Moreover, highly reactive cyber aggressor-victims experienced the most social disadvantages in our study, consistent with our prediction. Specifically, the highly reactive group reported less implicit social power and more friendship anxiety than the mixed and uninvolved groups. Given that highly reactive and mixed cyber aggressor-victims were equally involved in proactive cyber aggression and cyber victimization in this study, reactive cyber aggression may be driving the association with social disadvantages. This interpretation is consistent with longitudinal research showing that increases in traditional reactive aggression predict both increases in unpopularity and victimization (Cooley et al., 2018; Frey & Higheagle Strong, 2017; Salmivalli & Helteenvuori, 2007; van den Berg et al., 2019) and decreases in popularity (van den Berg et al., 2019) over time. Moreover, reactive aggression has been linked to negative perceptions by peers (e.g., dislike, rejection; Card & Little, 2006), and more conflictual friendships (Poulin et al., 1999). Given their social disadvantages, the cyber victimization experienced by the highly reactive group may often occur because they are perceived by peers as provocative, aversive, and socially vulnerable (Card & Little, 2006; Farrell & Dane, 2020; Hubbard et al., 2010; Juvonen et al., 2003), as well as less likely to be defended (Oldenburg et

al., 2018). Furthermore, cyber victimization experienced by the highly reactive group could also result in greater social disadvantages than those found in the mixed group as research on traditional victimization has shown that victimization is more strongly related to social disadvantages when it is experienced by adolescents who are less powerful than their perpetrators (Ybarra et al., 2014; Hunter et al., 2007). Regardless of the direction of association, it is evident that individuals in the highly reactive cyber aggression-victimization group had more social disadvantages and fewer advantages in comparison to mixed cyber aggression-victimization.

Limitations

Key limitations of this study include the cross-sectional design, which does not allow for inferences regarding causal direction of association, and the ethnic homogeneity of the sample may not generalize to all adolescents. Longitudinal research in more diverse populations is recommended. Another limitation pertains to the use of self-report data, which could have resulted in socially desirable responses and shared method biases; however, these measures were appropriate for assessing covert behaviours (e.g., cyber aggression involvement, dating and sexual behaviour) and cyber aggressive functions, which may not be known by outside observers. Regardless, future work may benefit from utilizing peer- or teacher-reports to corroborate self-reports. Another limitation was the method to assess number of sexual partners, which was measured with reference to broadly defined sexual experiences (i.e., “more than kissing or making out”) to ensure the item was developmentally appropriate for adolescents aged 12-18. However, this item does include sexual behaviours that could not lead directly to reproduction, therefore, this item and the measure of dating partners should only be considered as a proxy for reproduction.

Conclusions

In conclusion, the results of this person-centered analysis provided empirical evidence that adolescents were either involved as both perpetrators and victims of cyber aggression or not involved at all, which is in contrast to person-oriented research in the traditional aggression literature (e.g., Lovegrove & Cornell, 2014), where groups of pure perpetrators and pure victims have been identified. This is likely due to contextual differences between cyber and in-person interactions (Kowalski et al, 2014), with the potential anonymity and non-physical nature of aggression through cyber media facilitating intrasexual competition and aggression by adolescents who might otherwise defer or submit to more powerful in-person aggressors. Furthermore, similar to traditional, person-oriented aggression research (Smeets et al., 2017; Thomson & Centifanti, 2018), we found that cyber-aggressive adolescents tended to be involved in both proactive and reactive cyber aggression but varied in the extent to which they used reactive cyber aggression.

Consistent with previous evolutionary research, the results of this study suggest that although involvement in cyber aggression-victimization was associated with advantages including greater social dominance and more dating and sexual behaviour, highly reactive cyber aggression-victimization was associated with fewer social advantages and more social disadvantages than was mixed cyber aggression-victimization. These results have key implications for current anti-cyberbullying interventions. A recent meta-analysis examining the efficacy of school-based anti-cyberbullying interventions suggests that such interventions produce only small effects in reducing cyberbullying and cyber victimization (Gaffney et al., 2019). Evolutionary theory and research may offer a new perspective that can be incorporated into anti-cyberbullying interventions, providing a basis for improvement. For example, the

Meaningful Roles Intervention is a recent example of an evolutionary perspective being applied to address traditional bullying (e.g., the Meaningful Roles Intervention; Ellis et al., 2015). In this program, prosocial strategies were promoted as alternatives to aggressive strategies as a means to achieve or maintain social advantages, while limiting negative social consequences, and the preliminary results have been promising. Therefore, evolutionary psychological theory and research may also generate insights into components or strategies that may enhance anti-cyberbullying interventions and increase their effectiveness in reducing adolescents' involvement in cyber aggression.

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CHAPTER 3: STUDY 2

Evolutionary Functions of Cyber and Traditional Forms of Aggression in Adolescence²

In recent years, researchers have begun to examine cyber aggression from an evolutionary psychological perspective and have found that it functions similarly to traditional, in-person forms of aggression, suggesting that devices operating in cyberspace are utilized as modern tools for adaptive aggressive behaviour. According to an evolutionary perspective, aggression functions as a tool to solve various problems that humans have encountered in their evolutionary history, including negotiating status and power, obtaining tangible and social resources, defending against attack, deterring future attacks, as well as facilitating intersexual selection and intrasexual competition (Buss & Shackelford, 1997). Consistent with this contention, traditional aggression and bullying have been linked to evolutionarily relevant advantages, including social dominance (Pellegrini et al., 1999; Reijntjes et al., 2013a), social status (Juvonen et al., 2004; Lee et al., 2018), and perceived popularity (de Bruyn et al., 2010; Reijntjes et al., 2013b; Thunfors & Cornell, 2008; Vaillancourt et al., 2003), as well as more dating and sexual behaviour (Arnocky & Vaillancourt, 2012; Vaillancourt, 2013; Volk et al., 2015). Similarly, cyber aggression and bullying have been linked to social dominance (Lapierre & Dane, 2020b), perceived popularity (Badaly et al., 2013; Wegge et al., 2016; Wright, 2014), and more dating and sexual behaviour (Lapierre & Dane, 2020a; 2020b). However, research demonstrating the evolutionary advantages of traditional and cyber aggression has not examined

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self-report evidence to determine whether adolescents perceive using aggression to pursue a range of functions that theory and research suggest are of evolutionary significance. This gap in the literature is important because aggression is more likely to be used by adolescents when they perceive its utility to achieve goals (e.g., Crick & Dodge, 1994), which is of particular importance as the functions of aggressive behaviour broaden during adolescence with increased interest in status and dating goals (Ellis et al., 2012). Moreover, it is also important to understand when adolescents focus on proximate motives that do not align directly with ultimate evolutionary functions, especially in the case of impulsive and unreflective aggression that may be provoked or sadistic in nature. Such information can inform the development of effective intervention programs by illuminating when adolescents may benefit from becoming more cognizant of their specific goals, in order to apply problem-solving skills to achieve their goals in more prosocial and effective ways (e.g., Crick & Dodge, 1994).

Previous studies examining the self-reported functions of cyber and traditional aggression have provided information about a limited range of evolutionarily relevant aggressive functions. Research investigating aggressive functions as a proactive-reactive dichotomy suggests that both cyber and traditional bullying are generally more strongly related to proactive (i.e., goal-directed) than reactive (i.e., impulsive, emotional responses to real or perceived threats) functions (Ang et al., 2014; Runions et al., 2017; Sijtsema et al., 2009), consistent with the goal-directed nature of bullying (e.g., Volk et al., 2012). In contrast, person-oriented research focusing on general aggression rather than bullying suggests that cyber and traditional aggressors pursue both proactive and reactive functions, either to an equal degree or with greater emphasis on reactive functions (Lapierre & Dane, 2020b; Smeets et al., 2017; Thomson & Centifanti, 2018). However, the proactive-reactive dichotomy does not fully capture the range of evolutionary

functions that aggressive behaviour can accomplish (Buss & Shackelford, 1997). For example, some researchers assessed proactive functions only as a means of “getting what you want”, which limited proactive aggression to procuring resources or other unspecified instrumental purposes (Little et al., 2003). Other investigators broadened the assessment of proactive aggression to include motives to gain dominance, facilitate intrasexual competition, and experience enjoyment (i.e., sadism; Raine et al., 2006), as well as status seeking and revenge (Marsee et al., 2011). However, because these measures are scored as a proactive-reactive dichotomy, the various proactive functions cannot be examined separately. Moreover, these measures conflate form and function, such that aggressive functions are assessed in relation to specific aggressive actions (e.g., “I ignore or stop talking to others in order to get them to do what I want”; Marsee et al., 2011), resulting in the inability to determine how often aggression is generally used to achieve particular goals.

Recently, some research has moved beyond the proactive-reactive dichotomy to assess multiple proactive functions and gain a more nuanced understanding of proactive and reactive functions separate from form (e.g., Fluck, 2017; Prinstein & Cillessen, 2003; Runions et al., 2017; 2018). Runions and colleagues (2017; 2018) separated proactive and reactive functions into four factors: (1) impulsive-aversive (i.e., rage), (2), controlled-aversive (i.e., revenge), (3) controlled-appetitive (i.e., reward), and (4) impulsive-appetitive (i.e., recreation). In contrast, Fluck (2017) examined 5 functions: (1) instrumental, (2) power, (3) revenge, (4) ideology, and (5) sadism. According to this research, cyber and traditional bullying were consistently associated with goal-directed proactive functions, especially sadism/recreation (Fluck, 2017; Runions et al., 2017; 2018), whereas measures of victimization were more consistently linked to reactive functions (Runions et al., 2017; 2018). However, despite the range of functions explored

thus far, there is relatively little information about several evolutionarily relevant aggressive functions, including negotiating dominance hierarchies, facilitating intrasexual competition and intersexual selection, imposing costs on rivals, and pre-emptively deterring aggression from rivals (Buss & Shackelford, 1997). Therefore, one of the goals of this study was to extend the literature by examining cyber and traditional aggression and victimization in relation to a wider range of aggressive functions identified in evolutionary psychological research. We examined four aggressive functions: (1) *competitive functions*, which entail aggression directed toward a rival or adversary driven by aversive (e.g., aggression deterrence, and cost imposition on rivals) and appetitive motives (e.g., intrasexual competition, and negotiation of dominance hierarchies), (2) *impression management functions*, which encompass aggression with appetitive motives used to gain the attention, admiration, and affection of bystanders (e.g., intersexual selection, status seeking) and to generally procure desired resources, (3) *sadistic functions*, which involve unreflective aggression driven by appetitive motives related to enjoyment, and (4) *reactive functions*, which encompass impulsive and unreflective aggression driven by provocation and negative affect such as anger or frustration.

Although certain aggressive functions may not directly relate to ultimate evolutionary goals, such as survival and reproductive success, they may serve proximate functions that can increase the likelihood of adaptive outcomes (Volk et al., 2014). For example, at the most basic level, sadistic functions serve the proximate function of experiencing enjoyment to alleviate aversive emotions, like boredom, which can increase attention and purposeful behaviour (Pfattheicher et al., 2020), and may also motivate and reinforce aggression that serves competitive functions such as aggression deterrence, revenge, dominance, and the facilitation of intrasexual competition, as research has shown (Chester & Dewall, 2018; Pinker, 2011, pp. 550-

551). However, research suggests that sadism remains empirically distinct from dominance and other proactive functions (Fluck, 2017; Runions et al., 2018). Likewise, although reactive functions have the proximate function of retaliating against and potentially harming a provocateur, such behaviours may contribute to ultimate functions of aggression by deterring future victimization and increasing prospects of survival (e.g., Babcock et al., 2014). Although aggression deterrence is also characteristic of competitive functions, the means with which this is achieved differs between competitive and reactive functions. More specifically, although competitive functions aim to pre-emptively deter aggression by instilling fear in targets and bystanders, reactive functions are characterised by an impulsive and unreflective retaliatory response to threat, suggesting that competitive and reactive functions differ in terms of the cognitions driving the behaviour (e.g., Crick & Dodge, 1994). Despite the potential overlap, empirical and conceptual differences suggest that it remains important to gain a better understanding of adolescents' perceptions of the proximate goals that motivate aggression, because such information can have important implications for tailoring interventions to better address the functions of aggression (Babcock et al., 2014; Vitaro et al., 2006; Yeager et al., 2015).

Another limitation of previous research examining how cyber and traditional aggression are linked to aggressive functions is that it often confounds bullying with aggression involving other power balances between the perpetrator and victim, which we have called adversarial aggression. Differentiating power balances is important because bullying and adversarial aggression are likely associated with different functions. Aggressors who bully have a power advantage over the victim (Schoffstall & Cohen, 2011; Volk et al., 2014), allowing rewards to be gained at little cost due to a reduced risk of retaliation (Volk et al., 2014) and loss of peer

affection (Veenstra et al., 2010), and a greater likelihood of achieving goals through coercion and dominance (Sell et al., 2016; Volk et al., 2012). Therefore, bullying would likely be used to accomplish proactive functions, including competitive, impression management, and sadistic functions (Connolly et al., 2000; Dane et al., 2017; Hamm et al., 2015; Hawley, 2015; Prinstein & Cillessen, 2003; Runions et al., 2017; 2018), though this may depend on form and the perpetrator's gender. In particular, the overtness of direct bullying facilitates signalling to bystanders, a critical mechanism for impression management purposes, more than its indirect and covert (i.e., relational and cyber) counterparts (e.g., Dane et al., 2017; Volk et al., 2014). However, due in part to greater parental investment, girls would not be expected to use direct bullying for impression management purposes because they are generally more averse to risks inherent in the use of overt aggression than are boys (Campbell, 2013; Vaillancourt, 2013), and they can be evaluated negatively for involvement in gender non-normative aggression (Crick, 1997; Smith et al., 2010). In contrast, because boys utilize direct bullying more often than girls (Wang et al., 2009) and are more likely to achieve benefits related to impression management functions, such as access to resources and facilitation of intersexual selection, through direct bullying (Bjorklund & Hawley, 2014; Dane et al., 2017; Volk et al., 2012), impression management functions were expected to be linked to direct bullying only for boys.

In contrast, perpetrators of adversarial aggression (also called non-bullying aggression; e.g., Lapierre & Dane, 2020a) have equal or less power than their victim (Lapierre & Dane, 2020a; Volk et al., 2014), making it riskier and potentially more costly than bullying. Therefore, to justify the risk of costly aggression, it is likely to be associated with aversive motives expressed in aggression with competitive and reactive functions. Previous research provides some evidence of aggression being used competitively and pre-emptively to nullify advantages

of high-status intrasexual rivals. For example, indirect aggression has been positively associated with adolescent girls' body mass index (Gallup & Wilson, 2009) and concerns about being less attractive than their peers (Arnocky et al., 2012). Moreover, although being victimized is often linked to social vulnerabilities, it has also been associated with high popularity (Closson et al., 2017; Gradinger et al., 2012; Malamut et al., 2020), prestige (Andrews et al., 2016), earlier and more dating/sexual behaviour (Dane et al., 2017; Gallup et al., 2009; Leenaars et al., 2008; McComb & Dane, 2019; Volk et al., 2015), as well as females' physical attractiveness (Arnocky et al., 2012) and provocative dress (Vaillancourt & Sharma, 2011). However, cyberspace permits aggression in covert and less risky settings (Kowalski et al., 2014), which may empower adolescents to aggress against high-powered rivals (Vandebosch & Van Cleemput, 2008). Therefore, we predicted that adversarial cyber aggression would be linked to competitive functions more than traditional forms (Fisher & Cox, 2009; Lapierre & Dane, 2020a; McComb & Dane, 2019; Wyckoff et al., 2018). Finally, because adversarial aggression is generally thought to be provoked by peers who pose a threat, we also expected that all forms of adversarial aggression would be associated with reactive functions, a method of self-protection from victimization (e.g., Babcock et al., 2014).

Victimization by adversarial aggression and by bullying are also likely to have differential relations with aggressive functions. Adversarial victimization is more likely to be associated with competitive functions, in line with evidence cited above showing high-status peers being targeted by rivals in the context of competition and jealousy. In contrast, victims of bullying tend to be targeted due to social vulnerabilities including low popularity and peer status (Cook et al., 2010), as well as peer rejection (de Bruyn et al., 2010). However, in comparison to traditional, in-person contexts, cyberspace can minimize the risks of aggressing against high-

powered rivals, as discussed above, as well as increase the harm experienced by victims (Smith et al., 2008), potentially making cyber aggression an effective and relatively safe means to compete with high-powered rivals by damaging their reputation. Therefore, adversarial cyber victimization was expected to be most consistently associated with competitive functions of aggression. In contrast to competitive functions, we expected both bullying victimization and adversarial victimization to be associated with reactive functions, given the common experience of provocation and the need for self-protection (Babcock et al., 2014), and previous research demonstrating this relation for bullying victimization (Fung et al., 2017; Runions et al., 2017; 2018).

In summary, the present study sought to address the limitations of previous research by examining a wider range of proximate evolutionarily relevant aggressive functions in relation to bullying and adversarial aggression and victimization in cyber and traditional forms. In view of the foregoing theory and research, bullying and adversarial aggression and victimization were expected to be differentially related to aggressive functions as follows: (1) all forms of bullying would be positively associated with competitive, impression management and sadistic functions; (2) direct bullying would be positively associated with impression management functions only for boys; (3) all forms of bullying victimization would be positively associated with reactive functions; (4) adversarial cyber aggression and victimization would be positively associated with competitive functions; and (5) all forms of adversarial aggression and victimization would be positively associated with reactive functions.

Method

Participants

A sample of 379 adolescents (198 boys, 181 girls) ages 11 to 14 ($M = 12.86$, $SD = .84$) were recruited from six schools in Southern Ontario, Canada. Within the sample, self-reported ethnicities were as follows: White (59.1%), Asian (9.2%), Latin/Central/South American (9.2%), Black (2.9%); Indigenous (0.5%), and Mixed (13.7%). Finally, most participants reported their socio-economic status as belonging to the middle-class (60.2% middle-class; 17.4% lower-class; 22.4% upper-class).

Measures

The participants first completed a demographics questionnaire to assess age, gender, and socio-economic status, followed by various questionnaires to assess bullying and adversarial aggression and victimization in three forms (cyber, relational, and direct), as well as a questionnaire to assess aggressive functions.

Bullying and Adversarial Aggression Perpetration and Victimization. This self-report measure assesses adolescents' perpetration and victimization of various forms (direct, relational, and cyber) of bullying and adversarial aggression along a 5-point Likert-type scale ranging from *never* (1) to *very often* (5) (Lapierre & Dane, 2020a). To assess bullying and adversarial aggression perpetration, adolescents rated how often they had perpetrated certain behaviours to bully ("In the past few months, how often have you done the following against someone who was less popular or strong than you?"), and to perpetrate adversarial aggression ("In the past few months, how often had you done the following against someone who was equally or more popular or strong than you?"). To answer each of these questions, the participants responded to several items that described aggressive behaviours within each form,

including direct (6 items; e.g., “Hit, kicked, or shoved someone” and “Made fun of someone in a hurtful way to their face”; Bullying: $\alpha = .85$; Adversarial aggression: $\alpha = .89$), relational (4 items; e.g., “Spread negative rumours or gossip about someone while talking to others”; Bullying: $\alpha = .84$; Adversarial aggression: $\alpha = .78$), and cyber (5 items; “I used the internet or a cell phone to post information, pictures, or videos about someone that would embarrass or hurt that person”; Bullying: $\alpha = .83$; Adversarial aggression: $\alpha = .78$).

Likewise, to assess bullying victimization and adversarial victimization, adolescents rated how often they had experienced bullying victimization (“In the past few months, how often have the following things been done to you by someone who was more popular or strong than you?”), and adversarial victimization (“In the past few months, how often have the following things been done to you by someone who was equally or less popular or strong than you?”). To answer each of these questions, the participants rated several items that described experiences of victimization within each form, including direct (6 items; e.g., “Used physical force against me” and “Others put me down or called by hurtful names in person”; Bullying victimization: $\alpha = .88$; Adversarial victimization: $\alpha = .86$), relational (4 items; e.g., “Others left me out or excluded me from a group activity”; Bullying victimization: $\alpha = .88$; Adversarial victimization: $\alpha = .86$), and cyber (5 items; “Others spread negative rumours or gossip about me, using the internet or a cell phone”; Bullying victimization: $\alpha = .85$; Adversarial victimization: $\alpha = .87$).

Evolutionary Aggressive Functions. This self-report questionnaire is based on conceptual and theoretical research (e.g., Hubbard et al., 2010) and previous measures of proactive and reactive aggressive functions (e.g., Little et al., 2003; Marsee et al., 2011; Raine et al., 2006), as well as evolutionary-based research identifying aggressive functions that have received less attention in past research, including facilitating intersexual selection and intrasexual

competition, imposing costs on rivals, and deterring aggression from rivals (Buss & Shackelford, 1997; Pinker, 2011; Volk et al., 2012). After completing the questionnaire assessing form of aggression, participants were asked “How often have you done the things below for the following reasons?”; they were then given examples of direct, relational, and cyber aggressive behaviour and were asked to rate how often they had engaged in aggression for various aggressive functions (21 items), on a 5-point Likert-type scale ranging from *never* (1) to *very often* (5). Three of the 21 items had endorsement frequencies below 10% (i.e., “To get others to do what I want”, “To make someone look bad”, and “Because it felt exciting”), and were therefore excluded from further analyses, consistent with the procedure used by Raine and colleagues (2006). Then, to establish whether the remaining 18 items separated into distinct subscales, a Principle Component Analysis (PCA) with Varimax rotation was conducted. Two of the 18 items loaded highly on more than one factor (i.e., “To get back at someone for something they did to me a while ago” and “To get someone to back off from something we both wanted”) and were excluded to better differentiate the subscales. The PCA conducted on the remaining 16 items suggested that the four-factor solution had the best fit and accounted for 66.65% of the total variance; the competitive functions subscale accounted for the most variance (41.4%), followed by impression management (11.8%), reactive (7.2%), and sadistic (6.3%) function subscales.

The *competitive functions* subscale (6 items; $\alpha = .88$) encompasses proactive aggression directed toward a rival or adversary which aims to instill fear in targets and bystanders for aversive and appetitive motives, including deterring aggression from rivals (e.g., “To show others not to mess with me”), imposing costs on rivals (e.g., “To compete with or weaken a rival”), competing for dominance (e.g., “To be in charge”), and engaging in competition (e.g.,

“To win a competition”). In contrast, *impression management functions* (5 items; $\alpha = .83$) entail using proactive aggression for appetitive motives, primarily to gain the attention, admiration and affection of bystanders to attain social status (e.g., “To get attention and feel respected”), facilitate intersexual selection (e.g., “To show off and impress someone I’d like to date”), and to acquire resources in general (e.g., “To get the things I want”). The *sadistic functions* subscale (2 items; $\alpha = .62$) encompasses proactive aggression enacted for appetitive motives, with no proximate goals other than enjoyment (e.g., “Just for fun”, and “Joking or messing around with friends”). Finally, the *reactive functions* subscale (3 items; $\alpha = .87$) pertains to impulsive and unreflective aggression, driven by provocation and negative affect such as anger or frustration, with no explicit goal except to retaliate against the victim (e.g., “Others did something wrong to me and I reacted without thinking”).

Procedure

After obtaining approval for data collection from the ethics boards of the university and school board, students in grades 7-9 were recruited to participate. Students in grades 7 and 8 were required to obtain parental consent and provide personal assent before participation. Assenting students in grade 9 were able to participate with passive parental consent, however parents/guardians still had the option to exclude their adolescent from the study. Regardless of their response, all students who had returned completed consent forms were entered into a draw for the chance to win one of several gift cards valued at \$100. In total, 90% of the recruited students consented/assented to participate and they completed the questionnaires electronically on tablets.

