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# Time Spent Gaming and Social Competence in Children: Reciprocal Effects Across Childhood

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Electronic games are popular and many children spend much time on this activity. Here we investigate whether the quantity of time children spend on gaming is related to their social development, making this the first study to examine this relationship in children. We examine prospective relations between time spent gaming and social competence in a community sample of Norwegian 6 year olds ($n$ = 873) followed up at ages 8, 10, and 12, controlling for socioeconomic status, body mass index, and time spent gaming together with friends. Results revealed that greater social competence at both 8 and 10 years predicted less gaming 2 years later and that more age-10 gaming predicted less social competence at age 12 but only among girls.

Electronic gaming, whether online or offline, has become central to the lives of many children and adolescents in the modern, postindustrial world. By games and gaming, we refer to electronic games that are interactive, meaning that players are actively engaging the content of the game either by themselves or in competition or cooperation with other (present and nonpresent) players (Granic, Lobel, & Engels, 2014). When video games are available and affordable, most children and youth play them (Lenhart et al., 2008). Recent findings from the United Kingdom indicate that 66% of children between the ages 5–7 game regularly for about 7.5 hr a week; 81% percent of 8–11 year olds; and 77% of 12–15 year olds game regularly for about 10–12 hr a week (Office of Communications [Ofcom], 2017). In Norway, where the research reported herein was conducted, 96% of boys and 76% of girls age 9–16 years play video games; about half play up to 2 hr per day, but 8% play for more than 4 hr (Norwegian Media Authority, 2016).

Since the early 1990s, the popularity of games has raised questions among developmental scholars, parents, and policy makers regarding effects of gaming on children's psychological and behavioral development (Griffiths, 1993). Most gaming research to date has focused on excessive or problematic gaming (e.g., Desai, Krishnan-Sarin, Cavallo, & Potenza, 2010), and pathological gaming (e.g., Lemmens, Valkenburg, & Peter, 2011a), and thus on negative effects like aggression (Lemmens et al., 2011a), and symptoms of anxiety and depression (Männikkö, Billieux, & Kääriäinen, 2015).

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Here, we seek to extend gaming-related inquiry by focusing on (a) time spent gaming and (b) social competence in young children, guided by a recent review of potential benefits of gaming by Granic et al. (2014). Social competence is defined here as *effective social interaction*, which is transactional in nature, specific to the social context, and performed to meet certain goals (Rose-Krasnor, 1997). Becoming socially competent is a central developmental task of childhood (Gresham & Nagle, 1980). As children face a range of different developmental tasks (e.g., making friends, group entry), they often must implement a set of behaviors collectively labeled "social skills" (Gresham, 2016). Skills such as listening carefully, responding considereately to others, accurately recognizing nonverbal behavior and verbal qualities (e.g., tone of voice, voice volume, and rate), sharing and cooperating, appropriate assertiveness, and effectively regulating one's own emotions and behavior are key attributes of the socially competent child (Feldman, 2012).

### *Why Gaming Might Impair Social Competence*

The development of the social abilities described earlier requires practice, and such practice typically occurs in the context of naturally occurring social interactions with others (Semrud-Clikeman, 2007). In regular (face-to-face) communication, individuals have more eye contact and are in better position to read and respond to verbal and nonverbal cues than during gaming activity, however, while gaming there is a shared focus on the screen with coplayers (when playing together in the same room). Solitary gamers playing online typically cannot see other gamers, which makes it more challenging to understand and respond adequately to what others may be communicating. Perhaps this explains why much cross-sectional and longitudinal research indicates that higher frequency of gaming is associated with increased social difficulties among adolescents and young adults (Griffiths, 2010; Lemmens et al., 2011a (time spent on violent games in particular) and lower quality interpersonal relationships (Kowert, Domahidi, Festl, & Quandt, 2014, $M_{age}$ = 16.4). While Parkes, Sweeting, Wight, and Henderson (2013) longitudinal study failed to document such inverse relations, this work only focused on children from age 5 to 7 years, a very limited period of childhood.

Quite conceiveably, extensive time spent gaming might replace or influence face-to-face interaction, group socializing, and physical play. In so doing, it could compromise children's psychosocial development (Przybylski, 2014), including the ability to form and maintain relationships (Cole & Griffiths, 2007; Shen & Williams, 2011) and to develop adequate social skills (Shen & Williams, 2011). Consistent with this claim is evidence from a cross-sectional study of children aged 10–15 years, showing that children who gamed for more than 3 hr per day evinced more internalizing and externalizing problems than those who gamed for < 1 hr per day (Przybylski, 2014). These results were corroborated by another cross-sectional study, this one of younger children (7–12 year olds) in that more hours of gaming was associated with more peer and conduct problems as well as less prosocial behavior (Lobel, Granic, Stone, & Engels, 2014). Also worth mentioning is Hellström and associates' (2012) study of adolescents which found more time spent gaming to be associated with less time with friends (Hellström, Nilsson, Leppert, & Åslund, 2012).

### *Why Gaming Might Improve Social Competence*

Despite evidence suggesting that more time spent on gaming may impair social development, there are also reasons to assume that gaming may be beneficial for children because electronic games often contain a variety of cognitive challenges and may involve socialization with real-life friends and/or online acquaintances (Przybylski, 2014). These features of gaming may foster the development of social skills. Indeed, there is an emerging body of empirical evidence chronicling the (apparent) benefits of gaming on cognitive, motivational, emotional and social development (for review see: Granic et al., 2014).