Results

Descriptive and Correlational Analyses

The means, standard deviations, and ranges of all study variables are presented in Table 3.1. Within the sample, the following variables were significantly skewed: cyberbullying, adversarial aggression for cyber and direct forms, cyberbullying victimization, and adversarial cyber victimization, as well as competitive and impression management functions. These variables were therefore winsorized to their respective upper third standard deviations. The correlations between all study variables are presented for the whole sample in Table 3.2 and separately for boys and girls in Tables 3.3 and 3.4, respectively. Regarding the whole sample correlations, all three forms (cyber, relational, and direct) of bullying, adversarial aggression, bullying victimization, and adversarial victimization were positively correlated with each other, and with all four aggressive functions.

Table 3.1

Descriptive Statistics for all Study Variables

| Variable | Whole Sample Range | Whole Sample M(SD) | Boys M(SD) | Girls M(SD) |
|----------|-----------------------|-----------------------|---------------|----------------|
| Age | 11-14 | 12.86(.84) | 12.93(.87) | 12.79(.80) |
| SES | 1-5 | 3.04(.73) | 3.14(.75) | 2.92(.69) |
| CB | 1-2.34 | 1.13(.26) | 1.12(.27) | 1.13(.25) |
| ACA | 1-2.03 | 1.10(.24) | 1.09(.23) | 1.11(.24) |
| CBV | 1-2.53 | 1.16(.36) | 1.15(.35) | 1.17(.38) |
| ACV | 1-2.31 | 1.12(.29) | 1.12(.30) | 1.12(.28) |
| RB | 1-5 | 1.44(.66) | 1.40(.63) | 1.48(.69) |
| ARA | 1-4 | 1.28(.50) | 1.23(.44) | 1.33(.56) |
| RBV | 1-5 | 1.52(.83) | 1.48(.81) | 1.57(.84) |
| ARA | 1-5 | 1.36(.66) | 1.28(.58) | 1.45(.73) |
| DB | 1-3.83 | 1.30(.49) | 1.39(.55) | 1.20(.40) |
| ADA | 1-2.68 | 1.21(.39) | 1.27(.45) | 1.14(.30) |
| DBV | 1-5 | 1.44(.68) | 1.48(.73) | 1.39(.62) |
| ADV | 1-4.17 | 1.27(.51) | 1.29(.48) | 1.25(.47) |
| CF | 1-2.79 | 1.22(.20) | 1.29(.48) | 1.14(.32) |
| IMF | 1-2.53 | 1.18(.38) | 1.22(.43) | 1.14(.31) |
| SF | 1-5 | 1.76(.95) | 1.90(1.04) | 1.61(.82) |
| RF | 1-5 | 1.67(.86) | 1.75(.88) | 1.57(.84) |

Note. SES = Family socio-economic status, CB = cyberbullying, ACA = adversarial cyber aggression, CBV = cyberbullying victimization, ACV = adversarial cyber victimization, RB = relational bullying, ARA = adversarial relational aggression, RBV = relational bullying victimization, ARV = adversarial relational victimization, DB = direct bullying, ADA = adversarial direct aggression, DBV = direct bullying victimization, ADV = adversarial direct victimization, CF = Competitive functions, IMF = Impression management functions, SF = Sadistic functions, RF = Reactive functions.

Table 3.2

Correlations Between all Study Variables for the Whole Sample

| Variable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|----------|-------------------|-------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| 1. Age | --- | | | | | | | | | | | | | | | | | |
| 2. Gen. | -.09 | --- | | | | | | | | | | | | | | | | |
| 3. SES | .02 | -.15 ^b | --- | | | | | | | | | | | | | | | |
| 4. CB | .12 ^c | .02 | .11 ^c | --- | | | | | | | | | | | | | | |
| 5. ACA | .15 ^b | .05 | .04 | .75 ^a | --- | | | | | | | | | | | | | |
| 6. CBV | .02 | .02 | -.02 | .37 ^a | .43 ^a | --- | | | | | | | | | | | | |
| 7. ACV | -.05 | .01 | .01 | .45 ^a | .42 ^a | .69 ^a | --- | | | | | | | | | | | |
| 8. RB | -.11 ^c | .06 | .07 | .60 ^a | .50 ^a | .33 ^a | .37 ^a | --- | | | | | | | | | | |
| 9. ARA | -.03 | .10 | -.07 | .47 ^a | .52 ^a | .32 ^a | .29 ^a | .70 ^a | --- | | | | | | | | | |
| 10. RBV | -.18 ^a | .06 | -.09 | .27 ^a | .30 ^a | .57 ^a | .49 ^a | .35 ^a | .31 ^a | --- | | | | | | | | |
| 11. ARV | -.14 ^b | .13 ^c | -.08 | .23 ^a | .26 ^a | .46 ^a | .56 ^a | .31 ^a | .28 ^a | .64 ^a | --- | | | | | | | |
| 12. DB | -.11 ^c | -.19 ^a | .09 | .50 ^a | .42 ^a | .27 ^a | .33 ^a | .58 ^a | .47 ^a | .27 ^a | .23 ^a | --- | | | | | | |
| 13. ADA | -.04 | -.16 ^a | .02 | .45 ^a | .53 ^a | .26 ^a | .26 ^a | .50 ^a | .57 ^a | .26 ^a | .23 ^a | .79 ^a | --- | | | | | |
| 14. DBV | -.20 ^a | -.07 | -.04 | .25 ^a | .25 ^a | .36 ^a | .35 ^a | .28 ^a | .29 ^a | .64 ^a | .40 ^a | .47 ^a | .46 ^a | --- | | | | |
| 15. ADV | -.19 ^a | -.05 | -.01 | .28 ^a | .24 ^a | .35 ^a | .54 ^a | .28 ^a | .28 ^a | .46 ^a | .53 ^a | .48 ^a | .45 ^a | .65 ^a | --- | | | |
| 16. CF | -.05 | -.17 ^a | .15 ^b | .39 ^a | .33 ^a | .29 ^a | .35 ^a | .49 ^a | .34 ^a | .25 ^a | .26 ^a | .55 ^a | .49 ^a | .34 ^a | .39 ^a | --- | | |
| 17. IMF | -.06 | -.11 ^c | .09 | .41 ^a | .40 ^a | .22 ^a | .35 ^a | .53 ^a | .33 ^a | .33 ^a | .27 ^a | .52 ^a | .45 ^a | .28 ^a | .37 ^a | .68 ^a | --- | |
| 18. SF | .09 | -.15 ^b | .07 | .35 ^a | .29 ^a | .18 ^a | .20 ^a | .28 ^a | .24 ^a | .15 ^b | .13 ^c | .42 ^a | .40 ^a | .28 ^a | .27 ^a | .54 ^a | .50 ^a | --- |
| 19. RF | -.05 | -.11 ^c | -.09 | .30 ^a | .40 ^a | .30 ^a | .33 ^a | .38 ^a | .42 ^a | .36 ^a | .33 ^a | .48 ^a | .51 ^a | .38 ^a | .39 ^a | .43 ^a | .42 ^a | .37 ^a |

Note. SES = Family socio-economic status, Gen. = gender (boys = 0, girls = 1), CB = cyberbullying, ACA = adversarial cyber aggression, CBV = cyberbullying victimization, ACV = adversarial cyber victimization, RB = relational bullying, ARA = adversarial relational aggression, RBV = relational bullying victimization, ARV = adversarial relational victimization, DB = direct bullying, ADA = adversarial direct aggression, DBV = direct bullying victimization, ADV = adversarial direct victimization, CF = Competitive functions, IMF = Impression management functions, SF = Sadistic functions, RF = Reactive functions.

^a $p < .001$. ^b $p < .01$. ^c $p < .05$.

Table 3.3

Correlations Between all Study Variables for boys

| Variable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
|----------|-------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| 1. Age | --- | | | | | | | | | | | | | | | | |
| 2. SES | .01 | --- | | | | | | | | | | | | | | | |
| 3. CB | .03 | .25 ^a | --- | | | | | | | | | | | | | | |
| 4. ACA | .05 | .14 ^c | .68 ^a | --- | | | | | | | | | | | | | |
| 5. CBV | -.03 | .04 | .39 ^a | .43 ^a | --- | | | | | | | | | | | | |
| 6. ACV | -.15 ^c | .04 | .47 ^a | .44 ^a | .68 ^a | --- | | | | | | | | | | | |
| 7. RB | -.18 ^c | .13 | .59 ^a | .53 ^a | .41 ^a | .48 ^a | --- | | | | | | | | | | |
| 8. ARA | -.11 | .01 | .30 ^a | .44 ^a | .38 ^a | .33 ^a | .62 ^a | --- | | | | | | | | | |
| 9. RBV | -.31 ^a | -.02 | .22 ^b | .28 ^a | .52 ^a | .48 ^a | .43 ^a | .32 ^a | --- | | | | | | | | |
| 10. ARV | -.24 ^b | -.12 | .21 ^b | .26 ^a | .55 ^a | .67 ^a | .39 ^a | .30 ^a | .61 ^a | --- | | | | | | | |
| 11. DB | -.19 ^b | .13 | .56 ^a | .46 ^a | .36 ^a | .43 ^a | .61 ^a | .55 ^a | .37 ^a | .38 ^a | --- | | | | | | |
| 12. ADA | -.12 | .04 | .41 ^a | .54 ^a | .32 ^a | .30 ^a | .48 ^a | .60 ^a | .31 ^a | .31 ^a | .79 ^a | --- | | | | | |
| 13. DBV | -.27 ^a | -.00 | .27 ^a | .25 ^a | .36 ^a | .40 ^a | .31 ^a | .28 ^a | .69 ^a | .45 ^a | .51 ^a | .47 ^a | --- | | | | |
| 14. ADV | -.23 ^b | .02 | .36 ^a | .32 ^a | .42 ^a | .69 ^a | .33 ^a | .24 ^b | .44 ^a | .63 ^a | .57 ^a | .48 ^a | .59 ^a | --- | | | |
| 15. CF | -.01 | .19 ^b | .43 ^a | .45 ^a | .39 ^a | .45 ^a | .50 ^a | .37 ^a | .29 ^a | .32 ^a | .51 ^a | .43 ^a | .32 ^a | .40 ^a | --- | | |
| 16. IMF | -.09 | .12 | .46 ^a | .49 ^a | .25 ^b | .42 ^a | .59 ^a | .36 ^a | .33 ^a | .32 ^a | .52 ^a | .42 ^a | .27 ^a | .42 ^a | .71 ^a | --- | |
| 17. SF | .11 | .13 | .38 ^a | .31 ^a | .20 ^b | .21 ^b | .26 ^a | .18 ^c | .13 | .16 ^c | .36 ^a | .34 ^a | .23 ^b | .24 ^b | .54 ^a | .49 ^a | --- |
| 18. RF | -.16 ^c | -.03 | .18 ^c | .33 ^a | .27 ^a | .33 ^a | .33 ^a | .39 ^a | .33 ^a | .33 ^a | .48 ^a | .52 ^a | .38 ^a | .41 ^a | .46 ^a | .37 ^a | .36 ^a |

Note. SES = Family socio-economic status, CB = cyberbullying, ACA = adversarial cyber aggression, CBV = cyberbullying victimization, ACV = adversarial cyber victimization, RB = relational bullying, ARA = adversarial relational aggression, RBV = relational bullying victimization, ARV = adversarial relational victimization, DB = direct bullying, ADA = adversarial direct aggression, DBV = direct bullying victimization, ADV = adversarial direct victimization, CF= Competitive functions, IMF = Impression management functions, SF = Sadistic functions, RF = Reactive functions.

^a $p < .001$. ^b $p < .01$. ^c $p < .05$.

Table 3.4

Correlations Between all Study Variables for girls

| Variable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
|----------|-------------------|-------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| 1. Age | --- | | | | | | | | | | | | | | | | |
| 2. SES | .00 | --- | | | | | | | | | | | | | | | |
| 3. CB | .23 ^b | -.05 | --- | | | | | | | | | | | | | | |
| 4. ACA | .29 ^a | -.07 | .83 ^a | --- | | | | | | | | | | | | | |
| 5. CBV | .08 | -.08 | .34 ^a | .42 ^a | --- | | | | | | | | | | | | |
| 6. ACV | .07 | -.04 | .43 ^a | .40 ^a | .69 ^a | --- | | | | | | | | | | | |
| 7. RB | -.03 | .01 | .62 ^a | .48 ^a | .24 ^b | .25 ^b | --- | | | | | | | | | | |
| 8. ARA | .06 | -.12 | .63 ^a | .58 ^a | .26 ^a | .26 ^a | .76 ^a | --- | | | | | | | | | |
| 9. RBV | -.03 | -.14 | .32 ^a | .32 ^a | .62 ^a | .50 ^a | .27 ^a | .30 ^a | --- | | | | | | | | |
| 10. ARV | -.03 | -.01 | .24 ^b | .25 ^b | .40 ^a | .49 ^a | .23 ^b | .26 ^a | .67 ^a | --- | | | | | | | |
| 11. DB | -.05 | -.05 | .46 ^a | .42 ^a | .19 ^c | .19 ^b | .63 ^a | .48 ^a | .19 ^c | .12 | --- | | | | | | |
| 12. ADA | .06 | -.07 | .56 ^a | .58 ^a | .21 ^b | .20 ^b | .61 ^a | .65 ^a | .24 ^b | .21 ^b | .77 ^a | --- | | | | | |
| 13. DBV | -.12 | -.12 | .24 ^b | .25 ^b | .37 ^a | .29 ^a | .25 ^b | .32 ^a | .60 ^a | .40 ^a | .40 ^a | .43 ^a | --- | | | | |
| 14. ADV | -.14 | -.07 | .17 ^c | .15 ^c | .27 ^a | .34 ^a | .23 ^b | .34 ^a | .50 ^a | .48 ^a | .34 ^a | .39 ^a | .72 ^a | --- | | | |
| 15. CF | -.18 ^c | -.00 | .36 ^a | .21 ^b | .18 ^c | .21 ^b | .56 ^a | .34 ^a | .25 ^b | .30 ^a | .58 ^a | .57 ^a | .38 ^a | .37 ^a | --- | | |
| 16. IMF | -.03 | .01 | .36 ^a | .31 ^a | .21 ^b | .24 ^b | .51 ^a | .39 ^a | .33 ^a | .28 ^a | .51 ^a | .48 ^a | .29 ^a | .27 ^a | .59 ^a | --- | |
| 17. SF | .03 | -.08 | .33 ^a | .28 ^a | .18 ^c | .19 ^c | .36 ^a | .36 ^a | .22 ^b | .15 ^c | .47 ^a | .49 ^a | .36 ^a | .31 ^a | .49 ^a | .49 ^a | --- |
| 18. RF | .06 | -.21 ^b | .45 ^a | .51 ^a | .33 ^a | .33 ^a | .45 ^a | .48 ^a | .41 ^a | .38 ^a | .48 ^a | .49 ^a | .37 ^a | .37 ^a | .36 ^a | .48 ^a | .36 ^a |

Note. SES = Family socio-economic status, CB = cyberbullying, ACA = adversarial cyber aggression, CBV = cyberbullying victimization, ACV = adversarial cyber victimization, RB = relational bullying, ARA = adversarial relational aggression, RBV = relational bullying victimization, ARV = adversarial relational victimization, DB = direct bullying, ADA = adversarial direct aggression, DBV = direct bullying victimization, ADV = adversarial direct victimization, CF= Competitive functions, IMF = Impression management functions, SF = Sadistic functions, RF = Reactive functions.

^a $p < .001$. ^b $p < .01$. ^c $p < .05$.

Multigroup Path Models

Model specification. Multigroup path analyses were conducted in *Mplus* 8 (Muthén & Muthén, 2017). Each model was specified to assess direct paths from each predictor to each of the outcome variables, with age and SES included as covariates, and gender as the grouping variable. For each model, the fit of the fully unconstrained model, wherein the associations of interest could vary across gender, was compared to that of a fully constrained model, wherein the associations of interest were constrained to invariance across gender. If the fully constrained model did not indicate worse model fit than the fully unconstrained model, as evidenced by a non-significant chi-square difference test, this suggests that there were no significant gender differences in the associations of interest and therefore the fully constrained model would be examined further. If the fully constrained model indicates worse fit than the fully unconstrained model, as indicated by a significant chi-square difference test, a series of nested model comparisons were conducted by separately constraining each path of interest by gender and comparing it to a less constrained model to identify which paths significantly vary by gender.

Global model fit indices. Global model fit was assessed with the comparative fit index (CFI), the root-mean-square-error of approximation (RMSEA), and the standardized root-mean-square residual (SRMR). Good model fit was indicated by a CFI value greater than or equal to .95, and by RMSEA and SRMR values less than or equal to .05 (Hu & Bentler, 1999).

Model 1 – Cyber model. The fully unconstrained model was compared to a fully constrained model ($\Delta \chi^2 [\Delta df = 16] = 45.52, p = .00$) and the significant chi-square difference test suggested that there were gender differences within the paths of interest. Therefore, a series of nested models were conducted to obtain the final, partially constrained model, which indicated good fit (CFI = 1.00, RMSEA = .00 [.00 - .05], SRMR = .01). Gender differences were observed

in the regression paths from cyberbullying to competitive functions, from adversarial cyber aggression to competitive, impression management, and reactive functions, from cyberbullying victimization to impression management functions, and from adversarial cyber victimization to competitive and impression management functions. As shown in Table 3.5, Panel A, the results of the partially constrained model suggested that cyberbullying was positively related to competitive, impression management, and sadistic functions, but the effect was strongest for sadistic functions. Adversarial cyber aggression was positively related to reactive functions for both genders but was only significantly positively related to competitive and impression management functions for boys. Cyberbullying victimization was negatively associated with impression management functions for boys. Finally, adversarial cyber victimization was positively associated with reactive functions for both genders but was only positively related to competitive and impression management functions for boys.

Model 2 – Relational model. The fully unconstrained model was compared to a fully constrained model ($\Delta \chi^2 [\Delta df = 16] = 23.01, p = .11$) and the non-significant chi-square difference test indicated that there were no significant gender differences in the paths of interest. The fully constrained model indicated good fit (CFI = .990, RMSEA = .05 [.00 - .09], SRMR = .04). As shown in Table 3.5, Panel B, relational bullying was positively associated with all four aggressive functions. In contrast, adversarial relational aggression was only positively associated with reactive functions. Relational bullying victimization was positively associated with impression management and reactive functions, whereas adversarial relational victimization was positively related to competitive and reactive functions.

Table 3.5

Multigroup Path Model Coefficients

| | Competitive Functions <i>b</i> (<i>SE</i>) | Impression Management Functions <i>b</i> (<i>SE</i>) | Sadistic Functions <i>b</i> (<i>SE</i>) | Reactive Functions <i>b</i> (<i>SE</i>) |
|-----------------------------|--------------------------------------------------------|-----------------------------------------------------------------|-------------------------------------------------|---------------------------------------------------------|
| Panel A: Cyber model | | | | |
| Cyberbullying | G: .70 ^a (.14) B: .30 ^c (.14) | .31 ^b (.10) | 1.13 ^a (.28) | -.12 (.24) |
| Adversarial cyber agg. | G: -.29 (.15) B: .32 ^c (.16) | G: .13 (.13) B: .50 ^a (.14) | .08 (.30) | G: 1.65 ^a (.31) B: .99 ^a (.31) |
| Cyberbullying vic. | .09 (.07) | G: .03 (.08) B: -.23 ^b (.08) | .06 (.17) | .11 (.15) |
| Adversarial cyber vic. | G: -.01 (.10) B: .35 ^b (.11) | G: .09 (.10) B: .44 ^a (.11) | .09 (.22) | .44 ^c (.19) |
| R ² | G: .11 ^a B: .22 ^a | G: .12 ^a B: .26 ^a | G: .12 ^a B: .19 ^a | G: .19 ^a B: .10 ^a |
| Panel B: Relational model | | | | |
| Relational bullying | .27 ^a (.04) | .29 ^a (.03) | .30 ^b (.10) | .20 ^c (.08) |
| Adversarial relational agg. | -.03 (.05) | -.07 (.12) | .14 (.12) | .38 ^a (.10) |
| Relational bullying vic. | .01 (.03) | .05 ^c (.03) | .08 (.07) | .13 ^c (.06) |
| Adversarial relational vic. | .09 ^b (.03) | .05 (.03) | .05 (.09) | .19 ^b (.07) |
| R ² | G: .42 ^a B: .21 ^a | G: .37 ^a B: .25 ^a | G: .16 ^a B: .10 ^a | G: .34 ^a B: .21 ^a |
| Panel C: Direct model | | | | |
| Direct bullying | .28 ^a (.06) | .28 ^a (.06) | .42 ^b (.15) | .28 ^c (.13) |
| Adversarial direct agg. | .19 ^b (.07) | .12 (.07) | .47 ^c (.19) | .65 ^a (.15) |
| Direct bullying vic. | .02 (.03) | -.02 (.03) | .14 (.09) | .09 (.07) |
| Adversarial direct vic. | .10 ^c (.04) | .10 ^c (.04) | .11 (.11) | .24 ^c (.10) |
| R ² | G: .40 ^a B: .33 ^a | G: .27 ^a B: .29 ^a | G: .22 ^a B: .24 ^a | G: .28 ^a B: .36 ^a |

Note. Agg. = Aggression, Vic. = Victimization. G = Girls. B = Boys. R² values differ for girls and boys because other parameters (e.g., means, covariances) excepting the paths of interest were unconstrained by gender. ^ap < .001. ^bp < .01. ^cp < .05.

Model 3 – Direct model. The fully unconstrained model was compared to a fully constrained model ($\Delta\chi^2 [\Delta df = 16] = 13.69, p = .06$). The non-significant chi-square difference test indicated that there were no significant gender differences in the paths of interest. The fully constrained model was examined and indicated good model fit (CFI = 1, RMSEA = .00 [.00 - .06], SRMR = .03). As shown in Table 3.5, Panel C, direct bullying was positively associated with all four aggressive functions, whereas adversarial direct aggression was only positively associated with competitive, sadistic, and reactive functions. Direct bullying victimization was not statistically related to any of the four aggressive functions, however adversarial direct victimization was positively associated with competitive, impression management, and reactive functions.

Discussion

The goals of this study were to extend previous research by examining the differential relations of bullying and adversarial aggression perpetration and victimization in cyber and traditional forms with a range of proximate evolutionarily relevant aggressive functions. As expected, relations with evolutionary functions of aggression varied with respect to the balance of power and form of aggression. Consistent with the goal-directed nature of bullying (Volk et al., 2014) as well as previous empirical (Fluck, 2017; Runions et al., 2017; 2018) and qualitative (Pronk & Zimmer-Gambeck, 2010; Varjas et al., 2010) research, all forms of bullying were consistently associated with proactive aggressive functions that address unreflective proximate goals, such as enjoyment (i.e., sadistic functions), or goal-directed proximate goals that can contribute to the achievement of ultimate goals, including dominance, aggression deterrence, facilitation of intrasexual competition (i.e., competitive functions), social status and facilitation of intrasexual selection (i.e., impression management functions), as predicted. In comparison to

adversarial aggression, bullying may be preferred for appetitive functions because having a power advantage makes it easier to gain dominance and status, attract mates, procure resources in general or experience recreational excitement with minimal risk of harm from loss of peer affection (Veenstra et al., 2010) or retaliation (Volk et al., 2012). Interestingly, in the path analyses, traditional forms of bullying were associated with both proactive and reactive functions, whereas cyberbullying was only linked to proactive functions when observed alongside the predictive effects of adversarial aggression and measures of victimization. Although not predicted, this cyber-specific finding is consistent with research by Runions and colleagues (2017), wherein cyberbullying was not significantly correlated with reactive functions when controlling for proactive functions. However, empirical person-oriented research found that adolescents involved in cyber aggression and victimization (without reference to power balance) engaged in both proactive and reactive functions (e.g., Lapierre & Dane, 2020b). Given these conflicting findings, it is important to consider power balance when examining the motives for different forms of aggression.

Contrary to the second prediction, direct bullying was associated with impression management functions for both boys and girls. In fact, all forms of bullying were significantly associated with impression management functions for both genders, despite the greater signalling potential of direct forms and presumed gender differences in risk aversion. Although this result is generally inconsistent with evolutionary theory and research suggesting that girls are averse to the risks of direct aggression (e.g., Campbell 2013; Vaillancourt, 2013), it is in line with previous research illuminating complex links between adolescent girls' overt aggression and social rewards (e.g., Dane et al., 2017; Gallup et al., 2011; Houser et al., 2015). More specifically, although previous research by Dane and colleagues (2017) found that the links between physical

bullying and dating and sexual behaviour were only significant for adolescent boys, physical bully-victims of both genders reported more dating and sexual partners than uninvolved peers. Moreover, other research has shown that direct aggression was linked to girl's dating behaviour (Gallup et al., 2011), and dating popularity only for popular girls (Houser et al., 2015). Therefore, moderators like victimization or peer valued characteristics should be studied further to unpack these complexities.

In partial agreement with the third prediction and previous research (Card & Little, 2006; Runions et al., 2018), bullying victimization was associated with reactive functions for relational, but not for direct or cyber forms. The non-significant relations with cyber and direct forms were unexpected given previous research demonstrating these associations (Fung et al., 2017; Runions et al., 2017). In fact, neither cyber nor direct forms of bullying victimization have significant positive associations with any of the aggressive functions examined in this study. These findings suggest that victims of bullying in cyber and direct forms may be passive victims, whose lack of power makes them vulnerable to bullying as well as ineffectual, and therefore infrequent, aggressors (Lovegrove & Cornell, 2014; Menesini et al., 2009; Olweus, 1994), as passive victims tend to be socially withdrawn and submissive (Schwartz, 2000). In contrast, relational bullying victimization was also positively, albeit weakly, linked to impression management functions suggesting that victims of relational bullying are less likely to be passive victims.

The fourth prediction that adversarial cyber aggression and victimization would be associated with competitive functions was supported for boys, but not for girls. This result is inconsistent with previous research linking involvement in both adversarial cyber aggression and victimization to greater numbers of dating and sexual partners for both genders, which suggested that both boys and girls experienced adversarial cyber aggression and victimization in the

context of intrasexual competition for mates (Lapierre & Dane, 2020a). However, in comparison to this previous research, the current study examined adversarial cyber aggression and victimization in relation to a broader range of competitive functions, including competing for dominance, deterring aggression through intimidation, as well as imposing costs on rivals, rather than focusing exclusively on mating-related behaviour, which may partly account for the absence of gender differences. Interestingly, competitive functions were more strongly related to cyberbullying for girls than for boys, suggesting that girls may manage risk by competing with cyber aggression only when they have a power advantage. In general, these results are consistent with evolutionary theory and research suggesting that, in comparison to girls, boys are generally less risk averse and more aggressive and competitive overall (Volk et al., 2012, Barlett & Coyne, 2014). Finally, although not predicted, competitive functions were also associated with adversarial direct aggression and victimization, as well as adversarial relational victimization. Therefore, as was generally expected, it appears that adversarial aggression and victimization tend to occur in the context of competition, albeit with some differences across form and gender.

Concordant with the fifth prediction, adversarial aggression and victimization were associated with reactive functions in all forms. Because reactive aggression occurs as a result of real or perceived provocation (Hubbard et al., 2010), adolescents involved in adversarial aggression or victimization may reactively aggress to defend themselves when threatened by rivals (Meloy, 2005). Moreover, because overt displays of power are not necessary to achieve this objective, this aggressive function can be achieved through both direct and indirect forms. Interestingly, adversarial cyber aggression was more strongly associated with reactive functions for girls, whereas, as noted above, competitive functions were more strongly related to adversarial cyber aggression for boys, and to cyberbullying for girls. Given that girls are more

risk averse than boys, on average (Campbell 2013; Vaillancourt, 2013), these results suggest that girls might manage risk by engaging in risky adversarial cyber aggression only when necessary, as a defence against provocation, but strategically deploy cyberbullying toward competitive goals when risk is mitigated by a power advantage. Notably, adversarial victimization was unexpectedly associated more consistently with reactive functions than was bullying victimization, such that reactive functions were associated with all forms of adversarial victimization but related only to relational bullying victimization. Although reactive aggression is impulsive and driven by emotion, adolescents may manage risk by considering the power of their provocateur, as they appear more likely to aggress reactively when provoked by rivals of equal or less power, as opposed to more powerful bullies.

Finally, another unexpected finding that merits discussion was the use of risky aggression to achieve appetitive functions. Specifically, adversarial direct aggression was linked with sadistic functions and adversarial cyber aggression was linked with impression management functions. Because appetitive functions are generally not pursued in response to provocation or threats (e.g., Runions et al., 2017; 2018), evolutionary theory would predict that less risky aggression would be used to achieve appetitive functions to ensure a favorable cost-benefit ratio for the perpetrator (Buss & Shackelford, 1997; Volk et al., 2012). However, evolutionary theory would also predict that risky aggression may be worthwhile if the high risk is offset by the prospect of high rewards (Buss & Shackelford, 1997; Volk et al., 2012). Although sadistic functions do not reference any tangible goals or benefits, the proximate motive of fun and excitement likely motivates and reinforces aggression despite the risks, especially because the initiation of sadistic aggression tends to occur impulsively, without full consideration of the consequences (Runions et al., 2018). For example, the link between direct adversarial aggression

and enjoyment aligns with reports that some veterans considered the physical violence of warfare to be exciting and enjoyable despite the risks (MacMillan, 2020, pp. 171-172). Moreover, aggression consciously driven by sadistic enjoyment has been shown to serve other functions that may not be reflected upon consciously, including dominance, revenge, as well as schadenfreude-mediated (i.e., pleasure from other's misfortune) intrasexual competition (Chester & Dewall, 2018; Pinker, 2011, p. 550-551). Indeed, enjoyment of schadenfreude-driven sadism may be stronger when a person of higher status suffers (Takahashi et al., 2009). Such motivations for sadism imply a desire to harm a rival or enemy, as opposed to a vulnerable target, suggesting that adversarial aggression against a high-powered rival may be particularly enjoyable. Regarding the association between adversarial cyber aggression and impression management functions, it is possible that because impression management functions refer to the attainment of highly valued rewards such as status and mates, the prospect of achieving these rewards may make risky aggression worthwhile, especially when the protection afforded by cyberspace can reduce risks.

Limitations and Future Research

One limitation to this research is the cross-sectional design; although this design precludes determination of causal direction, it is sufficient for the purposes of examining how bullying and adversarial aggression in cyber and traditional forms are differentially associated with evolutionarily relevant aggressive functions. Longitudinal research on this topic would help to determine whether competitive motives of aggression increase as youth enter adolescence, consistent with adolescents' increasing involvement in bullying (see Volk et al., 2012) and emerging interest in, and competition over, status and dating (Ellis et al., 2012). Secondly, although this study differentiated between bullying and adversarial aggression by explicitly

referring to power differences within the aggressor-victim dyad, consistent with previous behavioural approaches to measuring bullying and aggression with various power balances (Book et al., 2012; Felix et al., 2011; Thomas et al., 2015; Volk & Lagzdins, 2009; Ybarra et al., 2014), and with distinctions between bullying and non-bullying aggression made in definitional approaches to studying bullying (e.g., Solberg & Olweus, 2003), a methodological limitation lies in the inability to consider all sources of power that can contribute to power balance. Due to practical limitations in the length of behaviour-based questions, we could not reference all possible sources of power, and therefore physical strength and popularity were selected as exemplary sources of power because they have been consistently associated with bullying involvement (see Volk et al., 2014) and often referenced in measures of bullying (Book et al., 2012; Dane et al., 2017; Volk & Lagzdins, 2009; Volk et al., 2015). However, to assess power balance more broadly, future research may benefit from also asking respondents to consider other sources of power within the aggressor-victim dyad, including social-cognitive power (Volk et al., 2014), or strength in numbers (Thomas et al., 2015).

In addition, the use of self-report questionnaires may be limiting due to the potential for socially desirable responding. However, self-report data is most appropriate for judging intentions, as well as power balances within perpetrator-victim dyads (Furlong et al., 2010; Volk et al., 2014), and adolescents' judgments about their own position within their social hierarchy align with various sociometric evaluations, including prominence, respect, and influence (Fournier, 2009). They have also been cited as the best source for determining the adolescent's personal motives for aggressing (Polman et al., 2007; Volk et al., 2014). Finally, because the measure of aggressive functions is completed without reference to specific forms of aggression, we cannot directly determine adolescents' perceptions of the functions of each form of

aggression they use. However, by decoupling aggressive form from function, we could assess a broader range of evolutionarily relevant functions to address one of the main goals of this research. To examine adolescents' perspectives of the utility of cyber and traditional forms of bullying and adversarial aggression more directly, future research may assess the wider range of evolutionarily relevant aggressive functions considered herein for each form of aggression.

Conclusions and Implications

This study provides further support for evolutionary psychological perspectives on aggression by showing that aggression and victimization with different forms (i.e., cyber and traditional) and balances of power (bullying and adversarial aggression against equally or more powerful targets) are associated with adolescent reports of using aggression to pursue a range of proximate evolutionarily relevant motives. Consistent with conceptualizations of bullying as a goal-directed behaviour, and evolutionary views of aggression (Volk et al., 2012), the results suggest that bullying is most consistently associated with proactive functions that focus on gains, or the protection and retention of gains in social dominance, social status, dating, and enjoyment, whereas adversarial aggression and victimization are most consistently associated with competitive and reactive functions, likely in the context of intrasexual competition with rivals. Notably, relations with functions differ by form, with results varying by gender for cyber aggression but not traditional forms. Specifically, cyberbullying is more strongly associated with competitive functions for adolescent girls. In contrast, adversarial cyber aggression against equally or more powerful peers is significantly related to competitive functions only for adolescent boys, and linked more strongly with reactive functions for adolescent girls, suggesting that girls may be more risk averse in their use of cyber aggression unless there is provocation prompting negative affect and an impulsive response, consistent with theories on adolescent

girls' aggression and differential parental investment (Campbell, 2013; Vaillancourt, 2013). In addition, the results suggest that traditional bullying is associated with both proactive and reactive motives, whereas cyberbullying is significantly related only to proactive functions in the path analyses. These results broaden and strengthen evidence supporting evolutionary perspectives on the (conditional) adaptiveness of aggression (Bjorklund & Hawley, 2014; Volk et al., 2012), by demonstrating that involvement in traditional and cyber forms of bullying and adversarial aggression is associated with evolutionarily relevant motives reported and perceived by the adolescents themselves.

By highlighting how aggression is linked with a range of proximate evolutionarily relevant motives reported by adolescents, this research may generate ideas for improving and modifying interventions aimed at reducing adolescents' aggression and bullying. More specifically, this knowledge can help to tailor interventions to address the specific triggers or motives driving aggression. For example, in the case of sadistic and reactive functions, which are characterized as impulsive and unreflective aggression primarily driven by affect, interventions could focus on enhancing adolescents' problem-solving skills, to help them exercise self-control, become more cognizant of their specific goals and the triggers that may precede or reinforce their aggression, as well as consider more prosocial and effective options for achieving their goals (Crick & Dodge, 1994; Larson & Lochman, 2010). Moreover, because sadistic functions are associated with moral disengagement, which involves diminishing or dismissing the harm inflicted on the victim, interventions could focus on developing adolescents' moral reasoning to address aggression motivated by sadism (Nocera et al., 2021). However, in the case of competitive and impression management functions, in which the goals of aggression are more explicitly identified, interventions may focus on replacing aggressive strategies with prosocial

strategies for goal attainment (Ellis et al., 2016), and reducing peer acceptance of aggression (Salmivalli et al., 2011). Thus, information about the various proximate motives and goals associated with adolescents' involvement in traditional and cyber aggression may provide a basis for incorporating intervention strategies to address evolutionarily relevant functions of aggression, which could improve interventions that have limited effectiveness, particularly with this age group (Ellis et al., 2016; Gaffney et al., 2019; Yeager et al., 2015).

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CHAPTER 4: STUDY 3

Early Adolescents' Involvement in Anonymous Relational and Cyber Aggression: An Evolutionary Perspective³

Consistent with the evolutionary perspective conceptualizing aggression as a means to achieve adaptive benefits in the domains of resource control, reputation, and reproductively relevant outcomes (e.g., attracting dating or sex partners; Volk et al., 2012), evolutionary research on indirect aggression – inflicting harm without direct confrontation through social exclusion, derogation, and reputational attacks (Card et al., 2008) – has shown that it is linked to proxies for adaptive outcomes in adolescence. Specifically, adolescents' perpetration of relational (in-person) and cyber (via electronic devices; Kowalski et al., 2014) forms of indirect aggression have been associated with greater perceived popularity (Badaly et al., 2013; Puckett et al., 2008; Watling Neal, 2010; Wegge et al., 2016; Wright, 2014), as well as earlier dating and sexual involvement (retrospective studies: Gallup et al., 2011; White et al., 2010) and more dating and sexual partners (Dane et al., 2017; Gallup et al., 2011; Lapierre & Dane, 2020a, 2020b; Lee et al., 2018). Additionally, adolescents' relational aggression has been associated with prominent social network positioning (Watling Neal, 2010), and their involvement in cyber aggression has been linked to social dominance (Lapierre & Dane, 2020b). Due in part to

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increasing social sanctions against antisocial behaviour and escalating concerns about reputation (Ingram, 2014), involvement in indirect aggression tends to become more prevalent in adolescence, likely because it has the potential to improve the cost-benefit ratio of aggression (e.g., Bjorklund & Hawley, 2014; Ingram, 2014; Lowry et al., 2016). More specifically, the circuitous nature of indirect aggression can enable aggressors to benefit from aggression by disrupting peer relations, inflicting reputational damage, or causing emotional distress while potentially remaining anonymous and avoiding costs, such as punishment (Archer & Coyne, 2005; Coyne et al., 2006), peer rejection (Crick & Grotpeter, 1995; Salmivalli et al., 2000), and low social preference (Cillessen & Mayeux, 2004; Vaillancourt & Hymel, 2006), as well as negative evaluations with respect to their trustworthiness and desirability as a mate (Fisher et al. 2010).

Because early adolescence marks a transition to a developmental period characterized by increases in covert aggression (Ingram, 2014), greater interest in status and dating goals (Ellis et al., 2012) and more intrasexual competition (Polo et al., 2018), this study aimed to examine whether early adolescents' perpetration of indirect aggression may be conditionally adaptive for some individuals in some circumstances. This may be especially true for females, who tend to prefer less risky, indirect aggression because they are more risk averse than males, on average (Archer, 2009; Benenson, 2016a, 2016b; Campbell, 2013; Card et al., 2008; Vaillancourt, 2013). This is due in part to their greater parental investment and lesser variability in their reproduction rate, which places greater importance on their survival to ensure the survival of their offspring and the propagation of their genes (Archer, 2009; Benenson, 2016a, 2016b). Although meta-analytic research suggests that adolescent girls use indirect aggression only slightly more frequently than boys (Card et al., 2008), some research finds that they are more likely than boys

to achieve adaptive benefits associated with indirect aggression, including increases in popularity (Badaly et al., 2013), as well as earlier and more dating/sexual involvement (Dane et al., 2017; Gallup, 2017). Additionally, girls are more often victims of indirect aggression (Carbone-Lopez et al., 2010; Dane et al., 2017; Felix et al., 2011), and have been found to report more perceived harm and negative outcomes associated with indirect victimization during adolescence (Campbell et al., 2012; Coyne et al., 2006), and into adulthood (Wyckoff et al., 2019). The greater susceptibility to harm from indirect aggression is in accordance with evolutionary perspectives contending that selection pressures throughout humans' evolutionary history have made females more reliant on close and supportive social relationships and less tolerant of conflict and violations of reciprocity in their social relationships (e.g., Campbell, 2013; Geary, 2003; Vaillancourt, 2013). Thus, anonymous indirect aggression may be a particularly adaptive means for girls to inflict harm on rivals while minimizing the costs of aggression by hiding behaviours likely to have negative personal consequences in their social groups.

Therefore, the present study examined early adolescents' use of anonymous relational and cyber aggression, which may further enhance the cost-benefit ratio of indirect aggression and seems particularly well suited to pursuing and preserving reputational gains, targeting closely matched rivals in certain contexts, and inflicting greater costs on targets. Previous research notes that indirectly aggressive interactions are not necessarily anonymous; during childhood it is often perpetrated directly against the victim (e.g., threatening to break the relationship unless the victim does what they want), but the development of social intelligence permits more covert actions during adolescence (Coyne et al., 2006; Salmivalli et al., 2000). Nonetheless, it remains unclear how often adolescents experience anonymous relational aggression. However, research on cyber aggression suggests that it has been experienced anonymously by 10-48% of cyber

victims (Dehue et al., 2008; Hamm et al., 2015; Kowalski & Limber, 2007; Li, 2007). Moreover, relatively little is known about the functions or the targets of anonymous indirect aggression, or whether it is a useful method to inflict costs on victims. As such, this study aimed to address the following questions about indirect aggression: (1) What aggressive functions are associated with anonymous aggression; (2) Is anonymity differentially related to perpetration and victimization with different power balances; and (3) Does anonymous victimization contribute to victims' perceptions of harm beyond the effects of victimization by known perpetrators?

Functions of Anonymous Indirect Aggression

Viewed through an evolutionary lens, anonymity may make indirect aggression more functional. Evolutionary perspectives emphasize that aggression is conditionally adaptive, with cost-benefit trade-offs that are more likely to yield net benefits when it is used selectively in relevant situations, against appropriate targets, in favorable contexts (Bjorklund & Hawley, 2014; Buss & Shackelford, 1997; Ellis et al., 2012; Veenstra et al., 2010; Volk et al., 2012). Qualitative and quantitative research suggests that adolescents indirectly aggress with the following motives: (1) competitive functions, including competing with rivals (e.g., Lapierre & Dane, 2021), deterring aggression (e.g., to be viewed as tough; Lapierre & Dane, 2021; Varjas et al., 2010), and negotiating dominance hierarchies (e.g., to demonstrate power and compete for social dominance; Lapierre & Dane, 2021; Pronk & Zimmer-Gambeck, 2010; Varjas et al., 2010); (2) impression management functions, including gaining attention and affection from bystanders (e.g., to seek approval and status; to attract potential mates; Houghton et al., 2012; Lapierre & Dane, 2021; Mishna et al., 2010; Varjas et al., 2010); (3) sadistic functions, which encompass unreflective and impulsive enjoyment (Hamm et al., 2015; Lapierre & Dane, 2021; Mishna et al., 2010; Runions et al., 2017; Varjas et al., 2010); and (4) reactive functions,

involving impulsive responses to provocation driven by negative affect (Lapierre & Dane, 2021; Pronk & Zimmer-Gambeck, 2010; Runions et al., 2017), linked theoretically to self-defence, aggression deterrence, and moralistic aggression to deter exploitation (e.g., Babcock et al., 2014; Sell, 2011; Trivers, 1971). However, to our knowledge, the aggressive functions associated with anonymous relational and cyber aggression have yet to be examined. Some functions of aggression may be conditionally adaptive, depending on anonymous perpetration to minimize costs, whereas anonymity may impede other aggressive functions.

For example, because anonymity makes the aggressor unknown to the victim and possibly bystanders, it may prevent or weaken the intensity of costly signals (Smith, 2004; Volk et al., 2012), an important component of competitive functions that aim to deter victimization and establish dominance (Lapierre & Dane, 2021; Volk et al., 2014). Thus, the use of anonymous indirect aggression for competitive functions seems unlikely, especially in cyber form since adolescents tend to engage in cyber aggression alone (Dehue et al., 2008). Anonymous indirect aggression may be more functional for impression management because it can minimize social and reputational costs, such as peer rejection (Crick & Grotpeter, 1995) and being perceived as cowardly (Hoff & Mitchell, 2009; DeSmet et al., 2013; Smith et al., 2008), untrustworthy and unkind (Fisher et al., 2010), as well as reduce the likelihood of sanctions or punishment from being reported to peers, parents, or teachers (Varjas et al., 2010). Being anonymous may also allow the perpetrator to control their audience, so they can choose to display aggression, which is anonymous to the victim, only to peers who are likely to approve, yielding net gains in reputational benefits. However, the associations between anonymous indirect aggression and impression management functions were predicted to be stronger for girls than for boys, because girls' reputations and social relationships are more likely to be damaged from known

involvement in relational or cyber aggression (e.g., Geary et al., 2003). In contrast to males who tend to form large and less intimate friend groups, females tend to have fewer but more intimate relationships (Benenson, 2016a; Geary et al., 2003; Rose & Rudolph, 2006), in part due to a greater historical need for reciprocal altruism and the benefits associated with reciprocal social support (Geary et al., 2003). As such, girls tend to pay greater attention to the fairness of their relationships and tend to dissolve relationships that lack reciprocity. Moreover, because relational aggression is common within the friendships of relationally aggressive children (Grotperter & Crick, 1996), indirectly aggressive girls are at particular risk of incurring social costs as a result of betraying trust and becoming an undesirable friend (Geary et al., 2003), suggesting that they would benefit most from anonymous aggression.

Sadistic functions have the proximate goal of enjoyment, which does not require costly signals of power to bystanders, and therefore adolescents may anonymously aggress to achieve sadistic functions at minimal risk of experiencing retaliation or punishment (e.g., Varjas et al., 2010). However, bullying, which has previously been linked to sadistic functions (Lapierre & Dane, 2021; Runions et al., 2017, 2018), may afford more sadistic enjoyment when the perpetrator is known to the victim because there are more opportunities to display dominance and power over the victim, as well as witness and enjoy the suffering of the victim, which are key components of sadistic enjoyment (Chester et al., 2019; Pinker, 2011, p. 550-551). As such, advantages and drawbacks associated with anonymous indirect aggression may cancel each other out in relation to sadistic functions. Finally, we expected only anonymous relational aggression to be associated with impulsive, reactive functions because anonymous cyber aggression is likely to require preparation, such as creating a pseudonym or fake social media account, or the opportunity to gain access to peers' accounts to hack or impersonate them. In contrast, the

prerequisites of anonymous relational aggression, including the cooperation of loyal assistants, are less time-consuming (Xie et al., 2002).

Anonymity in relation to Form of Aggression and Balance of Power

In line with the perspective that aggression may be conditionally adaptive, adolescents' use of anonymous aggression is likely to depend on the form of aggression and the power held by the intended victim. Because cyberspace is a relatively new social communication tool that did not exist in the environment of evolutionary adaptation (e.g., Li et al., 2020; Volk et al., 2012), cyber aggression per se cannot be considered an adaptation. However, many acts of indirect aggression, such as rumor spreading, social exclusion, derogation, and uttering threats, have occurred throughout human evolutionary history (see Volk et al., 2012) such that selection pressures may account for their continued use in-person and in modern contexts like cyberspace, just as evolved tendencies toward physical aggression may now be expressed through modern weapons in addition to the use of fists, knives, or spears. Although there is a risk of dysfunctional behavioural and psychological outcomes as the result of evolutionary mismatch between modern technologically-advanced environments and the environment of evolutionary adaptation in which psychological mechanisms driving aggression and competition have been selected (Li et al., 2020; Yong et al., 2017), associations with popularity, social dominance and dating suggests that both relational and cyber aggression may be conditionally adaptive in current contexts for some individuals, potentially increasing the likelihood of achieving the ultimate adaptive goals of survival, reproduction, and the propagation of genes (Volk et al., 2014). Furthermore, although anonymous aggression can be observed in ancient aggressive acts such as gossiping and social exclusion, which allow aggressors to conceal their identity (Benenson, 2016a, 2016b; Ingram,

2014), cyberspace can provide a new way to achieve anonymity (Wyckoff et al., 2019; Lowry et al., 2016), potentially impacting the adaptiveness of indirect aggression.

Previous research suggests that perceived anonymity can reduce accountability and disinhibit aggressive behaviour (Barlinska et al., 2013; Dennehy et al., 2020; Hoff & Mitchell, 2009; Ingram, 2014), subvert or change the power balance between the perpetrator and victim (Kowalski et al., 2014) and empower perpetrators to target peers who are feared (Varjas et al., 2010). Anonymous aggression may be ideally suited for inflicting costs on closely matched or more powerful rivals, to establish and maintain dominance, deter aggression and competition, and defend social prerogatives (Weisfeld & Dillon, 2012), because it may nullify unfavorable power balances and maximize harm inflicted on competitors unable to identify the perpetrator. Thus, anonymity may improve the cost-benefit ratio of more risky aggression against peers who hold equal or more power than the perpetrator (i.e., adversarial aggression), though this may depend on the form of aggression. Specifically, we expected only anonymous cyber aggression to be positively associated with adversarial (cyber) aggression because of differences in the ease of maintaining anonymity and recruiting collaborators within cyber and traditional contexts. It may be easier to maintain the anonymity of indirect aggression in cyberspace because technological anonymity reduces the need incumbent on relational aggressors in traditional contexts to build a coalition of loyal collaborators through social power and influence (Benenson, 2016b; Lowry et al., 2016), and the maintenance of anonymity is crucial to achieving a favorable cost-benefit ratio against powerful adversaries. Furthermore, recruitment of collaborators may be easier in the cyber context as bystanders are more inclined than those in traditional environments to “share” aggressive and hurtful content (Barlinska et al., 2013).

Although bullying is less risky given the relative powerlessness of the victim, anonymous relational and cyber aggression were also expected to be positively associated with bullying, but for different reasons. Cyberbullying vulnerable victims tends to be perceived as cowardly (Hoff & Mitchell, 2009; DeSmet et al., 2013; Smith et al., 2008) and is less accepted by peers than is targeting peers of equal status (i.e., adversarial cyber aggression; Talwar et al., 2014). Therefore, adolescents may aggress anonymously to hide cyberbullying perpetration and mitigate any potential harm to their reputation. Furthermore, there should be fewer challenges with maintaining anonymity in relational bullying than with adversarial relational aggression because low status individuals are likely to be selected as victims to minimize retaliation and loss of peer affection (Veenstra et al., 2010). Consequently, the power of the perpetrator relative to the victim may enhance incentives (and minimize costs) for informed bystanders to assist the perpetrator of anonymous relational bullying and maintain their anonymity (Xie et al., 2002). Lastly, the predicted associations between anonymous aggression and bullying or adversarial aggression were expected to be stronger for girls than for boys, given their greater risk aversion, in general, and concerns about being perceived as loyal and trustworthy friends or allies (Archer, 2009; Geary et al., 2003; Rose & Rudolph, 2006).

Anonymous Indirect Victimization and Victims' Perceptions of Harm

Anonymity may further enhance the functionality of indirect aggression by adding to the harm or costs that can be inflicted on a target beyond that imposed by bullying victimization or adversarial victimization with known perpetrators. Although the perceived harm of victimization is reported to be greatest when the victim lacks the power to defend themselves (i.e., bullying victimization), as opposed to when they have equal or more power than their perpetrator (i.e., adversarial victimization; Hunter et al., 2007; Ybarra et al., 2014), anonymity is reported to

further increase the perceptions of fear and harm experienced by victims (Hoff & Mitchell, 2009; Houghton et al., 2012; Smith et al., 2008; Sourander et al., 2010; Sticca & Perren, 2012).

However, research has yet to empirically determine whether anonymous victimization adds to perceptions of harm associated with bullying victimization and adversarial victimization. In bullying victimization, the power imbalance is often expressed in terms of the victim's inability to defend themselves against the perpetrator, who may have advantages in terms of strength, popularity, and number of allies (Volk et al., 2014). In contrast, victims of adversarial aggression have the wherewithal to defend themselves because they are not at a power disadvantage in comparison to their perpetrator. However, anonymity has the potential to make a victim powerless to defend themselves against an unknown perpetrator (Kowalski et al., 2014), regardless of the power balance if the perpetrator were known to the victim, and therefore may be used to augment fear and harm beyond overt victimization with an identifiable perpetrator (Houghton et al., 2012). As such, we examined the hypotheses that anonymous relational and cyber victimization would be associated with victims' perceptions of harm beyond the effects of bullying victimization and adversarial victimization. Furthermore, bullying victimization and adversarial victimization were expected to be most strongly associated with victims' perceptions of harm when combined with exposure to frequent anonymous victimization.

Additionally, although research has yet to examine gender differences in the perceived harm associated with anonymous indirect victimization, we expected that the associations between anonymous relational and cyber victimization and perceived harm would be stronger for girls than for boys. Adolescent girls and adult women experience more harm than their male counterparts from social forms of victimization (Cénat et al., 2014; Coyne et al., 2006; Soenens et al., 2008; Wyckoff et al., 2019; Yang et al., 2021). They place greater emphasis on developing

and maintaining close social relationships (Geary et al., 2003; Rose & Rudolph, 2006), and share more intimate details of their lives with friends (Geary et al., 2003; Hall, 2011; Rose & Rudolph, 2006), putting them at risk for social manipulation that is typical of indirect aggression (Geary et al., 2003). Furthermore, females are typically less tolerant of conflict in social relationships due to the importance of trust and reciprocity in close relationships and may experience more disruption in social relationships if conflicts are not resolved (Geary et al., 2003; Wright, 1982). As such, anonymous indirect victimization would likely be associated with greater perceived harm for girls than for boys, as anonymity would prevent the resolution of conflict stimulated by an anonymous aggressor, social exclusion (for unknown reasons) may be longer lasting, and reputational damage impugning trustworthiness could have more adverse effects.

In summary, the present study aimed to extend the literature on anonymous relational and cyber aggression by examining the functions of aggression associated with anonymous indirect aggression, the power balances between perpetrators and victims associated with anonymous aggression involvement, and the harm experienced by victims of anonymous aggression relative to bullying and adversarial victimization. On the basis of theory and previous research on anonymity in relational and cyber aggression reviewed above, the following was predicted: (1) anonymous relational and cyber aggression would be associated with impression management functions, more strongly for girls than boys; (2) anonymous relational aggression would be associated with reactive functions; (3) bullying perpetration/victimization would be associated with anonymity in both relational and cyber forms, whereas adversarial aggression/victimization would be associated with anonymity only in cyber form, with all of these associations being stronger for girls than boys; (4) anonymous relational and cyber victimization would be associated with victims' perceptions of harm above and beyond the effects of bullying

victimization and adversarial victimization, with these associations being stronger for girls than boys; and (5) in both cyber and relational form, adversarial victimization and bullying victimization would be most strongly associated with victims' perceived harm when paired with high levels of anonymous victimization.

Method

Participants

A sample of 378 early adolescents (198 boys, 180 girls) from grades 7-9 (age range: 11 - 14 years; $M = 12.87$, $SD = .84$) were recruited from six schools in Southern Ontario, Canada. Most participants identified as White (59%), followed by mixed (13.8%), Latin/Central/ South American (9.3%), Asian (9.2%), other (5.3%), Black (2.9%), and Indigenous (0.5%) ethnicities. Finally, most participants reported belonging to the middle-class (60.1% middle-class; 17.5% lower-class; 22.5% upper-class).

Measures

Demographics. The participants first completed a demographics questionnaire to assess age, gender, and socio-economic status.

Bullying and Adversarial Aggression. This measure assessed adolescents' perpetration of cyber and relational forms of bullying and adversarial aggression. More specifically, adolescents were asked how often they had engaged in aggressive behaviours to bully ("In the past few months, how often have you done the following against someone who was less popular or strong than you?"), and to perpetrate adversarial aggression ("In the past few months, how often have you done the following against someone who was equally or more popular or strong than you?"). To answer each of these questions, the participants used a 5-point Likert-type scale

ranging from *never* (1) to *very often* (5) (Lapierre & Dane, 2020a, 2021; Volk et al., 2021) to rate the frequency with which they had perpetrated several aggressive behaviours within relational (4 items; e.g., “Spread negative rumours or gossip about someone while talking to others”; Bullying: $\alpha = .84$; Adversarial aggression: $\alpha = .78$), and cyber (5 items; “I used the internet or a cell phone to post information, pictures, or videos about someone that would embarrass or hurt that person”; Bullying: $\alpha = .83$; Adversarial aggression: $\alpha = .78$) forms.

Bullying Victimization and Adversarial Victimization. To assess victimization, adolescents were asked how often they had experienced bullying victimization (“In the past few months, how often have the following things been done to you by someone who was more popular or strong than you?”), and adversarial victimization (“In the past few months, how often have the following things been done to you by someone who was equally or less popular or strong than you?”). To answer each of these questions, the participants rated several items that described experiences of victimization along a 5-point Likert-type scale ranging from *never* (1) to *very often* (5) (Lapierre & Dane, 2020a, 2021; Volk et al., 2021) within relational (4 items; e.g., “Others left me out or excluded me from a group activity”; Bullying victimization: $\alpha = .88$; Adversarial victimization: $\alpha = .86$), and cyber (5 items; “Others spread negative rumours or gossip about me, using the internet or a cell phone”; Bullying victimization: $\alpha = .85$; Adversarial victimization: $\alpha = .87$) forms.

Anonymous Aggression & Victimization. This measure assessed the frequency of adolescents’ perpetration of, and victimization by anonymous aggression in cyber and relational forms, without reference to power balance. More specifically, using a 5-point Likert-type scale ranging from *never* (1) to *very often* (5), adolescents rated how frequently they had perpetrated anonymous aggression in cyber (“In the past few months, how often have you used the internet

or your cell phone to gossip or spread rumours about someone, or to send or post things that are hurtful or embarrassing to someone, when they were not sure who had done it to them?") and relational form ("In the past few months, how often have you spread rumours about someone, or left someone out, when they were not sure who had done it to them?"). Likewise, using the same response scale, adolescents reported the frequency with which they had experienced anonymous victimization in cyber ("In the past few months, how often has someone used the internet or their cell phone to gossip or say mean things about you, threaten you, or to send or post things that are hurtful or embarrassing to you, when you weren't sure who had done it to you?") and relational form ("In the past few months, how often have you had negative rumours spread about you or been left out of groups when you weren't sure who had done it to you?").

Evolutionary Aggressive Functions. This questionnaire (Dane et al., 2022; Lapierre & Dane, 2021) is based on conceptual and theoretical research on aggressive functions (e.g., Hubbard et al., 2010), previous measures of proactive and reactive aggressive functions (e.g., Little et al., 2003; Marsee et al., 2011; Raine et al., 2006), as well as evolutionary-based research (Buss & Shackelford, 1997; Pinker, 2011; Volk et al., 2012). Importantly, although the aggressive functions examined in this questionnaire do not map directly onto ultimate evolutionary functions of survival and reproduction, this measure assesses conscious and unreflective motives that contribute to the pursuit of benefits that are proxies for fitness, such as dominance and attracting dating partners, which may increase the likelihood of achieving adaptive outcomes related to ultimate evolutionary functions (Scott-Phillips et al., 2011; Volk et al., 2014). Participants were asked "How often have you done the things below for the following reasons?"; they were then given examples of different forms of aggressive behaviour and were asked to rate how often they had engaged in aggression to pursue various aggressive functions

(16 items), on a 5-point Likert-type scale ranging from *never* (1) to *very often* (5). Factor analysis identified four subscales, namely, competitive, impression management, sadistic, and reactive functions.

The *competitive functions* subscale (6 items; $\alpha = .88$) encompasses proactive aggression driven by the presence of a rival or adversary and aims to instill fear in targets and bystanders for aversive and appetitive motives, including deterring aggression from rivals (e.g., “To show others not to mess with me”), inflicting costs on rivals (e.g., “To compete with or weaken a rival”), competing for dominance (e.g., “To be in charge”), and engaging in competition (e.g., “To win a competition”). In contrast, *impression management functions* (5 items; $\alpha = .83$) include proactive aggression with appetitive motives directed toward gaining resources, or the attention and admiration of bystanders, including gaining social status (e.g., “To get attention and feel respected”), resource control (e.g., “To get the things I want”), and facilitating intersexual selection (e.g., “To show off and impress someone I’d like to date”). The *sadistic functions* subscale (2 items; $\alpha = .62$) encompasses proactive aggression enacted for appetitive motives, with no proximate goals other than enjoyment (e.g., “Just for fun”, and “Joking or messing around with friends”). Finally, the *reactive functions* subscale (3 items; $\alpha = .87$) pertains to impulsive (i.e., unreflective) aggression, driven by provocation and negative affect such as anger or frustration, and has no explicit goal except to retaliate against the victim (e.g., “Others did something wrong to me and I reacted without thinking”).

Perceived Harm of Victimization. This measure assessed victims’ perceptions of harm associated with cyber and relational victimization along a 5-point Likert-type scale ranging from *not at all* (1) to *very much* (5). Adolescents were asked to report the harm they experienced in cyber (“How much have you been hurt or harmed [e.g., emotionally, socially, or physically]

when others have used the internet or a cell phone to spread rumours or say mean things about you, threaten you, or send or post things that were embarrassing or hurtful to you?") and relational ("How much have you been hurt or harmed [e.g., emotionally, socially, or physically] by having negative rumours spread about you, being left out, or being ignored?") victimization.

Procedure

After obtaining approval for data collection from the ethics board of the university and school board, students in grades 7-9 were recruited to participate. Students in grades 7 and 8 were required to obtain parental consent before participation, whereas students in grade 9 were able to participate with passive consent in which parents/guardians had the option to exclude their adolescent from the study. Regardless of their response, all students who had returned completed consent forms were entered into a draw for the chance to win one of several gift cards valued at \$100. In total, 90% of the recruited students consented/assented to participate and they completed the questionnaires electronically on tablets.

Results

Preliminary Analyses

The means, standard deviations, and ranges of all study variables are provided in Table 4.1, and the correlations between study variables are presented for the whole sample in Table 4.2 and separately for boys and girls in Tables 4.3 and 4.4, respectively. Notably, mean-level endorsement of aggressive behaviours was quite low, but this can be expected within the general population, and has been observed in previous research (Dumas et al., 2017; Goldstein, 2016; Lee & Yeager, 2019; van Geel et al., 2017; Williford & DePaolis, 2019; Wyckoff et al., 2019). Moreover, all cyber-specific variables as well as competitive and impression management

functions were significantly skewed and therefore winsorized to their respective upper third standard deviation, consistent with recommendations from previous research (Barbeau et al., 2019). Within aggressive form, anonymous aggression was moderately correlated with bullying (r values range from .48 - .50) and adversarial aggression (r values range from .40 - .53). Likewise, anonymous victimization was moderately correlated with bullying victimization (r values range from .58 - .59) and adversarial victimization (r values range from .51 - .53).

In the whole sample, 31.7% of early adolescents reported that they have perpetrated cyber aggression (at any power balance), and of those involved in cyber aggression perpetration, 28.3% reported that they had cyber aggressed anonymously. Similarly, 29.4% of adolescents had experienced cyber victimization, with about 41.8% of cyber victims experiencing anonymous cyber victimization. In relational form, 54.5% of the whole sample reported being involved in relational aggression perpetration, with 32.5% of relational aggressors reporting that they had aggressed anonymously. Likewise, 52.4% of the whole sample had experienced relational victimization, however, girls ($M=1.45$, $SD=.73$) were significantly more likely than boys ($M=1.28$, $SD=.58$) to report relational victimization, $t(339.49)=-2.5$, $p = .013$. Of those who had been relationally victimized, 53% reported experiencing anonymous relational victimization.

Table 4.1

Descriptive Statistics and Range of all Study Variables.

| Variable | Whole Sample Range | Whole Sample <i>M(SD)</i> | Boys n = 198 <i>M(SD)</i> | Girls n = 180 <i>M(SD)</i> |
|----------|--------------------------|---------------------------------|---------------------------------|----------------------------------|
| Age | 11-14 | 12.87(.84) | 12.93(.87) | 12.79(.80) |
| SES | 1-5 | 3.04(.73) | 3.14(.75) | 2.92(.69) |
| CB | 1-2.34 | 1.13(.26) | 1.12(.27) | 1.13(.25) |
| ACA | 1-2.03 | 1.10(.24) | 1.09(.23) | 1.11(.24) |
| Anon CA | 1-2.41 | 1.12(.35) | 1.13(.37) | 1.11(.33) |
| CBV | 1-2.53 | 1.16(.36) | 1.15(.35) | 1.17(.38) |
| ACV | 1-2.31 | 1.12(.29) | 1.12(.30) | 1.12(.28) |
| Anon CV | 1-3.11 | 1.21(.54) | 1.23(.54) | 1.19(.53) |
| CV Harm | 1-3.61 | 1.28(.67) | 1.22(.56) | 1.35(.76) |
| RB | 1-5 | 1.44(.66) | 1.40(.63) | 1.48(.69) |
| ARA | 1-5 | 1.28(.50) | 1.23(.44) | 1.33(.56) |
| Anon RA | 1-5 | 1.25(.53) | 1.24(.52) | 1.26(.54) |
| RBV | 1-5 | 1.52(.83) | 1.48(.81) | 1.57(.84) |
| ARV | 1-5 | 1.36(.66) | 1.28(.58) | 1.45(.73) |
| Anon RV | 1-5 | 1.51(.82) | 1.46(.77) | 1.57(.88) |
| RV Harm | 1-5 | 1.67(1.01) | 1.47(.89) | 1.89(1.09) |
| CF | 1-2.79 | 1.22(.42) | 1.29(.48) | 1.14(.32) |
| IMF | 1-2.53 | 1.18(.38) | 1.22(.43) | 1.14(.31) |
| SF | 1-5 | 1.76(.95) | 1.90(1.04) | 1.61(.82) |
| RF | 1-5 | 1.67(.86) | 1.75(.88) | 1.57(.84) |

Note. SES = Family socio-economic status, CB = Cyberbullying, ACA = Adversarial cyber aggression, Anon CA = Anonymous cyber aggression, CBV = Cyberbullying victimization, ACV = adversarial cyber victimization, Anon CV = Anonymous cyber victimization, CV Harm = Perceived harm of cyber victimization. RB = Relational bullying, ARA = Adversarial relational aggression, Anon RA = Anonymous relational aggression, RBV = Relational bullying victimization, ARV = Adversarial relational victimization, Anon RV = Anonymous relational victimization. RV Harm = Perceived harm of relational victimization CF= Competitive functions, IMF = Impression management functions, SF = Sadistic functions, RF = Reactive functions.

Table 4.2

Correlations Between all Study Variables for Whole Sample

| Variable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|-------------|-------------------|-------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| 1. Age | --- | | | | | | | | | | | | | | | | | | | |
| 2. Gen. | -.08 | --- | | | | | | | | | | | | | | | | | | |
| 3. SES | .02 | -.15 ^b | --- | | | | | | | | | | | | | | | | | |
| 4. CB | .21 ^c | .02 | .11 ^c | --- | | | | | | | | | | | | | | | | |
| 5. ACA | .15 ^b | .05 | .04 | .75 ^a | --- | | | | | | | | | | | | | | | |
| 6. Anon CA | .06 | -.04 | .15 ^b | .48 ^a | .53 ^a | --- | | | | | | | | | | | | | | |
| 7. CBV | .02 | .02 | -.02 | .37 ^a | .43 ^a | .20 ^a | --- | | | | | | | | | | | | | |
| 8. ACV | -.05 | .01 | .01 | .45 ^a | .42 ^a | .21 ^a | .69 ^a | --- | | | | | | | | | | | | |
| 9. Anon CV | -.01 | -.04 | .04 | .30 ^a | .36 ^a | .21 ^a | .59 ^a | .53 ^a | --- | | | | | | | | | | | |
| 10. CV Harm | -.04 | .10 | -.04 | .30 ^a | .32 ^a | .21 ^a | .54 ^a | .60 ^a | .50 ^a | --- | | | | | | | | | | |
| 11. RB | -.11 | .06 | .07 | .60 ^a | .50 ^a | .39 ^a | .33 ^a | .37 ^a | .25 ^a | .23 ^a | --- | | | | | | | | | |
| 12. ARA | -.03 | .10 | -.07 | .47 ^a | .52 ^a | .35 ^a | .32 ^a | .29 ^a | .22 ^a | .23 ^a | .70 ^a | --- | | | | | | | | |
| 13. Anon RA | .02 | .01 | .09 | .47 ^a | .44 ^a | .58 ^a | .21 ^a | .26 ^a | .29 ^a | .20 ^a | .50 ^a | .40 ^a | --- | | | | | | | |
| 14. RBV | -.18 ^a | .06 | -.09 | .27 ^a | .30 ^a | .11 ^c | .57 ^a | .49 ^a | .42 ^a | .40 ^a | .35 ^a | .31 ^a | .20 ^a | --- | | | | | | |
| 15. ARV | -.14 ^b | .13 ^b | -.08 | .23 ^a | .26 ^a | .06 | .46 ^a | .56 ^a | .36 ^a | .33 ^a | .31 ^a | .28 ^a | .18 ^a | .64 ^a | --- | | | | | |
| 16. Anon RV | -.10 | .07 | .02 | .25 ^a | .29 ^a | .18 ^a | .46 ^a | .45 ^a | .49 ^a | .42 ^a | .23 ^a | .26 ^a | .28 ^a | .58 ^a | .51 ^a | --- | | | | |
| 17. RV Harm | -.09 | .21 ^a | -.09 | .19 ^a | .24 ^a | .09 | .37 ^a | .41 ^a | .43 ^a | .55 ^a | .28 ^a | .24 ^a | .18 ^a | .56 ^a | .52 ^a | .52 ^a | --- | | | |
| 18. CF | -.05 | -.17 ^a | .15 ^b | .39 ^a | .33 ^a | .33 ^a | .30 ^a | .35 ^a | .31 ^a | .20 ^a | .49 ^a | .34 ^a | .44 ^a | .25 ^a | .26 ^a | .21 ^a | .20 ^a | --- | | |
| 19. IMF | -.06 | -.11 ^c | .09 | .41 ^a | .40 ^a | .39 ^a | .22 ^a | .35 ^a | .29 ^a | .24 ^a | .53 ^a | .33 ^a | .48 ^a | .32 ^a | .27 ^a | .28 ^a | .29 ^a | .68 ^a | --- | |
| 20. SF | .09 | -.15 ^b | .07 | .35 ^a | .29 ^a | .28 ^a | .18 ^a | .20 ^a | .24 ^a | .18 ^a | .28 ^a | .24 ^a | .28 ^a | .15 ^b | .13 ^a | .17 ^a | .17 ^a | .54 ^a | .50 ^a | --- |
| 21. RF | -.05 | -.11 ^c | -.09 | .30 ^a | .40 ^a | .22 ^a | .30 ^a | .33 ^a | .25 ^a | .27 ^a | .38 ^a | .42 ^a | .36 ^a | .36 ^a | .33 ^a | .28 ^a | .28 ^a | .43 ^a | .42 ^a | .37 ^a |

Note. Gen. = Gender (M=0, F=1), SES = Family socio-economic status, CB = Cyberbullying, ACA = Adversarial cyber aggression, Anon CA = Anonymous cyber aggression, CBV = Cyberbullying victimization, ACV = adversarial cyber victimization, Anon CV = Anonymous cyber victimization, CV Harm = Perceived harm of cyber victimization. RB = Relational bullying, ARA = Adversarial relational aggression, Anon RA = Anonymous relational aggression, RBV = Relational bullying victimization, ARV = Adversarial relational victimization, Anon RV = Anonymous relational victimization. RV Harm = Perceived harm of relational victimization CF= Competitive functions, IMF = Impression management functions, SF = Sadistic functions, RF = Reactive functions.

^a $p < .001$. ^b $p < .01$. ^c $p < .05$.

Table 4.3

Correlations Between all Study Variables for boys

| Variable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | |
|-------------|-------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|-----|
| 1. Age | --- | | | | | | | | | | | | | | | | | | | |
| 2. SES | .01 | --- | | | | | | | | | | | | | | | | | | |
| 3. CB | .03 | .25 ^a | --- | | | | | | | | | | | | | | | | | |
| 4. ACA | .05 | .14 ^c | .69 ^a | --- | | | | | | | | | | | | | | | | |
| 5. Anon CA | -.01 | .18 ^c | .51 ^a | .57 ^a | --- | | | | | | | | | | | | | | | |
| 6. CBV | -.03 | .04 | .39 ^a | .43 ^a | .32 ^a | --- | | | | | | | | | | | | | | |
| 7. ACV | -.15 ^c | .04 | .47 ^a | .44 ^a | .33 ^a | .68 ^a | --- | | | | | | | | | | | | | |
| 8. Anon CV | -.08 | .09 | .24 ^a | .37 ^a | .33 ^a | .53 ^a | .47 ^a | --- | | | | | | | | | | | | |
| 9. CV Harm | -.21 ^b | -.01 | .21 ^b | .22 ^b | .26 ^a | .43 ^a | .59 ^a | .38 ^a | --- | | | | | | | | | | | |
| 10. RB | -.18 ^c | .13 | .59 ^a | .53 ^a | .36 ^a | .41 ^a | .48 ^a | .31 ^a | .29 ^a | --- | | | | | | | | | | |
| 11. ARA | -.11 | .01 | .30 ^a | .44 ^a | .38 ^a | .38 ^a | .33 ^a | .27 ^a | .24 ^b | .62 ^a | --- | | | | | | | | | |
| 12. Anon RA | -.03 | .19 ^b | .42 ^a | .48 ^a | .68 ^a | .25 ^a | .33 ^a | .40 ^a | .28 ^a | .37 ^a | .32 ^a | --- | | | | | | | | |
| 13. RBV | -.31 ^a | -.02 | .22 ^b | .28 ^a | .19 ^b | .52 ^a | .48 ^a | .34 ^a | .39 ^a | .43 ^a | .32 ^a | .20 ^b | --- | | | | | | | |
| 14. ARV | -.24 ^b | -.12 | .21 ^b | .26 ^a | .13 | .54 ^a | .67 ^a | .33 ^a | .48 ^a | .39 ^a | .30 ^a | .23 ^b | .61 ^a | --- | | | | | | |
| 15. Anon RV | -.18 ^c | .05 | .17 ^c | .21 ^b | .26 ^a | .34 ^a | .42 ^a | .47 ^a | .46 ^a | .20 ^b | .23 ^b | .27 ^a | .49 ^a | .39 ^a | --- | | | | | |
| 16. RV Harm | -.23 ^b | -.06 | .11 | .16 ^c | .14 ^b | .22 ^b | .34 ^a | .36 ^a | .53 ^a | .34 ^a | .21 ^b | .17 ^c | .55 ^a | .49 ^a | .49 ^a | --- | | | | |
| 17. CF | -.01 | .19 ^b | .43 ^a | .45 ^a | .32 ^a | .39 ^a | .45 ^a | .39 ^a | .25 ^a | .50 ^a | .37 ^a | .48 ^a | .29 ^a | .32 ^a | .18 ^c | .25 ^a | --- | | | |
| 18. IMF | -.09 | .12 | .46 ^a | .49 ^a | .36 ^a | .25 ^b | .42 ^a | .35 ^a | .31 ^a | .59 ^a | .36 ^a | .55 ^a | .33 ^a | .32 ^a | .29 ^a | .38 ^a | .71 ^a | --- | | |
| 19. SF | .11 | .13 | .38 ^a | .31 ^a | .26 ^a | .20 ^b | .21 ^b | .24 ^b | .16 ^c | .26 ^a | .18 ^c | .36 ^a | .13 | .16 ^c | .17 ^c | .15 ^a | .54 ^a | .49 ^a | --- | |
| 20. RF | -.16 ^c | -.03 | .18 ^c | .33 ^a | .16 ^c | .27 ^a | .33 ^a | .27 ^a | .30 ^a | .33 ^a | .39 ^a | .32 ^a | .33 ^a | .33 ^a | .27 ^a | .31 ^a | .46 ^a | .37 ^a | .36 ^a | --- |

Note. SES = Family socio-economic status, CB = Cyberbullying, ACA = Adversarial cyber aggression, Anon CA = Anonymous cyber aggression, CBV = Cyberbullying victimization, ACV = adversarial cyber victimization, Anon CV = Anonymous cyber victimization, CV Harm = Perceived harm of cyber victimization. RB = Relational bullying, ARA = Adversarial relational aggression, Anon RA = Anonymous relational aggression, RBV = Relational bullying victimization, ARV = Adversarial relational victimization, Anon RV = Anonymous relational victimization. RV Harm = Perceived harm of relational victimization CF= Competitive functions, IMF = Impression management functions, SF = Sadistic functions, RF = Reactive functions.

^a $p < .001$. ^b $p < .01$. ^c $p < .05$.

Table 4.4

Correlations Between all Study Variables for girls

| Variable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
|-------------|-------------------|-------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| 1. Age | --- | | | | | | | | | | | | | | | | | | |
| 2. SES | .00 | --- | | | | | | | | | | | | | | | | | |
| 3. CB | .23 ^b | -.05 | --- | | | | | | | | | | | | | | | | |
| 4. ACA | .29 ^a | -.07 | .83 ^a | --- | | | | | | | | | | | | | | | |
| 5. Anon CA | .16 ^c | .10 | .44 ^a | .49 ^a | --- | | | | | | | | | | | | | | |
| 6. CBV | .08 | -.08 | .34 ^a | .42 ^a | .06 | --- | | | | | | | | | | | | | |
| 7. ACV | .07 | -.04 | .43 ^a | .40 ^a | .06 | .69 ^a | --- | | | | | | | | | | | | |
| 8. Anon CV | .07 | -.04 | .34 ^a | .35 ^a | .07 | .65 ^a | .60 ^a | --- | | | | | | | | | | | |
| 9. CV Harm | .12 | -.03 | .37 ^a | .39 ^a | .18 ^c | .63 ^a | .64 ^a | .63 ^a | --- | | | | | | | | | | |
| 10. RB | -.03 | .01 | .62 ^a | .48 ^a | .44 ^a | .24 ^b | .25 ^b | .20 ^b | .17 ^c | --- | | | | | | | | | |
| 11. ARA | .06 | -.12 | .63 ^a | .58 ^a | .34 ^a | .26 ^a | .26 ^a | .19 ^c | .22 ^b | .76 ^a | --- | | | | | | | | |
| 12. Anon RA | .09 | -.01 | .53 ^a | .40 ^a | .48 ^a | .16 ^c | .18 ^c | .17 ^c | .14 | .63 ^a | .47 ^a | --- | | | | | | | |
| 13. RBV | -.03 | -.14 | .32 ^a | .32 ^a | .03 | .62 ^a | .50 ^a | .50 ^a | .40 ^a | .27 ^a | .30 ^a | .19 ^c | --- | | | | | | |
| 14. ARV | -.03 | -.01 | .24 ^b | .25 ^a | -.00 | .40 ^a | .49 ^a | .40 ^a | .23 ^b | .23 ^b | .26 ^a | .14 | .67 ^a | --- | | | | | |
| 15. Anon RV | -.00 | -.00 | .32 ^a | .36 ^a | .10 | .57 ^a | .48 ^a | .53 ^a | .39 ^a | .24 ^b | .28 ^a | .28 ^a | .66 ^a | .60 ^a | --- | | | | |
| 16. RV Harm | .08 | -.06 | .27 ^a | .30 ^a | .07 | .50 ^a | .49 ^a | .52 ^a | .55 ^a | .23 ^b | .23 ^b | .19 ^c | .58 ^a | .53 ^a | .54 ^a | --- | | | |
| 17. CF | -.18 ^c | -.00 | .36 ^a | .21 ^b | .33 ^a | .18 ^c | .21 ^b | .18 ^c | .21 ^b | .56 ^a | .39 ^a | .43 ^a | .25 ^b | .30 ^a | .30 ^a | .27 ^a | --- | | |
| 18. IMF | -.03 | .01 | .36 ^a | .31 ^b | .44 ^a | .21 ^b | .24 ^b | .20 ^b | .21 ^b | .51 ^a | .36 ^a | .42 ^a | .33 ^a | .28 ^a | .31 ^a | .29 ^a | .59 ^a | --- | |
| 19. SF | .03 | -.08 | .33 ^a | .28 ^a | .30 ^a | .18 ^c | .19 ^c | .24 ^b | .26 ^a | .36 ^a | .36 ^a | .18 ^c | .22 ^b | .15 ^c | .20 ^b | .28 ^a | .49 ^a | .49 ^a | --- |
| 20. RF | .06 | -.21 ^b | .45 ^a | .51 ^a | .29 ^a | .33 ^a | .33 ^a | .22 ^b | .28 ^a | .45 ^a | .48 ^a | .43 ^a | .41 ^a | .38 ^a | .30 ^a | .32 ^a | .36 ^a | .48 ^a | .36 ^a |

Note. SES = Family socio-economic status, CB = Cyberbullying, ACA = Adversarial cyber aggression, Anon CA = Anonymous cyber aggression, CBV = Cyberbullying victimization, ACV = adversarial cyber victimization, Anon CV = Anonymous cyber victimization, CV Harm = Perceived harm of cyber victimization. RB = Relational bullying, ARA = Adversarial relational aggression, Anon RA = Anonymous relational aggression, RBV = Relational bullying victimization, ARV = Adversarial relational victimization, Anon RV = Anonymous relational victimization. RV Harm = Perceived harm of relational victimization CF= Competitive functions, IMF = Impression management functions, SF = Sadistic functions, RF = Reactive functions.

^a $p < .001$. ^b $p < .01$. ^c $p < .05$.

Multigroup Path Models

Model specification. *Mplus 8* (Muthén & Muthén, 2017) was used to conduct 4 path analysis models. Each model was specified to assess direct paths from each predictor to each outcome variable, with age and family's socio-economic status (SES) included as covariates. All models were first conducted as multigroup models with gender as the grouping variable to determine whether there were significant gender differences in the paths of interest. More specifically, the fit of the fully unconstrained model, wherein the associations of interest could vary across gender, was compared to the fit of a fully constrained model, wherein the associations of interest were constrained to invariance across gender. When compared to the unconstrained model, if the fully constrained multigroup model did not indicate worse model fit, as evidenced by a non-significant chi-square difference test, no significant gender differences were observed in the paths of interest. In this case, a fully constrained path model, with gender included as a covariate along with age and SES, was examined further in favor of a simplified model. However, if the fully constrained multigroup model indicated worse fit, as indicated by a significant chi-square difference test, a series of nested model comparisons were conducted by separately constraining each path of interest by gender and comparing it to a less constrained model to identify which paths vary by gender. In Model 4, which included interaction terms as predictors, interaction terms were calculated by multiplying mean-centered predictor variables. Significant interactions were probed by examining the effect of holding the applicable moderator (i.e., anonymous aggression or anonymous victimization) at the centered mean, as well as at one standard deviation below and above the centered mean.

Global model fit indices. Global model fit was assessed with the comparative fit index (CFI), the root-mean-square-error of approximation (RMSEA), and the standardized root-mean-

square residual (SRMR). Good model fit was indicated by a CFI value greater than or equal to .95, and by RMSEA and SRMR values less than or equal to .05 (Hu & Bentler, 1999).

Model 1 – Aggressive Functions Predicting Anonymous Aggression. In Cyber Model 1, the significant chi-square difference test ($\Delta\chi^2 [\Delta df = 4] = 15.24, p < .01$) indicated gender differences in the paths of interest, and the final, partially constrained model indicated good fit (CFI = 1.00, RMSEA = .00 [.00 - .10], SRMR = .01). As shown in Table 4.5, when cyberbullying and adversarial cyber aggression were included as covariates along with age and SES, impression management functions were positively associated with anonymous cyber aggression for girls, but not for boys, whereas the remaining aggressive functions were not significantly related to anonymous cyber aggression for either gender.

Similarly, in Relational Model 1, the significant chi-square difference test indicated that there were significant gender differences in the paths of interest ($\Delta\chi^2 [\Delta df = 4] = 13.35, p = .01$) and the partially constrained model indicated good fit (CFI = .99, RMSEA = .05 [.00 - .14], SRMR = .01). As shown in Table 4.5, when relational bullying and adversarial relational aggression were included as covariates along with age and SES, impression management and reactive functions were positively associated with anonymous relational aggression for both genders, whereas sadistic functions were negatively associated with anonymous relational aggression for girls.

Table 4.5

Aggressive Functions Predicting Anonymous Aggression (Model 1)

| | Anonymous Cyber Aggression <i>b</i> (<i>SE</i>) | Anonymous Relational Aggression <i>b</i> (<i>SE</i>) |
|---------------------------------|---------------------------------------------------------|--------------------------------------------------------------|
| Competitive Functions | .06(.05) | .14(.08) |
| Impression Management Functions | B: -.00(.07) G: .34(.08) ^{***} | .35(.09) ^{***} |
| Sadistic Functions | .02(.02) | B: .04(.03) G: -.11(.04) ^{**} |
| Reactive Functions | -.03(.02) | .07(.03) [*] |
| R ² | B: .38 ^{***} G: .36 ^{***} | B: .34 ^{***} G: .46 ^{***} |

Note. For parameters where significant gender differences were indicated by multigroup modelling procedures, *b*(*SE*) values are presented separately for girls (G) and boys (B). R² values differ for girls and boys in multigroup models because other parameters (e.g., means, covariances) excepting the paths of interest were unconstrained by gender.

p* < .05, *p* < .01, ****p* < .001.

Model 2 – Bullying and Adversarial Aggression Predicting Anonymous Aggression.

In Cyber Model 2, the non-significant chi-square difference test of the fully constrained multigroup model ($\Delta\chi^2 [\Delta df = 2] = 5.76, p = .06$) indicated no significant gender differences. As shown in Table 4.6, Panel A, both cyberbullying and adversarial cyber aggression were positively associated with anonymous cyber aggression, but the effect appears stronger for adversarial cyber aggression.

In Relational Model 2, the significant chi-square difference test of the multigroup model ($\Delta\chi^2 [\Delta df = 2] = 9.51, p < .01$) indicated significant gender differences in the paths of interest. The partially constrained model indicated fair model fit (CFI = .99, RMSEA = .10 [.00 - .24], SRMR = .01). As shown in Table 4.6, Panel A, relational bullying was positively linked to anonymous relational aggression for both genders, but the effect was stronger for girls.

Model 3 – Bullying and Adversarial Victimization Predicting Anonymous

Victimization. In Cyber Model 3, the non-significant chi-square difference test of the fully constrained model ($\Delta \chi^2 [\Delta df = 2] = 2.13, p > .05$) indicated that there were no significant gender differences. As shown in Table 4.6, Panel B, the final, fully constrained model indicated that both cyberbullying victimization and adversarial cyber victimization were positively associated with anonymous cyber victimization, but the effect appears stronger for cyberbullying victimization.

In Relational Model 3, the significant chi-square difference test of the fully constrained model ($\Delta \chi^2 [\Delta df = 2] = 5.93, p < .05$) indicated significant gender differences in the paths of interest and the final, partially constrained model indicated good model fit (CFI = 1.00, RMSEA = .05 [.00 - .21], SRMR = .01). As shown in Table 4.6, Panel B, the results suggested that relational bullying victimization was positively associated with anonymous relational victimization for both genders, and adversarial relational victimization was only associated with anonymous relational victimization for girls.

Model 4 – Bullying Victimization, Adversarial Victimization, and Anonymous

Victimization Predicting Perceived Harm. In Cyber Model 4, the significant chi-square difference test ($\Delta \chi^2 [\Delta df = 5] = 20.78, p < .05$) indicated significant gender differences in the paths of interest, and the final, partially constrained model indicated good fit (CFI = 1.00, RMSEA = .00 [.00 - .17], SRMR = .01). As shown in Table 4.7, anonymous cyber victimization was only positively associated with perceived harm for girls. Moreover, adversarial cyber victimization was positively associated with perceived harm for both genders, however, a significant interaction with anonymous cyber victimization suggested that, for boys, adversarial

Table 4.6

Bullying & Adversarial Aggression/Victimization Predicting Anonymous Aggression (Model 2) and Anonymous Victimization (Model 3)

| | Model 2 Outcomes | | Model 3 Outcomes | |
|------------------------------------------------|--------------------------------------------------|-------------------------------------------------------|-----------------------------------------------------|----------------------------------------------------------|
| | Anonymous Cyber Aggression <i>b(SE)</i> | Anonymous Relational Aggression <i>b(SE)</i> | Anonymous Cyber Victimization <i>b(SE)</i> | Anonymous Relational Victimization <i>b(SE)</i> |
| Panel A: Model 2 Predictors | | | | |
| Bullying (in applicable form) | .24(.09)** | B: .27(.06)** G: .46(.06)** | - | - |
| Adversarial Aggression (in applicable form) | .58(.10)** | .06(.07) | - | - |
| R ² | .31** | B: .16** G: .41** | - | - |
| Panel B: Model 3 Predictors | | | | |
| Bullying Victimization (in applicable form) | - | - | .63(.08)** | .44(.05)** |
| Adversarial Victimization (in applicable form) | - | - | .43(.10)** | B: .16(.10) G: .39(.08)** |
| R ² | - | - | .37** | B: .29** G: .47** |

Note. For parameters where significant gender differences were indicated by multigroup modelling procedures, *b(SE)* values are presented separately for girls (G) and boys (B). R² values differ for girls and boys in multigroup models because other parameters (e.g., means, covariances) excepting the paths of interest were unconstrained by gender.

p* < .05, *p* < .01, ****p* < .001.

cyber victimization was more strongly associated with perceived harm when anonymous cyber victimization was frequently experienced ($b = 1.07, p < .001$) than when it was less frequently experienced ($b = .78, p < .001$).

In contrast, for Relational Model 4, the non-significant chi-square difference test ($\Delta \chi^2 [\Delta df = 5] = 4.70, p > .05$) indicated no significant gender differences in the paths of interest. As shown in Table 4.7, the final, fully constrained model suggested that both relational bullying victimization and anonymous relational victimization were positively associated with perceived harm to similar degrees, with no significant interactions.

Table 4.7

Bullying Victimization, Adversarial Victimization, Anonymous Victimization and Interactions Predicting Perceived Harm (Model 4)

| | Perceived Harm of Cyber Victimization | Perceived Harm of Relational Victimization |
|------------------------------------------------|------------------------------------------|--------------------------------------------------|
| | <i>b</i> (<i>SE</i>) | <i>b</i> (<i>SE</i>) |
| Bullying Victimization (in applicable form) | .13(.15) | .34(.11)** |
| Adversarial Victimization (in applicable form) | .93(.17)*** | .18(.13) |
| Anonymous Victimization (in applicable form) | B: .06(.12) G: .79(.15)*** | .38(.10)*** |
| BVxAnonVic | .03(.13) | .00(.23) |
| AVxAnonVic | B: .27(.13)* G: -.11 (.14) | .10(.13) |
| R ² | B: .37*** G: .56*** | .37*** |

Note. BV = Bullying victimization, AV = Adversarial victimization. AnonVic = Anonymous Victimization. For parameters where significant gender differences were indicated by multigroup modelling procedures, *b*(*SE*) values are presented separately for girls (G) and boys (B). R² values differ for girls and boys in multigroup models because other parameters (e.g., means, covariances) excepting the paths of interest were unconstrained by gender. * $p < .05$, ** $p < .01$, *** $p < .001$.

Discussion

Because anonymity is a key feature of indirect aggression that has been given little attention in previous research, the current study used an evolutionary psychological perspective to examine whether anonymous indirect aggression is associated with the functions of early adolescents' aggressive behaviour, perpetration against particular targets to minimize costs, and victims' perceptions of harm beyond links to victimization by known perpetrators. Moreover, this study further extends literature by examining anonymity in the context of in-person relational aggression and cyber aggression. Notably, we found substantial involvement in anonymous indirect aggression amongst early adolescents, with 28.3% of cyber aggressors and 32.5% of relational aggressors reporting that they have aggressed anonymously, and 41.8% of cyber victims and 53% of relational victims indicating that they have experienced anonymous victimization, consistent with estimates from previous cyber victimization research (Dehue et al., 2008; Hamm et al., 2015; Kowalski & Limber, 2007; Li, 2007).

Partially consistent with our first prediction, impression management functions (e.g., status seeking, attracting romantic partners) were positively associated with anonymous relational aggression, and with anonymous cyber aggression for girls only (see Table 2). Generally, these findings align with our expectation that anonymous aggression enables perpetrators to select an audience of bystanders likely to approve of their actions, while hiding their behaviour from victims, bystanders and authority figures who may disapprove, retaliate or impose sanctions, to maximize net social and reputational gains, a prominent concern in adolescence (Houghton et al., 2012; Ingram, 2014; Mishna et al., 2010). Moreover, although the predicted gender difference was observed only in cyber form, it remains consistent with gender differences in risk aversion (Archer, 2009). Generally, girls are more risk averse than boys, due

in part to greater parental investment and lesser variability in reproduction rate and given that their survival and that of their offspring is more closely tied to the accessibility of social resources (Geary et al., 2003), maintaining a reputation as trustworthy and loyal is of particular importance for females, to ensure that they have close and supportive relationships (in accordance with reciprocal altruism; Geary et al., 2003). Furthermore, this finding is consistent with previous research demonstrating that indirect aggression is more consistently associated with popularity motives (Wright, 2017), and dating/reproductive outcomes (Dane et al., 2017; Gallup, 2017) for females than for males. This gender difference may have been particularly salient in cyber form as evidence of overt/identifiable cyber aggression persists longer online than it would in in-person contexts (Wingate et al., 2012) and cannot be as easily denied by the aggressor. Thus, anonymous cyber aggression may be a particularly adaptive means for girls to inflict reputational harm on rivals to make the aggressor look better in comparison, while mitigating reputational and social costs (Campbell, 2013; Vaillancourt, 2013), which are of particular concern for girls (e.g., Geary et al., 2003).

As hypothesized, reactive functions were positively associated with anonymous aggression in relational but not cyber form. Although adolescents are motivated to cyber aggress in retaliation for real or perceived threats (Hamm et al., 2015; Lapierre & Dane, 2021; Ybarra & Mitchell, 2007; Varjas et al., 2010), this research suggests that anonymous cyber aggression is less likely to be used to achieve such functions. This is probably because it requires technical preparation or opportunities for hacking or impersonation that impose practical constraints on its use in an impulsive and unplanned manner. On the other hand, anonymous relational aggression is easier to perpetrate reactively because there are no time-consuming technical requirements.

Although no prediction was made regarding potential links between sadistic functions and adolescents' use of anonymous indirect aggression, it is interesting that sadistic functions were negatively associated with anonymous relational aggression for girls. Although this finding appears to contradict evolutionary perspectives that aggression can be used strategically to maintain a favorable cost-benefit ratio (Buss & Shackelford, 1997; Volk et al., 2012), it is possible that enjoyment attained through anonymous relational aggression may not be substantial enough to merit its use for sadistic functions. Anonymity may dampen enjoyment achieved by displaying dominance over the victim (Pinker, 2011, p. 550; Russell, 2019), or witnessing the suffering of the victim immediately and in-person (Chester et al., 2019), potentially making bullying by a known perpetrator the preferred method of achieving sadistic enjoyment for girls. This interpretation is partially supported by previous research linking relational bullying and sadistic functions for both genders (Lapierre & Dane, 2021).

Consistent with the third prediction, both relational and cyber forms of bullying perpetration and victimization were associated with anonymity, whereas adversarial aggression and victimization were only associated with anonymity in cyber form. Such results suggest that adolescents utilize anonymity strategically with targets varying depending on the form of aggression. In relational form, anonymous aggression may be associated with bullying but not riskier adversarial aggression against rivals because bystanders are more likely to collaborate and maintain the perpetrator's anonymity when the target is vulnerable and marginalized in the peer group (Veenstra et al., 2010; Xie et al., 2002). Moreover, the association between relational bullying and anonymous relational aggression was stronger for girls, consistent with expectations that girls would use anonymity to further reduce their chances of incurring social and reputational costs associated with perpetrating indirect aggression (Archer, 2009; Geary et al.,

2003; Rose & Rudolph, 2006). In contrast, anonymous cyber aggression was associated with cyber bullying and adversarial cyber aggression, possibly because anonymity in cyberspace may be achieved through technology rather than social power (e.g., Lowry et al., 2016). Thus, cyber aggressors rely on anonymity achieved through technology either to hide their cyberbullying involvement from disapproving peers to mitigate negative evaluation (Talwar et al., 2014), or to shift power balances to their advantage when aggressing against riskier or feared targets (Dennehy et al., 2020; Kowalski et al., 2014; Thomas et al., 2015; Varjas et al., 2010) to reduce the chances of incurring harm through retaliation.

Controlling for the effects of bullying victimization and adversarial victimization, perceived harm was significantly associated with anonymous relational victimization for both genders and anonymous cyber victimization for girls, partially consistent with prediction four and prior evidence suggesting that anonymity is perceived to increase the harm experienced from victimization (Hoff & Mitchell, 2009; Smith et al., 2008; Sourander et al., 2010; Sticca & Perren, 2012). In addition, anonymous cyber victimization was only predictive of girls' perceived harm, aligning with evidence that females are more negatively impacted by cyber aggression overall (Bennett et al., 2011; Campbell et al., 2012; Cénat et al., 2014; Pettalia et al., 2013; Wyckoff et al., 2019), and tend to place more importance on close social relationships (Geary et al., 2003; Rose & Rudolph, 2006). Moreover, because girls are less tolerant of conflict and violations of reciprocity in social relationships (Geary et al., 2003; Wright, 1982), anonymous cyber victimization may disrupt their social relationships more substantially, preventing them from resolving conflicts and countering reputational damage potentially impugning trustworthiness, consequently prolonging social exclusion. In contrast, anonymous relational victimization may be associated with harm for both genders because it is more likely than anonymous cyber

aggression to involve the cooperation of multiple individuals (Lowry et al., 2016), which may induce fears about the unknown number of peers involved. Moreover, anonymous relational aggression was associated only with bullying (see Table 4.6), so the pervasiveness of links to perceived harm may also reflect its predominant use against socially vulnerable targets, which in turn may affect whether bystanders believe rumours or collaborate in social exclusion.

Finally, partially supporting the fifth prediction, adversarial cyber victimization was more strongly associated with perceived harm of cyber victimization for boys when combined with more frequent anonymous cyber victimization, providing further evidence that anonymous cyber aggression may contribute to inflicting costs on closely matched or more powerful rivals (e.g., Weisfeld & Dillon, 2012), by potentially negating the victim's ability to defend themselves (Kowalski et al., 2014). This finding may apply only to boys because they tend to have larger social groups than girls (Geary et al., 2003), which may make it difficult to discover or identify anonymous perpetrators, creating more fear and distress (e.g., Houghton et al., 2012).

Limitations and Future Research

This research may be limited by the use of self-report questionnaires, as they can be subject to socially desirable responding and may have resulted in low endorsement of aggressive behaviour. However, relatively low means commonly appear in self-reported aggression research (e.g., Dumas et al., 2017; Goldstein, 2016; Lee & Yeager, 2019; van Geel et al., 2017; Williford & DePaolis, 2019; Wyckoff et al., 2019), and self-report questionnaires ensure that the most knowledgeable informant responds to questions about adolescents' perpetration of, and victimization by, anonymous aggression, as well as the perceived harm they have experienced as a result of victimization. Moreover, self-report questionnaires are considered the best source for

determining adolescents' personal motives for aggressing (Polman et al., 2007; Volk et al., 2014), as well as the power balances within perpetrator-victim dyads (Furlong et al., 2010; Volk et al., 2014). Another limitation may lie in the measurement of anonymous aggression without reference to power balance, which prevents differentiation between anonymous bullying and anonymous adversarial aggression. Although it would be informative to address this issue in future research, the emphasis in the current study was to explain unique variance in functions, aggressive power differentials and perceived harm due to anonymity, a facet of aggression that is conceptually distinct from form, function, and balance of power. Finally, the cross-sectional design of this research precludes conclusions about causal direction or changes over time. However, the methodology and research design in this study was sufficient to address novel questions about the relations of anonymous indirect aggression with aggressive functions, power balances within aggressor-victim dyads, and the perceived harm of victimization. Future research would benefit from using a longitudinal design to determine relations with anonymous aggression over time, and to examine how anonymous victimization may contribute to a range of harmful psychosocial outcomes, including internalizing problems, suicidal ideation, and school and peer problems.

Conclusions and Implications

This research provides an evolutionary perspective on anonymous indirect aggression, showing that it is fairly common among early adolescents, associated with evolutionarily relevant functions of relational and cyber aggression, strongly related in cyber form to aggression against rivals, and linked to victim perceptions of harm. Notably, anonymous indirect aggression is primarily associated with aggressive functions that seek to increase social standing and mate value relative to peers, which may also indicate that anonymity is a strategy perceived to

minimize risks of incurring reputational costs. Observed links between anonymous aggression and involvement in adversarial aggression in cyber form, and reactive functions in relational form, suggest that anonymous aggression may also be used to target powerful rivals, potentially mitigating the retaliatory costs of an unfavorable power balance. However, consistent links between anonymous aggression and cyber and relational bullying indicate that anonymity may also help to offset reputational costs (e.g., being perceived as cowardly; Hoff & Mitchell, 2009; DeSmet et al., 2013; Smith et al., 2008) and sanctions (e.g., punishment or peer rejection; Coyne et al., 2006; Salmivalli et al., 2000) for perpetrators aggressing from a favorable position. Finally, anonymous aggression may inflict costs on targets of aggression beyond that related to victimization by known perpetrators. However, there were important gender differences, with girls' anonymous aggression being more strongly associated with impression management functions and relational bullying, and anonymous victimization being more strongly associated with girls' perceptions of harm. These findings are consistent with parental investment and reciprocal altruism perspectives which highlight that, on average, girls are risk averse in their use of aggression and would therefore be more motivated to minimize retaliatory, reputational and social costs (Archer, 2009; Geary et al., 2003), and more likely to experience harm as a result of social victimization (Cénat et al., 2014; Coyne et al., 2006; Soenens et al., 2008; Wyckoff et al., 2019; Yang et al., 2021), especially when it cannot be resolved (Geary et al., 2003; Wright, 1982).

This research has important implications for interventions that seek to reduce indirect aggression. For example, anti-bullying interventions that focus on reducing peer acceptance of bullying and aggression, like the KiVa program (Salmivalli et al., 2011), may help to reduce the benefits of anonymous aggression for impression management functions and the likelihood that

bystanders will reinforce or assist an aggressor who is anonymous to the victim, and potentially increase the likelihood that they report the aggressor to authorities. In the case of anonymous cyber aggression, which has been associated with disinhibition (Varjas et al., 2010; Zimmerman & Ybarra, 2016) and greater confidence about not getting caught (Wright, 2014), intervention strategies that focus on reducing adolescents' perceptions of anonymity in online contexts may be effective, as suggested by previous research conducted in a college sample (Barlett et al., 2020). Such intervention strategies have the potential to decrease adolescents' involvement in anonymous indirect aggression by creating an unfavorable cost-benefit ratio, consistent with evolutionary views that aggression may only be adaptive when used strategically in favorable circumstances (Bjorklund & Hawley, 2014; Buss & Shackelford, 1997).

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CHAPTER 5: GENERAL DISCUSSION

In recent years, there has been increasing support for the evolutionary contention that aggression can function as a means to compete for resource control, dominance, and social status, facilitate intrasexual competition and intersexual selection, inflict costs on rivals, as well as deter or defend against aggression (e.g., Archer, 2009; Buss & Shackelford, 1997; Smith, 2020; Vaillancourt, 2013; Volk et al., 2012; 2014). Although these proximate functions may not map directly onto ultimate evolutionary functions of survival and reproduction, they may indirectly and probabilistically increase the likelihood of these outcomes (Volk et al., 2012; 2014). However, aggression is thought to be adaptive in a narrow sense, as it may only be adaptive as a means to pursue the specific functions for which it is well suited (as listed above), rather than being generally beneficial. Furthermore, it is an antisocial strategy that can hinder social relationships, as evidenced by its links to various social costs or disadvantages (e.g., Hawley, 2011). Indeed, consistent with previous research demonstrating that adolescent aggression is linked to greater social dominance (Traditional: Pellegrini et al., 1999; Reijntjes et al., 2013a), social status (Traditional: Juvonen et al., 2004; Lee et al., 2018), and perceived popularity (Traditional: De Bruyn et al., 2010; Reijntjes et al., 2013b; Thunfors & Cornell, 2008; Vaillancourt et al., 2003; Cyber: Badaly et al., 2013; Wegge et al., 2016; Wright, 2014), as well as more dating and sexual behaviour (Traditional: Arnocky & Vaillancourt, 2012; Vaillancourt, 2013; Volk et al., 2015; Cyber: Lapierre & Dane, 2020), Study 1 demonstrated that involvement in cyber aggression was associated with previously understudied evolutionarily relevant social advantages (i.e., more social dominance and dating experiences) that are consistent with the expected aggressive functions related to competition (e.g., dominance) and impression management (e.g., attracting mates). Moreover, in line with the evolutionary framework

conceptualizing aggression as a tool to solve various adaptive problems that humans have encountered throughout our evolutionary history (e.g., Archer, 2009; Buss & Shackelford, 1997; Smith, 2020; Vaillancourt, 2013; Volk et al., 2012; 2014), Studies 2 and 3 showed that aggressive adolescents are more likely to report using aggression as a means to pursue a range of functions that theory and research suggest are of evolutionary significance, including impulsive, proximate functions (e.g., sadistic and reactive functions) that may advance evolutionarily relevant goals without conscious reflection on those outcomes, and goal-directed proximate functions, such as gaining dominance, deterring aggression from others, and facilitating intrasexual competition (i.e., competitive functions), or achieving social status and facilitating intersexual selection (i.e., impression management functions), which may indirectly contribute to the achievement of ultimate goals related to survival and reproduction.

Although the evidence presented above supports the contention that aggression may function as a means to strive for or achieve evolutionarily relevant social advantages, evolutionary theory and research further suggests that its adaptiveness would be subject to various conditions, including the characteristics of the aggression, perpetrator, context, and target. This is because aggression may be a facultative adaptation manifested in certain environmental contexts (Eisner & Malti, 2015; Underwood, 1954), and may only be conditionally adaptive for individuals who use it selectively and effectively (see Volk et al., 2012). Therefore, in a series of three studies, this dissertation extended evolutionarily based research by investigating the conditions under which aggression may be adaptive (in a narrow, evolutionary sense) for adolescents, as indicated by associations with proximate evolutionarily relevant advantages or functions that may probabilistically and indirectly increase the likelihood of achieving ultimate evolutionary goals. In particular, the conditional adaptiveness of

adolescents' aggression was examined in relation to aggression characteristics (i.e., aggressive form, functions, and degree of anonymity), target characteristics (i.e., power held by target relative to perpetrator), and perpetrator characteristics (i.e., gender, and experience of victimization). In general, the results of this dissertation were largely consistent with predictions based on evolutionary theory and suggest that the relations between adolescents' aggression and various indicators of adaptiveness were affected by these conditions, potentially impacting the cost-benefit ratio of aggression.

Adaptiveness and Aggression Characteristics

Across all three studies, it was evident that both traditional and cyber forms of aggression were motivated by proactive and reactive functions. Indeed, Study 1 demonstrated that adolescents involved in cyber aggression were motivated by both proactive and reactive functions, although some adolescent cyber aggressors were more frequently motivated by reactive than proactive functions. Studies 2 and 3 extended this research to find that adolescents' involvement in direct, relational, and cyber forms of aggression was linked to various evolutionary functions, as evidenced by their relations with competitive, impression management, sadistic, and reactive functions. These findings are consistent with previous research linking traditional and cyber forms of aggression to various proactive and reactive motives (e.g., Ang et al., 2014; Fluck, 2017; Runions et al., 2017; 2018; Sijtsema et al., 2009; Smeets et al., 2017; Thomson & Centifanti, 2018), but also extend this work by examining a wider range of evolutionary functions (Studies 2 and 3). Findings from this research suggest that although cyberspace is a relatively new context for social communication that did not exist in the environment of evolutionary adaptation (e.g., Li et al., 2020; Volk et al., 2012), adolescents seem to use both traditional and cyber forms of aggression similarly to strive for benefits that have

evolutionary significance. Selection pressures that operated on verbal and relational forms of traditional aggression throughout human evolutionary history (see Volk et al., 2012) would likely facilitate their continued use in modern contexts, like cyberspace, because evolved psychological mechanisms, such as anger, jealousy, and pride, may trigger aggressive tendencies in relevant contexts (e.g., competition for status and mates), prompting the use of similar strategies using modern electronic devices (Buss & Shackelford, 1997; Eisner & Malti, 2015; Smith, 2020). Indeed, emotions such as these have been reported as contributors to adolescents' cyber aggression perpetration (Dennehy et al., 2020; Varjas et al., 2010). Moreover, these psychological mechanisms may even trigger the use of new methods of derogating targets online (e.g., sharing embarrassing photos/videos of the target, or hacking/impersonating the target; Kowalski et al., 2014), just as these evolved tendencies operate in modern, in-person contexts, wherein physical aggression can now also be expressed through modern weapons, such as guns, in addition to the use of fists, knives, or spears. However, the functionality of traditional and cyber forms of aggression does seem to differ based on the characteristics of the target (i.e., victim's power relative to perpetrator), and the perpetrator (i.e., gender), as discussed below.

Study 1 further suggested that adolescents' relative use of proactive and reactive cyber aggression may impact the adaptiveness of cyber aggression, as suggested by differential associations with concurrent social advantages and disadvantages. More specifically, Study 1 demonstrated that adolescent cyber aggressor-victims who were involved in moderate levels of proactive and reactive cyber aggression were more likely to report evolutionarily relevant social advantages such as greater social dominance and dating behaviour, whereas those who were more highly involved in reactive cyber aggression were likely to experience social disadvantages, as indicated by low implicit social power (e.g., admiration and respect) and

greater friendship anxiety. These findings are consistent with theory and previous traditional aggression research in suggesting that aggression motivated by proactive functions is more often associated with social advantages because it is goal-directed and enacted in a controlled manner, whereas aggression motivated by reactive functions is more often associated with social disadvantages due to its links to emotional dysregulation and impulsivity (Hubbard et al., 2010; van den Berg et al., 2019). Given that highly reactive and mixed cyber aggressor-victims were equally involved in proactive cyber aggression and cyber victimization in Study 1, reactive cyber aggression appears to be driving the association with social disadvantages, consistent with longitudinal research demonstrating that increases in traditional reactive aggression are related to increases in unpopularity and victimization (Cooley et al., 2018; Frey & Higheagle Strong, 2017; Salmivalli & Helteenvuori, 2007; van den Berg et al., 2019), and decreases in popularity over time (van den Berg et al., 2019), and correlational research linking reactive aggression to peer difficulties (e.g., Card & Little, 2006; Poulin et al., 1999). Taken together, it appears that high levels of reactive aggression may be less likely to achieve adaptive benefits in contemporary contexts, partly because it is enacted emotionally and impulsively, rather than in a controlled and planful manner. Furthermore, it may be more costly because it is directed toward the provocateur rather than a strategically selected and potentially easier target. Therefore, although adolescents perpetrate cyber aggression for both proactive and reactive functions, the degree with which they engage in cyber aggression for each function may impact the adaptiveness of their cyber aggression involvement.

Finally, Study 3 demonstrated that anonymity is associated with the functionality of aggression in relational and cyber forms and may be an effective way to harm victims while minimizing risk. In contrast to Study 2, which found that relational and cyber forms of

aggression were positively associated with various evolutionary aggressive functions (i.e., competitive, impression management, sadistic, and reactive functions), Study 3 found that anonymous aggression was most consistently associated with impression management functions in both relational and cyber form, and to reactive functions only in relational form. Generally, the results from Studies 2 and 3 suggest that identifiable perpetration may be better suited to achieving proactive functions that are motivated by dominance, such as competitive or sadistic functions. This is likely because identifiable perpetration would send a stronger costly signal to victims and bystanders when displaying dominance to develop an intimidating or fearsome reputation and deter future victimization (i.e., competitive functions; Volk et al., 2014). Furthermore, identifiable perpetration may amplify the sadistic enjoyment achieved through harming a victim (i.e., sadistic functions; Pinker, 2011, p. 550; Russell, 2019), as suggested by the negative link between girls' anonymous relational aggression and sadistic functions in Study 3.

On the other hand, anonymous perpetration appears to be better suited for proactive impression management functions, such as status or mate seeking, presumably because anonymity enables the aggressor to control their audience to hide their actions from bystanders who are likely to disapprove or retaliate and display their actions to those who are likely to approve. As a result, anonymous perpetration can mitigate negative sanctions and reputational costs often associated with aggression (e.g., low peer liking and preference; de Bruyn et al., 2010; Fisher et al., 2010; Ingram, 2014). Additionally, Study 3 found that anonymous victimization was uniquely associated with perceptions of harm for victims of both genders in relational form, and only for girls in cyber form, which suggests that anonymous perpetration may also maximize benefits for the aggressor by successfully inflicting harm which could

diminish the reputation of competitors relative to their own, and potentially induce the target to withdraw from competition. In sum, these results suggest that anonymous perpetration may be a condition associated with the adaptiveness of aggression and may improve the cost-benefit ratio of indirect aggression by maximizing social and reputational gains while minimizing potential costs, which are of particular importance for adolescents in general (Houghton et al., 2012; Ingram, 2014; Mishna et al., 2010), but possibly to a greater extent for girls than boys, as discussed below.

Adaptiveness and Target Characteristics

According to Studies 2 and 3, adolescents' aggression against different targets was differentially associated with evolutionarily relevant aggressive functions. Consistent with the goal-directed nature of bullying (Volk et al., 2014) and previous research (Fluck, 2017; Pronk & Zimmer-Gambeck, 2010; Runions et al., 2017; 2018; Varjas et al., 2010), Study 2 demonstrated that both traditional and cyber forms of bullying were consistently associated with appetitive proactive functions of aggression. These findings suggest that bullying may be an adaptive means to signal dominance and power over others and deter aggression from rivals (i.e., competitive functions), coerce the target to yield desirable resources, or to signal desirable qualities to potential mates (i.e., impression management functions), and to achieve enjoyment (i.e., sadistic functions), at minimal risk of retaliation or social costs (Veenstra et al., 2010; Volk et al., 2014; 2021). Moreover, in comparison to adversarial aggression, bullying was less strongly and consistently associated with aggression serving as self-defence in response to immediate threat (i.e., reactive functions), possibly because provocation from a low-powered peer may not be perceived as a threat that merits immediate retaliation. In contrast, adolescents' involvement in adversarial aggression was most consistently linked to aggressive functions with

aversive motives, namely competitive and reactive functions. Such findings suggest that the rationale for targeting victims of equal or greater power, despite the risks, may be to compete with rivals for dominance, impose costs on rivals, defend one's social prerogatives against threats, and pre-emptively deter future victimization through intimidation (i.e., competitive functions), as well as retaliate in response to provocation (i.e., reactive functions).

Although adversarial aggression holds greater risks for the aggressor due to their lack of power advantage (Meloy, 2005; Weisfeld & Dillon, 2012), this research suggests that adversarial aggression may be an adaptive means to compete with rivals through competitive and reactive functions, but may not be as adaptive or functional as a means to achieve impression management or sadistic functions. Adversarial aggression may facilitate the achievement of competitive goals because taking potential risks to aggress against powerful targets can send stronger costly signals of dominance to rivals and bystanders if the perpetrator wins when targeting a closely matched competitor (e.g., Weisfeld & Dillon, 2012). Furthermore, by directing aggression toward rivals who pose a threat or have previously targeted the aggressor, adversarial aggression may also deter future victimization (e.g., Babcock et al., 2014) by inflicting costs on rivals, potentially affecting a rival's whereabouts and willingness to compete against the aggressor (e.g., Vaillancourt, 2013; Weisfeld & Dillon, 2012). Although one cannot infer from this research that these advantages are achieved by using aggression for these functions, previous research suggests that adversarial aggression may provide advantages with respect to obtaining and maintaining status (Andrews et al., 2017; Malamut et al., 2020; Peets & Hodges, 2014), and access to mates (for adolescents involved in both cyber aggression and cyber victimization; Lapierre & Dane, 2020). Moreover, popular adolescent aggressors who prioritize popularity are likely to target victims of high status (Malamut et al., 2020), presumably to

maintain or increase their status relative to their rivals. Taken together, this research suggests that adversarial aggression may be a conditionally adaptive means for some adolescents to achieve or maintain competitive advantages. Therefore, both bullying and adversarial aggression may yield adaptive benefits for some adolescents but only if they are used for appropriate purposes, such that bullying may be more functional than adversarial aggression as a means to achieve purely appetitive functions (e.g., impression management and sadistic functions), whereas adversarial aggression may be most useful as a means to counter provocation and threats by rivals and defend social prerogatives.

Furthermore, the importance of aggressing strategically against appropriate targets also seems to hold true for anonymous perpetration in relational and cyber form. Study 3 found that whereas cyber and relational forms of bullying were associated with anonymous perpetration, adversarial aggression was only associated with anonymous perpetration in cyber form. This is likely because cyberspace can shift unfavorable power balances in the aggressor's favor by nullifying traditional sources of power (Kowalski et al., 2014), and make anonymity easier to achieve without social power (e.g., Lowry et al., 2016). Together with the fact that anonymous cyber aggression can inflict harm on victims over and above adversarial cyber victimization at the hands of known cyber aggressors (Study 3), these results suggest that anonymous cyber aggression may be a particularly adaptive means to target and harm rivals, especially for girls, as discussed below.

Adaptiveness and Perpetrator Characteristics

Across all three studies, it was clear that perpetrator characteristics, such as their experiences of victimization and gender, may impact the adaptiveness of aggression. Regarding experiences of victimization, research on traditional aggression often distinguishes between pure

bullies and bully-victims and comparisons between these bullying-victimization status groups suggest that pure traditional bullying is often more strongly and consistently associated with evolutionarily relevant benefits, whereas bullying-victimization is more strongly and consistently associated with social disadvantages or costs (Volk et al., 2012; Smith, 2020). Therefore, Study 1 assessed cyber victimization alongside cyber aggression perpetration to investigate whether the experience of victimization similarly affects relations between aggression and adaptive benefits in the cyber context. However, unlike empirical traditional aggression research which often identifies groups of pure bullies and bully-victims (Jenson et al., 2013; Lam et al., 2015; Lovegrove & Cornell, 2014; Lovegrove et al., 2012; Pan et al., 2017; Shao et al., 2014; Young Chung & Lee, 2020), the results from the latent class analysis conducted in Study 1 demonstrate that adolescents' experiences of cyber aggression and victimization tend to co-occur, consistent with theory and previous research suggesting that the indirect and less risky nature of aggression in cyberspace can make it more amenable to cycles of victimization and retaliation (Betts et al., 2017; Festl et al., 2017; Kowalski et al., 2014; Lowry et al., 2016; Martinez-Monteagudo et al., 2020; Schultze-Krumbholz et al., 2015; Ybarra & Mitchell, 2007).

Thus, by using empirical, person-centered approaches to establish cyber aggression-victimization status groups, rather than non-empirical procedures based on a priori assumptions, the current research illuminates the importance of considering aggressive form when examining adolescents' involvement in aggression and victimization. Additionally, although much previous traditional empirical research focused on bullying, which is conceptualized as a subtype of proactive aggression (Volk et al., 2014), Study 1 and some previous cyber aggression research (i.e., Betts et al., 2017; Martinez-Monteagudo et al., 2020; Schultze-Krumbholz et al., 2015) assessed aggression more generally, which is often motivated by both proactive and reactive

functions (Eisner & Malti, 2015; Smeets et al., 2017; Thomson & Centifanti, 2018). Indeed, Study 1 identified two groups of cyber aggressor-victims who engaged in both proactive and reactive cyber aggression, with one group being more highly involved in reactive aggression. Given that involvement in traditional reactive aggression is more strongly linked with bully-victim status as opposed to pure bully status (Runions et al., 2018; Salmivalli & Nieminen, 2002), it is not surprising that Study 1 and some previous research mainly identified groups of cyber aggressor-victims but not pure cyber aggressors. Interestingly, however, the experience of cyber victimization in Study 1 seemed to affect relations with associated social advantages and disadvantages differently than the typical pattern found in traditional contexts. More specifically, because the identified groups did not differ in their experience of cyber victimization, reactive aggression seemed to play the most important role in the differential relations between cyber aggression-victimization involvement and associated social advantages and disadvantages, as noted above. Thus, it seems that the experience of cyber aggression-victimization is not necessarily associated with social disadvantages, in contrast to previous traditional (Schwartz et al., 2001; Smith, 2020; Volk et al., 2012) and cyber (Bonanno & Hymel, 2013; Lee et al., 2021; Martinez-Monteagudo et al., 2020) research.

Interestingly, the power of the perpetrator who victimizes the adolescent seems to affect relations between victimization experiences and the perpetration of aggression for evolutionarily relevant purposes. In both Studies 1 and 2, adolescents who experienced victimization were also likely to use aggression to achieve proactive and reactive functions. However, according to the results of Study 2, adversarial victimization was most consistently associated with using aggression to pursue competitive functions, suggesting that adolescents who are often victimized by rivals, as opposed to bullies, likely use aggression for competitive functions in the context of

competition with jealous rivals who present as threats to their social prerogatives (e.g., Weisfeld & Dillon, 2012). This interpretation is consistent with previous research demonstrating that adolescents who hold social advantages, such as popularity/prestige (Andrews et al., 2016; Closson et al., 2017; Gradinger et al., 2012; Malamut et al., 2020), and access to dates/mates (Dane et al., 2017; Gallup et al., 2009; Leenaars et al., 2008; McComb & Dane, 2019; Volk et al., 2015), are at risk of experiencing victimization. Moreover, for girls, physical attractiveness (Arnocky et al., 2012; Reynolds et al., 2018) and provocative dress (Keys & Singh Bhogal, 2018; Reynolds et al., 2018; Vaillancourt & Sharma, 2011) are also associated with risk of victimization. These findings are likely due in part to jealousy, as indirect aggression has been positively associated with adolescent girls' body mass index (Gallup & Wilson, 2009) and concerns about being less attractive than their peers (Arnocky et al., 2012; Morgan et al., 2021). Thus, the experience of adversarial victimization may trigger adolescents' use of competitive aggression as a facultative, conditionally adaptive response, when it is necessary to defend one's social prerogatives from rivals who threaten them (e.g., Weisfeld & Dillon, 2012).

Likewise, both bullying victimization and adversarial victimization were associated with reactive functions of aggression, potentially because the experience of victimization may trigger the use of reactive aggression as a means of self-protection (e.g., Babcock et al., 2014; Meloy, 2005). However, because associations with reactive functions were more consistent for adversarial victimization than bullying victimization, it seems that provoked, emotional, and impulsive aggressive responses are less likely from those who have been bullied in cyber or direct forms. Overall, these results suggest that victims of bullying may be more passive than victims of adversarial aggression, perhaps lacking power to effectively retaliate with aggression to defend themselves and deter future attacks (Lovegrove & Cornell, 2014; Menesini et al., 2009;

Olweus, 1994). Therefore, victims of bullying may not necessarily benefit from the defensive advantages of reactive aggression. Combined with the fact that bullying victimization was not associated with competitive functions in any aggressive form, these results suggest that the power disadvantage experienced by victims of bullying may diminish the adaptiveness of retaliatory or competitive aggression because the costs of aggressing against high-powered peers may outweigh potential benefits of self-defence and aggression deterrence. Furthermore, it is also possible that the use of reactive aggression may place socially vulnerable adolescents at risk for bullying victimization as they are more often perceived as aversive to peers (Hubbard et al., 2010).

Studies 2 and 3 also demonstrate that the adaptiveness of aggression may depend on the gender of the perpetrator. For example, in Study 2, cyberbullying was more strongly linked to competitive functions for girls than for boys, whereas adversarial cyber aggression was only associated with competitive functions for boys. Together with the fact that adversarial cyber aggression was more strongly linked to reactive functions for girls than for boys, these findings suggest that girls may use risky cyber aggression against equally or more powerful peers mainly when provoked and acting impulsively and emotionally, but use the less risky type of cyber aggression (i.e., cyberbullying) to compete for resources and dominance. Additionally, according to Study 3, anonymous cyber aggression was only associated with impression management functions for girls and the link between relational bullying and anonymous relational aggression was stronger for girls. Taken together, the results from Studies 2 and 3 suggest that girls may be more risk averse in their use of aggression than are boys, as they were more likely to use aggression against vulnerable victims unless provoked into responding in an emotional and impulsive manner, and to bully anonymously. Girls may be more likely to use anonymous cyber

aggression to impress bystanders because they are more cognizant than boys of mitigating the social or reputational costs of cyber aggression. Additionally, stronger links between girls' relational bullying and anonymous perpetration suggest that girls may use anonymity to further reduce their chances of incurring social and reputational costs, even in situations with a favourable power balance. These gender differences are in line with evolutionary perspectives contending that, in general, girls are more risk averse and less competitive than boys, in part due to their greater obligatory parental investment and greater historical reliance on social support received from non-kin relationships (Archer, 2009; Bjorklund & Hawley, 2014; Ellis et al., 2012; Geary et al., 2003). As a result, theory and research suggest that girls would prefer using less risky indirect aggression (Campbell, 2013; Davis et al., 2018; Lee et al., 2018; Monks et al., 2009; Vaillancourt, 2013) to mitigate risk of physical and reputational harm to ensure their survival (and that of any offspring) and access to important social resources (Archer, 2009; Geary et al., 2003; Rose & Rudolph, 2006).

Finally, although Study 3 suggests that anonymous aggression can be an adaptive means to inflict harm on victims, as evidenced by its unique links in both relational and cyber form to victims' perceptions of harm beyond the contribution of victimization by known perpetrators, it may be more useful for girls than boys in cyber form. More specifically, anonymous cyber victimization was uniquely associated with greater perceived harm for girls but not boys. Generally, these findings align with evolutionary theory and research suggesting females may be more negatively impacted by social forms of victimization (Benenson, 2016; Geary et al., 2003; Rose & Rudolph, 2006) because selection pressures throughout humans' evolutionary history have made them more reliant on close and supportive non-kin social relationships and less tolerant of conflict and violations of reciprocity within their social relationships (Benenson,

2016; Geary et al., 2003). Moreover, because adversarial cyber victimization, but not cyberbullying victimization, was associated with increased perceived harm for victims, this research suggests that anonymous cyber aggression may be a particularly adaptive means for adolescent girls to inflict harm on closely matched or more powerful rivals to potentially induce their withdrawal from competition while minimizing the risk of retaliation. Taken together with previous research demonstrating that girls are more likely to benefit from indirect forms of aggression (Badaly et al., 2013; Dane et al., 2017; Gallup, 2017), these findings suggest that cyber aggression may be particularly adaptive for girls, as it can improve the cost-benefit ratio of aggression by inflicting harm on the victims while reducing the chances of incurring physical and reputational harm, which are of particular concern for girls.

Limitations and Future Directions

Although the research within this dissertation highlights some important factors that may impact the adaptiveness of adolescent aggression, there are some limitations to note. First, all three studies could potentially be limited by their homogeneous, predominately white samples recruited from community groups and schools in Southern Ontario; future research should aim to observe more ethnically diverse samples to determine whether these results are generalizable to more diverse populations of adolescents. Furthermore, because previous research suggests that ethnicity (Law & Shapka, 2013; Monks et al., 2009; Wang et al., 2009; Ybarra et al., 2014), culture (e.g., Volk et al., 2015; 2019), school/classroom characteristics (e.g., Cook et al., 2010; Pan et al., 2020; Zych et al., 2018), and age (Barlett & Coyne, 2014; Cook et al., 2010; Kowalski et al., 2014) can play a role in adolescents' involvement in aggression and victimization, future research may wish to concurrently and longitudinally examine the impact of contextual characteristics (e.g., socio-ecological context, developmental period) that can affect adolescents

involvement in aggression and its associations with evolutionarily relevant aggressive functions and social advantages/disadvantages.

Another potential limitation is that all three studies relied on self-reported measures, which can be limiting due to socially desirable responding and shared method biases (see Volk et al., 2017). However, self-report questionnaires may be the best method to assess many of the variables of interest within this dissertation, as they ensure that the most knowledgeable informant (i.e., the adolescent) reports on covert behaviours, intentions, and outcomes of which other informants may be unaware. Indeed, adolescents are considered the best informants to judge the frequency with which they perpetrate or are victimized by covert behaviours (e.g., indirect and anonymous aggression), the functions that motivate their aggression involvement (Polman et al., 2007; Volk et al., 2014), the power balances within the aggressor-victim dyad (Furlong et al., 2010; Volk et al., 2014), their involvement in dating and sexual behaviour, as well as the perceived harm they've experienced as a result of victimization. However, to minimize the potential limitations associated with self-report measures, future research could also include peer or teacher reports to provide different perspectives (Volk et al., 2017). Another methodological limitation to note is that the cross-sectional research designs utilized in all three studies precludes inferences about direction of causation for this research. Because it is possible that the observed associations are bidirectional in nature, future research could use a longitudinal, cross-lagged panel design to investigate bidirectional effects. Similarly, future research could also aim to utilize more empirical, person-oriented research designs to better understand adolescents' patterns of aggression involvement with regards to the aggressive functions it may serve or the balance of power in which it occurs.

Finally, because Studies 2 and 3 examined the conditional adaptiveness of aggression with respect to its association with evolutionary aggressive functions rather than adaptive social advantages as done in Study 1, it is not clear from these measures whether the benefits associated with each aggressive function were achieved. Despite this potential limitation, examining the intent behind adolescents' aggression involvement is still beneficial because it provides insight into what they expected to achieve and what motivated their involvement in aggression (e.g., Crick & Dodge, 1994). Moreover, given that previous research (e.g., Farrell & Dane, 2019; Hubbard et al., 2010; Poulin & Boivin, 1999; Prinstein & Cillessen, 2003; Vaillancourt & Hymel, 2006; van den Berg et al., 2019), as well as Study 1 of this dissertation, have differentially linked proactive and reactive aggression to various evolutionarily relevant social advantages and disadvantages, it is likely that adolescents use of aggression for the evolutionary functions assessed in Studies 2 and 3 would be similarly associated with advantages or disadvantages under certain conditions, but this contention should be investigated further.

Conclusions and Implications

In conclusion, the results of this dissertation are largely consistent with evolutionary perspectives highlighting the utility of aggression to solve various adaptive problems for which it would be well-suited, including negotiating dominance and status hierarchies, facilitating intrasexual competition and inflicting costs on rivals, facilitating intersexual selection by attracting mates, pre-emptively deterring or defending oneself against aggression, and gaining access to social and material resources (Buss & Shackelford, 1997; Volk et al., 2012). Indeed, the results of this dissertation demonstrated that adolescents' aggression was linked to various evolutionarily relevant aggressive functions motivated by competitive (e.g., aggression deterrence and intrasexual competition), impression management (e.g., seeking status and

mates), sadistic (i.e., enjoyment), and reactive (e.g., impulsive response to real or perceived threats) functions (Studies 2 & 3). Furthermore, adolescents' aggression was also linked to evolutionarily relevant social advantages, such as social dominance and dating behaviour, for some aggressors (Study 1), and is perceived by victims to inflict significant harm (Study 3). Combined, these findings generally suggest that adolescents' aggression may be adaptive, in a narrow evolutionary sense, as it can address various adaptive problems for which it is well suited, as outlined above, but also may be associated with social costs/disadvantages for some perpetrators (Study 1) and for victims (Study 3). Such findings support the contention that aggression can be dysfunctional or contribute to maladjustment in areas beyond its intended functions (e.g., establishing high quality, cooperative relationships; Hawley, 2011), as well as when it is used in unfavorable contexts (see Volk et al., 2015) or by individuals who lack the wherewithal to use aggression effectively (e.g., Hubbard et al., 2010). Indeed, the adaptiveness of adolescents' aggression appears to be conditional, depending on the characteristics of the aggression (i.e., aggressive form, function, and degree of anonymity), target (i.e., power of target relative to perpetrator), and perpetrator (i.e., experience of victimization, gender).

Regarding aggression characteristics, the results of this dissertation suggest that traditional and cyber aggression generally function similarly, as indicated by their comparable links to various evolutionarily relevant aggressive functions (Studies 2 & 3) and social advantages (Study 1), despite the evolutionary mismatch between cyberspace and the environment of evolutionary adaptation in which aggressive tendencies were selected (e.g., Li et al., 2020; Volk et al., 2012). Additionally, like traditional aggression research suggesting that reactive aggression is more maladaptive than proactive aggression (e.g., Hubbard et al., 2010), the adaptiveness of cyber aggression appears to depend upon adolescents' relative use of

proactive and reactive cyber aggression, because adolescents who more frequently use cyber aggression reactively tend to report social disadvantages, including a lack of implicit social power and greater friendship anxiety, as opposed to social advantages (Study 1). Finally, contextual differences between traditional and cyber interactions may impact the adaptiveness of anonymous perpetration in the pursuit of certain evolutionary functions. Most notably, the technological preparation that is required for anonymous cyber aggression but not anonymous relational aggression (e.g., creation of a pseudonym/fake social media account, or the opportunity to gain access to peers' accounts to impersonate them) appears to impose practical constraints on the utility of anonymous cyber aggression for impulsive and unplanned reactive functions.

In terms of target characteristics, the results of this dissertation generally suggest that the power held by the target relative to the perpetrator may impact the functionality of aggression to achieve certain evolutionary aggressive functions. More specifically, bullying may be most consistently associated proactive functions of aggression that focus on obtaining or maintaining social dominance (i.e., competitive), social status and dating opportunities (i.e., impression management), and enjoyment (i.e., sadistic), whereas adversarial aggression may be most consistently associated with functions with aversive motives, because it may be necessary as a means to compete with rivals for dominance and pre-emptively defend one's social prerogatives (i.e., competitive functions) as well as engage in self-defence in response to provocation (i.e., reactive functions), despite the risks associated with aggressing without a power advantage (Study 2). However, anonymous perpetration may be useful as a means to mitigate the risks associated with adversarial aggression in cyberspace where traditional power balances can be nullified (Kowalski et al., 2014) and anonymity can be achieved and maintained without social

power (Lowry et al., 2016). Taken together, adolescents' identifiable and anonymous aggression may be used strategically in each form, for appropriate functions, and against suitable targets, to improve the likelihood that the intended function is achieved at minimal risk (Volk et al., 2012).

Finally, regarding characteristics of the perpetrator, the type of victimization experienced by an adolescent seems to be related to the functions for which they use aggression. Notably, adversarial victimization was most consistently associated with both competitive and reactive functions, whereas bullying victimization was associated with reactive functions only in relational form (Study 2). These findings suggest that although victimization in general may trigger the use of reactive aggression as a means of self-protection (e.g., Babcock et al., 2014; Meloy, 2005), victims of bullying appear more likely to be passive than victims of adversarial aggression, likely because they lack the power to effectively retaliate (Lovegrove & Cornell, 2014; Menesini et al., 2009; Olweus, 1994). Indeed, it appears that the experience of adversarial victimization may also trigger adolescents' use of competitive aggression as a facultative, conditionally adaptive response when it is necessary to maintain dominance and pre-emptively defend one's social prerogatives from threats (e.g., Dane et al., 2017; Fink et al., 2014; Weisfeld & Dillon, 2012). Finally, the perpetrator's gender also may play a role in the adaptiveness of aggression as a strategy used to achieve certain aggressive functions or inflict harm on targets. This was evident in findings demonstrating that cyberbullying was more strongly linked to competitive functions for girls than for boys, whereas adversarial cyber aggression was only associated with competitive functions for boys and to reactive functions for girls (Study 2). Additionally, anonymous cyber aggression was associated with impression management functions and to greater perceived harm only for girls (Study 3). These results are generally consistent with evolutionary perspectives contending that indirect forms of aggression may be

particularly adaptive for girls because they have evolved to be more risk averse in general (Campbell, 2013; Vaillancourt, 2013), and more reliant on close and supportive social relationships than males (Archer, 2009; Geary et al., 2003). However, this may be especially true in cyber form because technological anonymity can nullify traditional sources of power and further mitigate reputational and retaliatory harm (Kowalski et al., 2014; Lowry et al., 2016), which are of particular concern for girls.

By highlighting that adolescents' traditional and cyber aggression involvement is associated with a range of evolutionarily relevant goals (Studies 2 & 3), and with related social advantages such as social dominance or access to dates (Study 1), research such as this dissertation can clarify the purposes of, and potential payoffs associated with, adolescent aggression and may provide a basis for improving intervention efficacy, which has been limited in adolescence (e.g., Ellis et al., 2016; Gaffney et al., 2019; Yeager et al., 2015). Indeed, because current evolutionary research on aggression suggests that it can be an adaptive strategy with which to pursue various evolutionarily relevant goals, interventions designed to reduce aggressive behaviour may be limited in their efficacy because it is difficult to persuade people to eschew effective strategies to achieve goals. As such, it may be more beneficial to take the goals or payoffs reinforcing aggression into consideration when developing interventions. For example, because adolescents' involvement in traditional and cyber aggression is associated with various goal-directed, proactive functions of aggression and related social advantages, intervention efforts may wish to promote prosocial strategies as an alternative to aggressive strategies for goal attainment, to mitigate social costs associated with adolescent competition (e.g., Ellis et al., 2016). Another method to potentially reduce adolescents' involvement in aggression for proactive functions is to reduce peer acceptance and reinforcement of aggression,

to create an unfavorable cost-benefit ratio for aggression within the peer group, consequently making it a costly strategy for goal attainment (e.g., Bullo & Schulz, 2022; Salmivalli et al., 2011).

However, intervention strategies for aggression aimed at achieving impulsive or unreflective proximate motives such as enjoyment (i.e., sadistic functions) or retaliation (i.e., reactive functions) may need to be tailored to address specific challenges. Firstly, addressing sadistic aggression may be particularly challenging if the intended motive for an adolescents' sadistic aggression is purely enjoyment, rather than a specific goal like popularity or competition with rivals. In this case, attempting to replace sadistic aggression with prosocial strategies of goal attainment may be difficult since there is no specific goal other than fun. Indeed, sadistic aggression appears to be most highly rewarding when aggressor perceives that the target has suffered as a result (Chester et al., 2019), suggesting that prosocial strategies may not be an effective replacement for sadistic aggression motivated purely by enjoyment. However, if adolescents are simply not reflecting on other specific goals that motivate their sadistic aggression (e.g., dominance, revenge, intrasexual competition; Chester & Dewart, 2018; Pinker, 2011, p. 550-551), intervention strategies could aim to help adolescents become more cognizant of the specific goals they wish to achieve through sadistic aggression. By doing so, adolescents may become more willing and able to engage in problem solving techniques to select prosocial strategies of goal attainment that have a more favorable cost-benefit ratio (e.g., Crick & Dodge, 1994; Larson & Lochman, 2010).

Furthermore, because moral disengagement can contribute to sadistic aggression (e.g., Nocera et al., 2021), moral reasoning training may help to encourage sadistic aggressors to acknowledge the harm inflicted on the victims with the aim to reduce their perpetration of

sadistic aggression by inducing feelings of guilt or empathy. In fact, arousing feelings of empathy for the victim have been shown to increase bullies' intentions to stop bullying in the future (Garandea et al., 2016), as well as reduce the likelihood of negative bystander behaviour online (Barlinska et al., 2013). Additionally, because some aggression is done for fun with friends, bystander-focused interventions that address peer responses to aggression may reduce the reinforcement and assistance that makes aggression fun (e.g., Salmivalli et al., 2011).

On the other hand, in the case of reactive functions of aggression, which are often associated with greater social costs/disadvantages than are proactive functions (e.g., Study 1; Farrell & Dane, 2020; van den Berg et al., 2019), it may be easier to persuade reactive aggressors to employ alternative strategies through a problem-solving approach. This may be especially true for adolescents involved in reactive aggression in response to bullying victimization, as their retaliation is likely an ineffective strategy against more powerful peers (e.g., Hubbard et al., 2010). However, because reactive aggression is an emotional and impulsive response to provocation, self-control skills training may be needed to improve the efficacy of problem-solving skills training, especially for those who experience social vulnerability and emotional dysregulation (e.g., Larson & Lochman, 2010).

Finally, since anonymous cyber aggression is often associated with feelings of disinhibition (Varjas et al., 2010; Zimmerman & Ybarra, 2016) and greater confidence about not getting caught when aggressing online (Wright, 2014), adolescents' involvement in cyber aggression may be best addressed by reducing their perceptions of anonymity in online contexts (Barlett et al., 2020). In sum, the results of this dissertation broaden and strengthen research from an evolutionary perspective by offering important insights into what motivates adolescent aggression and how it can be conditionally adaptive for some adolescents. As such, future

research may wish to incorporate an evolutionary perspective to better understand why adolescent aggression often persists despite the implementation of intervention strategies and the widespread concern and disapproval expressed by parents, educators, and policy makers.

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APPENDICES

APPENDIX A: Parental Form (Study 1)

Adolescent Relationships Parental Form

Please keep this form for your records.

Principal Investigator:

Dr. Anthony Volk, Professor

Department of Child and Youth Studies

Brock University

905-688-5550 xt. 5368

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INVITATION

Your son/daughter has been invited to participate in a study that involves research into adolescent relationships. The purpose of this study is to better understand how adolescent relationships in one domain (e.g., parents) influence their relationship in another (e.g., personality, school, or peers). What follows are the specific goals of the study.

We are interested in exploring factors associated with adolescent social relationships including personality, peer relationships, and school factors. For instance, we are interested in how an adolescent's individual traits, such as personality, influence the likelihood that they will be a bully and/or a victim. So far, no one has looked at most of these factors in teenagers, and no one has looked at the combination of all these factors. We believe that answering these questions will give us a much better idea of what factors are involved in adolescent social relationships. We would like to note that a small number of the questions are about violence, sexual activity and related behaviors.

WHAT'S INVOLVED

As a participant, your son/daughter has been asked to fill out questionnaires about themselves, their friends, their peers, their parents, and their basic demographics (e.g., age) on an online survey website. Participation will take approximately 45-50 minutes of their time. Only the researchers will see these responses, and the only ties to participant names will be a unique Identification (ID) number that will be used to confirm participation so that participants can receive \$15 cash for participating. The ID number will not be linked to any other responses to the questionnaires. They will only be linked to participant names on the consent forms, which will be stored separately in a filing cabinet separate from questionnaire responses. The original consent form, which includes the unique identification number, will only be removed from the filing cabinet in the event that the participant chooses to withdraw from the study. In such an event, the removed identification number will be used to identify the participant's response in the questionnaire database, and the data will be deleted.

POTENTIAL BENEFITS AND RISKS

Possible benefits of participation include getting to know their own relationships better, and learning more about adolescent relationships in general through reflection on some of the participants' own relationships. There also may be risks associated with participation in that some relationships are stressful to think about. If they find any part of this study to be stressful, they may contact the researcher, the Brock University Ethics board, or simply stop their participation. We also tell your son/daughter that "[they] may also freely discuss the study with parents or friends if [they] need to, although we would ask that [they] try not to talk to someone before [they] complete the study on [their] own (e.g., don't share answers until both have completed the study). Sharing answers before the study ends can complicate and/or change their own natural answers. We do not ask any specific questions regarding specific incidents, **so there are no issues of personal or legal liability for any of your son/daughter's answers, nor are we legally obligated to disclose any of their answers (including abuse or harm) to our questions.**

All participants will be offered \$15 cash for their participation. They will receive this payment once the completed forms are returned. Once receiving the \$15, participants will have to sign a sheet for our records indicating you have received the payment.

CONFIDENTIALITY

Participants in this study will only be identified by a unique number that is tied to a master list kept by Dr. Volk. You, or they, may request the withdrawal of their data from the study within 5 years of their participation. Unique, identifiable data (such as date of birth, names) will not be collected.

As a parent, you will have to consent to your son/daughter's participation, **but you will not gain access to their answers. You may only control whether WE are able to view their answers or not by providing or withdrawing your consent.** *We feel that it is very important for the participants in our study to be able to know that their answers are completely confidential.* This will hopefully encourage them to be as honest as possible so we can really understand what is going on in their relationships. To this end, we again ask that you don't discuss the study with your son/daughter until they have completed it in order to avoid biasing their answers. Once the study is completed (i.e., after they have filled in and handed in the forms), you may of course discuss any related topic you feel fit. In the final form explaining the study, we encourage participants to talk to people whom they trust (including parents) about any related issues.

Data collected during this study will be stored on a secure computer and hard copies of forms will be kept in a locked filing cabinet. Data will be kept for five years, after which time the data will be deleted. Access to this data will be restricted to Dr. Volk and his collaborators, who have signed confidentiality agreements. Parents, friends, and participants will not have access to any individual data, although they may have access to the overall study results.

The researchers will own all data collected through Qualtrics and therefore all information will be confidential. Qualtrics data are temporarily stored in the United States and therefore is subject to the Homeland Security or Patriot Act. However, data will be downloaded daily on a secured Canadian server onto a password protected lab computer. Once data is downloaded in the lab, the data will be immediately deleted off from Qualtrics.

VOLUNTARY PARTICIPATION

Your teenager's participation is voluntary. They need not participate, even if you give parental consent. There are no organizational or personal consequences for not participating other than not receiving the \$15. **Again, as a parent,**

you do NOT have access to your adolescent's individual results. You control whether or not we are able to view them by providing or withdrawing your consent for their participation. In the event of withdrawal, data will be confidentially destroyed.

PUBLICATION OF RESULTS

Results of this study may be published in professional journals and presented at conferences. Feedback about this study will be available by late Spring or Early Summer on Dr. Volk's research web page (<http://www.brocku.ca/volk-developmental-science-lab>).

CONTACT INFORMATION AND ETHICS CLEARANCE

If you have any questions or concerns about this study, please contact the study coordinator, Dr. Volk, using the contact information provided above. This study has been reviewed and received ethics clearance through the Research Ethics Board at Brock University #15-173. If you have any comments or concerns about the study ethics, or your adolescent's rights as a research participant, please contact the Research Ethics Office at (905) 688-5550 Ext. 3035, reb@brocku.ca.

If you have any concerns about your adolescent participating as a bully, or being a victim of bullying, please feel free to discuss the matter with other parents, teachers, friends, and/or any trusted individuals. For advice on how to talk to your teen or other individuals about bullying, we recommend www.bullying.org, <http://www.lfcc.on.ca/bully.htm>, and the Niagara Youth Connection (905-641-2118 ext. 5592). You may also feel free to contact me, Dr. Anthony Volk, at tvolk@brocku.ca (905-688-5550 ext. 5368) with any related questions or concerns.

Thank you for your help in this project!

Please keep this form for your records.

APPENDIX B: Adolescent Form (Study 1)

Adolescent Relationships

Principal Investigator:

Dr. Anthony Volk, Professor

Department of Child and Youth Studies

Brock University

905-688-5550 xt. 5368

tvolk@brocku.ca

INVITATION

You are invited to participate in a study on adolescent relationships. The purpose of this study is to better understand how adolescent relationships are influenced by various aspects of their personal and social lives, such as personality, school, peers, and parents. We would like to note that a small number of the questions are about violence, sexual activity and related behaviors.

WHAT'S INVOLVED

As a participant, you will be asked to fill out questionnaires about yourself, your social group, and your basic demographics (e.g., things like age, who you live with, etc.) online using the link provided for Qualtrics, a questionnaire website. It should take you about 45-50 minutes to complete the forms. You will need to complete these questionnaires in one sitting. If you close the website or stop in the middle, there will be no way to return to the questionnaire. Only the researchers will see these responses, and the only ties to participant names will be a unique Identification (ID) number that will be used to confirm participation so that you can receive \$15 cash for participating. The ID number will not be linked to any other responses to the questionnaires. They will only be linked to participant names on the consent forms, which will be stored separately in a filing cabinet separate from questionnaire responses. The original consent form, which includes the unique identification number, will only be removed from the filing cabinet in the event that the participant chooses to withdraw from the study. In such an event, the removed identification number will be used to identify the participant's response in the questionnaire database, and the data will be deleted.

POTENTIAL BENEFITS AND RISKS

Possible benefits of participation include getting to know your own relationships better, and learning about adolescent relationships in general through reflection on some of your own experiences. There also may be risks associated with participation. Some relationships are tough to think about. If you find any part of this study to be stressful, you may contact the researcher, the Brock University Ethics board, or simply stop your participation. You may also freely discuss the study with parents or friends if you need to, although we would ask that you try not to talk to someone before they complete the study on their own (e.g., don't share answers until both of you have completed the study unless you feel it's really necessary). Sharing answers before the study ends can distort and/or change your own natural answers.

We do not ask for any specific incidents or events, so **there is no personal or legal liability associated with any of your answers, nor are we legally obligated to disclose any of your answers to our questions (including abuse**

and harm). If you have any concerns about specific behaviours or incidents, we strongly suggest that you discuss them with trusted individuals. These individuals could be parents, teachers, friends, or other trusted adults. You may also contact the Kids Help Phone at: <http://www.kidshelpphone.ca/en/> (1-800-668-6868). It is important to know that you do not need to tolerate any form of abuse!

You will receive \$15 cash for your participation in this study. You will receive this payment once you have completed the questionnaires and returned the consent and assent forms. Once receiving the \$15, you will have to sign a sheet for our records indicating you have received the payment.

CONFIDENTIALITY

You will only be identified by a unique number that is tied your name. There is no way for anyone to identify the data beyond this number. Unique, identifiable data (such as exact date of birth, name, names of friends and family) will not be collected. Your parents will have to consent to your participation, **but they will not be able to read your answers** (*although they can request that any such data be deleted*). You also do not have to reveal your answers to any of your friends, peers, or anyone else other than the researchers in this study. The only exception is that Dr. Volk will have a copy of your consent form, with your participation number, stored in a password protected computer in his lab, so that you can later request that your data be removed from the study if you wish. No other individual will have access to this link to your name, and Dr. Volk will ONLY access this information if you contact him asking to remove your data from the study within 5 years. Your name or ID will in no other way be involved with the data analysis or presentation.

Data collected during this study will be stored on a secure computer. Data will be kept for five years, after which time the data will be deleted or shredded. Access to this data will be restricted to Dr. Volk and his collaborators, who have signed confidentiality agreements. Your parents, friends, participants, and coaches will not have access to any individual data, although they may have access to the overall study results. So you do not have to worry about anyone finding out your answers, or about anyone following up on your answers, or about any consequences of the answers you provide. Your responses will be confidential and the only links between your name and ID number will be stored separately from your questionnaire responses, with access only by Dr. Volk.

In order to best protect your confidentiality, we suggest completing the online questionnaires in private and on your own. This will limit the possibility of others (e.g., parents, siblings, friends) from seeing your responses.

The researchers will own all data collected through Qualtrics and therefore all information will be confidential. Qualtrics data are temporarily stored in the United States and therefore is subject to the Homeland Security or Patriot Act. However, data will be downloaded daily on a secured Canadian server onto a password protected lab computer. Once data is downloaded in the lab, the data will be immediately deleted off from Qualtrics.

VOLUNTARY PARTICIPATION

Participation in this study is purely voluntary. Whether you participate, or what questions you answer, is completely up to you. If you want to withdraw from this study at any time, you may do so without any penalty other than not receiving the \$15 and your data will be confidentially destroyed in the event of withdrawal. This research is not linked to your organization, so there is no organizational penalty if you do not participate. If you would like to withdraw your data after you have completed the study, you must provide your unique identification number as it is the only way we have to identify your data. Please keep your ID number attached to this sheet in a safe place in case you wish to withdraw from the study.

However, before you can participate in this study, you **MUST** obtain parental consent. If you are reading this form, you should have already obtained parental consent. If you haven't, please provide your parents with the appropriate forms immediately. If you do not provide parental consent, you may **NOT** participate in this study. Again, your parents will not have direct access to your answers, but they do control whether **WE** are able to see your answers or not. If your parents do provide consent, you are not obligated to participate. That is your own decision. So you need their consent to participate, but that consent doesn't force you to participate.

PUBLICATION OF RESULTS

Results of this study may be published in professional journals and presented at conferences. Feedback about this study will be available by late Spring or Early Summer on Dr. Volk's research web page (<http://www.brocku.ca/volk-developmental-science-lab>).

CONTACT INFORMATION AND ETHICS CLEARANCE

If you have any questions about this study or require further information, please contact Dr. Volk using the contact information provided above. You can also use this contact information if you have any questions about what the questionnaires mean, or if you need any help completing the questionnaires. If you have any questions while you are filling out the forms, please feel free to contact Dr. Volk. This study has been reviewed and received ethics clearance through the Research Ethics Board at Brock University # 15-173 VOLK. If you experience any stress while participating in this study, please refer to debriefing form for a list of agencies you may contact.

If you have any comments or concerns about your rights as a research participant, please contact the Research Ethics Office at (905) 688-5550 Ext. 3035, reb@brocku.ca.

LINK TO QUALTRICS

If you are interested in participating, please follow this link to the Qualtrics website and use the following password to proceed:

Link: <https://goo.gl/LWcMkk>

Your ID number:

Thank you for your help in this project!

Please keep this form for your records.

Appendix C: Parental Consent Form (Study 1)

CONSENT FORM

I agree to allow my teen to participate in this study described above. I have made this decision based on the information I have read in the Information-Consent Letter. I have had the opportunity to receive any additional details I wanted about the study and understand that I may ask questions in the future. I understand that I may withdraw this consent at any time and request that my son/daughter's data be removed from the study.

Name: _____

Signature: _____ Date: _____

Do you agree to allow your teen to be contacted via e-mail and participate in follow-up studies in the future?

Yes: _____

No: _____

Please return this form.

Appendix D: Adolescent Assent Form (Study 1)

ASSENT FORM

I agree to participate in this study described above. I have made this decision based on the information I have read in the Information-Assent Letter. I have had the opportunity to receive any additional details I wanted about the study and understand that I may ask questions in the future. I understand that I may withdraw this assent at any time.

Name: _____

Signature: _____ Date: _____

ID number:

Would you like to be contacted for follow-up studies in the future?

Yes: _____

No: _____

If Yes, please provide your e-mail address:

Please return this form.

APPENDIX E: Cyber Aggression and Victimization Measures (Study 1)

Question: How often have YOU DONE the things listed above (i.e., used the internet or cell phone to spread rumours, threaten etc.) for the following reasons?

Response scale: Never, Hardly Ever, Sometimes, Fairly Often, Almost Always

Proactive cyber aggression

1. To be cool or popular, or to feel powerful or respected
2. To get others to do what I want
3. To show others not to mess with me
4. To get back at someone for something they did to me a while ago
5. To take things from others
6. Just for fun or excitement
7. To show off and impress the opposite sex
8. To damage someone's reputation
9. To compete with someone for a boyfriend or girlfriend
10. To stick up for, or fit in with, a group

Reactive cyber aggression

1. To defend myself, in the heat of the moment, because someone threatened or hurt me
2. Others made me frustrated & I acted before calming down
3. Someone made me angry & I reacted without thinking
4. Others did something wrong to me & I reacted without thinking

Cyber victimization

Question: In the past year, how often have the following been done to you?

Response scale: Never, once or twice, several times, almost every month, almost every week

1. Others spread rumours or gossip about me, using the internet or a cell phone
2. Someone told hurtful lies about me, using the internet or a cell phone
3. Someone used the internet or a cell phone to make fun of me & say mean things about me

4. Someone used the internet or a cell phone to send or post embarrassing information, pictures, or videos of me
5. Someone threatened me using the internet or a cell phone
6. Someone pretended to be me, in a mean or hurtful way, using the internet or a cell phone
7. Someone sent unwanted sexual jokes, comments, or pictures using the internet or a cell phone
8. Others ignored or stopped responding to me, using the internet or a cell phone
9. Others kept me out of a group of friends, using the internet or a cell phone

APPENDIX F: Dating and Sex Measures (Study 1)

Please answer these questions about dating, love, and romantic relationships among teenagers. Dating is going out or spending time with girls (boys) you like, love, or have a crush on. Boys and girls can spend time together in many ways. Answer the questions below, to describe the types of ways you spend time together with girls (boys) after school and on weekends.

Open-ended questions:

Number of dating partners: How many different people have you gone on dates with, just the two of you?

Number of sex partners: How many diff partners have you had a voluntary sexual experience with [i.e., more than kissing or making out] since the age of 12?

APPENDIX G: Resource Control Strategies and Outcomes Measure (Study 1)

Instructions: How true are the following statements?

Response Scale: 1= never true, 2 = hardly ever true, 3 = sometimes true, 4 = often true, 5 = almost always true

Social Dominance

1. I am good at being able to get what I want from others.
2. I am able to make others do what I want.
3. I usually get what I need, even if others don't.
4. I am able to get others to do what I say.
5. I have a lot of power over others.

Implicit Social Power

1. I am admired by others
2. I am able to get people to help me
3. Others pay attention to me
4. Others want to be in my group
5. People respect me
6. Others want to be friends or to hang out with me
7. Others usually side with me
8. I get a lot of positive attention from others
9. Most people think I'm pretty cool
10. People usually want me to join their group
11. Others often invite me to do things
12. People usually approve of the things I do
13. Others usually stick with me and stick by me
14. People want to spend time with me
15. People want to have someone like me around
16. Others look up to me

APPENDIX H: Relationship Quality Questionnaire (Study 1)

This questionnaire is designed to assess the way in which you mentally represent important people in your life. You'll be asked to answer questions about your parents, your romantic partners, and your friends. Please indicate the extent to which you agree or disagree with each statement by circling a number for each item.

Partner anxiety/avoidance Instructions: Please answer the following questions about your dating partner.

Note: If you are not currently in a dating or marital relationship with someone, answer these questions with respect to a former partner or a relationship that you would like to have with someone.

Friendship anxiety/avoidance Instructions: Please answer the following questions about your best friend.

7-point response scale: strongly disagree 1 2 3 4 5 6 7 strongly agree

1. It helps to turn to this person in times of need.
2. I usually discuss my problems and concerns with this person.
3. I talk things over with this person.
4. I find it easy to depend on this person.
5. I don't feel comfortable opening up to this person.
6. I prefer not to show this person how I feel deep down.
7. I often worry that this person doesn't really care for me.
8. I'm afraid that this person may abandon me.
9. I worry that this person won't care about me as much as I care about him or her.

Appendix I: Peer Aggression and Victimization Measures (Studies 2 & 3)

Direct Aggression (Verbal and Physical)

Response Scale: Never, Hardly Ever, Sometimes, Fairly Often, Very Often

Bullying: In the PAST FEW MONTHS, how often have **YOU DONE** the following, against someone who was **LESS** popular or strong than you?

- a) Damaged or broken someone's things on purpose
- b) Hit, kicked, or shoved someone
- c) Used physical force against someone
- d) Threatened someone in person
- e) Made fun of someone in a hurtful way to their face
- f) Put others down or said mean things to them in person

Adversarial Aggression: In the PAST FEW MONTHS, how often have **YOU DONE** the following, against someone who was **EQUALLY or MORE** popular or strong than you?

- a) Damaged or broken someone's things on purpose
- b) Hit, kicked, or shoved someone
- c) Used physical force against someone
- d) Threatened someone in person
- e) Made fun of someone in a hurtful way to their face
- f) Put others down or said mean things to them in person

Relational Aggression

Response Scale: Never, Hardly Ever, Sometimes, Fairly Often, Very Often

Bullying: In the PAST FEW MONTHS, how often have **YOU DONE** the following, against someone who was **LESS** popular or strong than you?

- a) Spread negative rumours or gossip about someone while talking to others
- b) Kept someone out of my group of friends
- c) Ignored or stopped talking to someone
- d) Left someone out or excluded someone from a group activity

Adversarial Aggression: In the PAST FEW MONTHS, how often have **YOU DONE** the following, against someone who was **EQUALLY or MORE** popular or strong than you?

- a) Spread negative rumours or gossip about someone while talking to others
- b) Kept someone out of my group of friends
- c) Ignored or stopped talking to someone
- d) Left someone out or excluded someone from a group activity

Anonymous Relational Aggression Perpetration: In the PAST FEW MONTHS, how often have you spread rumours about someone, or left someone out, **WHEN THEY WERE NOT SURE WHO HAD DONE IT TO THEM?**

- a) Never
- b) Hardly Ever
- c) Sometimes
- d) Fairly Often
- e) Very Often

Cyber Aggression

Response Scale: Never, Hardly Ever, Sometimes, Fairly Often, Very Often

Bullying: In the PAST FEW MONTHS, how often have **YOU DONE** the following against someone who was **LESS** popular or strong than you?

- a) I used the internet or a cell phone to spread negative rumours or gossip about someone
- b) I used the internet or a cell phone to say mean things to someone or send them embarrassing or hurtful pictures or videos
- c) I used the internet or a cell phone to post information, pictures, or videos about someone that would embarrass or hurt that person
- d) I used the internet or a cell phone to threaten someone
- e) Using the internet or a cell phone, I ignored or stopped responding to someone

Adversarial Aggression: In the PAST FEW MONTHS, how often have **YOU DONE** the following against someone who was **EQUALLY or MORE** popular or strong than you?

- a) I used the internet or a cell phone to spread negative rumours or gossip about someone
- b) I used the internet or a cell phone to say mean things to someone or send them embarrassing or hurtful pictures or videos
- c) I used the internet or a cell phone to post information, pictures, or videos about someone that would embarrass or hurt that person
- d) I used the internet or a cell phone to threaten someone
- e) Using the internet or a cell phone, I ignored or stopped responding to someone

Anonymous Cyber Aggression Perpetration: In the PAST FEW MONTHS, how often have you used the internet or your cell phone to gossip or spread rumours about someone, or to send or post things that are hurtful or embarrassing to someone, **WHEN THEY WERE NOT SURE WHO HAD DONE IT TO THEM?**

- a) Never
- b) Hardly Ever
- c) Sometimes
- d) Fairly Often
- e) Very Often

Direct Victimization (Physical and Verbal)

Response Scale: Never, Hardly Ever, Sometimes, Fairly Often, Very Often

Bullying Victimization: In the PAST FEW MONTHS, how often have the following things **BEEN DONE TO YOU** by someone who was **MORE** popular or strong than you?

- a) Damaged or broke my things on purpose
- b) Hit, kicked, or shoved me
- c) Used physical force against me
- d) Someone threatened to harm me in person
- e) Others said mean things or made fun of me to my face
- f) Others put me down or called me hurtful names in person

Adversarial Victimization: In the PAST FEW MONTHS, how often have the following things **BEEN DONE TO YOU** by someone who was **EQUALLY or LESS** popular or strong than you?

- a) Damaged or broke my things on purpose
- b) Hit, kicked, or shoved me
- c) Used physical force against me
- d) Someone threatened to harm me in person
- e) Others said mean things or made fun of me to my face
- f) Others put me down or called me hurtful names in person

Relational Victimization

Response Scale: Never, Hardly Ever, Sometimes, Fairly Often, Very Often

Bullying Victimization: In the PAST FEW MONTHS, how often have the following things **BEEN DONE TO YOU** by someone who was **MORE** popular or strong than you?

- a) Others spread negative rumours or gossip about me
- b) Others kept me out of their group of friends
- c) Someone ignored or stopped talking to me
- d) Others left me out or excluded me from a group activity

Adversarial Victimization: In the PAST FEW MONTHS, how often have the following things **BEEN DONE TO YOU** by someone who was **EQUALLY or LESS** popular or strong than you?

- a) Others spread negative rumours or gossip about me
- b) Others kept me out of their group of friends
- c) Someone ignored or stopped talking to me
- d) Others left me out or excluded me from a group activity

Anonymous Relational Victimization: In the PAST FEW MONTHS, how often have you had negative rumours spread about you or been left out of groups when you **WEREN'T SURE WHO HAD DONE IT TO YOU?**

- a) Never
- b) Hardly Ever
- c) Sometimes
- d) Fairly Often
- e) Very Often

Perceived Harm of Relational Victimization: How much have you been **HURT OR HARMED** (e.g., emotionally, socially, or physically) by having negative rumours spread about you, being left out, or being ignored?

- a) Not at all
- b) A little bit
- c) Somewhat
- d) Quite a bit
- e) Very much

Cyber Victimization

Response Scale: Never, Hardly Ever, Sometimes, Fairly Often, Very Often

Bullying Victimization: In the PAST FEW MONTHS, how often have the following things **BEEN DONE TO YOU** by someone who was **MORE** popular or strong than you?

- a) Others spread negative rumours or gossip about me, using the internet or a cell phone

- b) Someone used the internet or a cell phone to say mean things to me, or to send me hurtful or embarrassing pictures or videos
- c) Someone used the internet or a cell phone to post hurtful or embarrassing information, pictures, or videos about me
- d) Someone used the internet or a cell phone to threaten me
- e) Others ignored or stopped responding to me when I messaged them using the internet or a cell phone

Adversarial Victimization: In the PAST FEW MONTHS, how often have the following things **BEEN DONE TO YOU** by someone who was **EQUALLY or LESS** popular or strong than you?

- a) Others spread negative rumours or gossip about me, using the internet or a cell phone
- b) Someone used the internet or a cell phone to say mean things to me, or to send me hurtful or embarrassing pictures or videos
- c) Someone used the internet or a cell phone to post hurtful or embarrassing information, pictures, or videos about me
- d) Someone used the internet or a cell phone to threaten me
- e) Others ignored or stopped responding to me when I messaged them using the internet or a cell phone

Anonymous Cyber Victimization: In the PAST FEW MONTHS, how often has someone used the internet or their cell phone to gossip or say mean things about you, threaten you, or to send or post things that are hurtful or embarrassing to you, when you **WEREN'T SURE WHO HAD DONE IT TO YOU?**

- a) Never
- b) Hardly Ever
- c) Sometimes
- d) Fairly Often
- e) Very Often

Perceived Harm of Cyber Victimization: How much have you been **HURT OR HARMED** (e.g., emotionally, socially, or physically) when others have used the internet or a cell phone to spread rumours or say mean things about you, threaten you, or send or post things that were embarrassing or hurtful to you?

- a) Not at all
- b) A little bit
- c) Somewhat
- d) Quite a bit
- e) Very much

APPENDIX J: Evolutionary Aggressive Functions Measure (Studies 2 & 3)

How often have you done the things below for the following reasons?

- Hitting, kicking, shoving, or using physical force against someone
- Threatening or saying mean things to someone in person
- Spreading hurtful rumours or leaving someone out of a group
- Using the internet or a cell phone to post embarrassing or hurtful pictures or videos about someone, or say mean things about them

Response Scale: Never, Hardly Ever, Sometimes, Fairly Often, Very Often

1. To be cool or popular
2. To show others not to mess with me
3. Someone made me angry and I reacted without thinking
4. To get the things I want
5. To get attention and feel respected
6. To make people afraid of me and show that I'm tough
7. Just for fun
8. To get someone to like me more than another person
9. Joking or messing around with a group of friends
10. Others did something wrong to me and I reacted without thinking
11. Others frustrated me and I acted before calming down
12. To compete with or weaken a rival
13. To win a competition
14. To show off and impress someone I'd like to date
15. To show who's the boss
16. To be in charge