Such seemingly positive effects of gaming might stem from gaming not always being a purely solitary activity. In fact, contemporary electronic games frequently involve children playing with others (Olson, 2010), a situation that can—and often does—lead to intense social exchange. This is especially so in massive multiplayer online games (MMOGs) and massive multiplayer online role-playing games (MMORPGs; Cole & Griffiths, 2007). Such games involve large numbers of players who participate simultaneously over the Internet and require good cooperative and communicative skills. To illustrate, in games such as *Fortnite Battle Royale*—a MMOG survival game and perhaps one of the most popular games in the world in 2018 with its 125 million downloads according to the website PCGames[N] (2018)—gamers communicate verbally via gaming headsets or via symbols. Furthermore, they need to make quick decisions, organize themselves and help each other out, all while acquiring good weapons and protecting each other from shared enemies (when playing in duos or squads). These tasks require social skills such as cooperation and self-control. From this perspective, games may provide good platforms to practice and develop social skills that might generalize to real-life, face-to-face, relationships. In fact, this may explain why Gentile et al. (2009) found that children, adolescents and undergraduate students who played games with prominent social aspects proved to be more prosocial in real life. Once again it would seem, then, that gaming may have rather diverse developmental consequences. Nevertheless, the direction of causality linking time spent gaming and various developmental outcomes, whether positive or negative, remains unclear. This observation leads to a consideration of the impact of social competence on gaming.

### *Effects of Social Development on Gaming*

Regardless of whether—or how—gaming influences social development, it should be acknowledged that having limited social competence may increase time spent gaming. In other words, the gaming/social-functioning relation may well be bidirectional. Within online games, children often do not face the same social requirements as they do in real-life interactions, as noted earlier. Games allow children to be anonymous, enabling them to create their own social identities (Griffiths, 1998). Furthermore, when children play games, their nonverbal behavior (e.g., facial expressions) is hidden from fellow gamers, which might result in less obvious evidence of social inadequacy. Hence, children with limited social competence may increase the time they spend on gaming, as gaming may be an arena in which they experience fewer social demands, more togetherness, greater mastery and an escape from their daily struggles in the face-to-face social world. Some empirical work—focused on problematic gaming not just time spent (as in this study)— indicates this to be the case. Chak and Leung (2004) reported that adolescents and young adults who have difficulty interacting competently with peers are drawn to online activities more so than more socially confident age-mates. Just as notable is that children who consider themselves lonely spend more time in online communication than do other children, with online activity often motivated by a desire to compensate for poorer social skills that make it difficult to meet new people (Bonetti, Campbell, & Gilmore, 2010). Thus, online communication may fulfill the need for social interaction even if leisure time spent on gaming may result in fewer opportunities to practice and develop social skills. Consequently, limited social competence may increase the risk of future gaming problems or even just more time spent gaming (Gentile et al., 2011).

### *Gender Differentiated Effects of Gaming*

Boys tend to play in larger groups than girls (Rose-Krasnor, 1997) and gaming may be a typical activity boys share and bond over since boys spend substantially more time on gaming than do girls (Desai et al., 2010; Lemmens et al., 2011a). Moreover, boys play video games with friends to a greater extent than girls do (Hastings et al., 2009, 6–10 year olds). Thus, it is possible that gaming is more integrated in boys’ play culture and has currently become an important part of boys’ socialization. Girls tend to have fewer and more intimate relationships than boys (Rose-Krasnor, 1997). Thus, it might be that girls who game are not in the position to share this activity with other girls (like boys may). Gaming girls may therefore be more isolated socially and have less opportunity to practice social skills with other girls. Consequently, gaming girls may develop poorer social competence. Such reasoning may explain the findings in a study of adolescents who reported that girls—but not boys—who played electronic games were more likely than others to engage in externalizing behavior (Desai et al., 2010), which is known to correlate with poor social competence (Burt, Obradovic, Long, & Masten, 2008). In sum, the aforementioned reasoning and findings indicate that the gaming-social competence link may be stronger for girls than for boys; we therefore perform gender specific analyses to test this possibility.

### *Current Study*

To disentangle the possible reciprocal effects of gaming time and social competence, longitudinal studies are required. When adolescents were twice studied Lemmens, Valkenburg, and Peter (2011b) found that whereas lower social competence predicted more pathological gaming (using a seven-item gaming addiction scale based on *Diagnostic and Statistical Manual of Mental Disorders*, 4th ed.-criteria for pathological gaming), even if not more time spent gaming, over a 6 month period, pathological gaming did not predict lower social competence. The work considered above, like most research on gaming, has focused on adolescents and young adults (e.g., Gentile, Lynch, Linder, & Walsh, 2004, 13–16 year olds; Lemmens et al., 2011a, 2011b, 11–17 year olds; Wiegman & Schie, 1998, 10–14 year olds), but results do not necessarily translate into a different developmental period —middle childhood. To our knowledge, no such investigations of prepubertal children have addressed this issue. We therefore begin to address this research gap by studying reciprocal effects in a community sample of Norwegian children from age 6 to 12, across four measurement occasions. Based on the current literature on possible effects of time spent gaming on social competence, we considered two contrasting hypotheses; (a) more time spent gaming forecasts lower social competence, with more detrimental effects for girls; (b) more time spent gaming forecasts higher social competence. Additionally, we predict (c) that lower social competence forecasts more time spent gaming.

In testing these hypotheses we controlled for a number of potentially confounding factors. Given that this study stems from an ongoing, large-scaled and in-depth investigation of children's development (see Method for a more detailed description), we have access to a wide range of variables that could serve as possible confounding factors. In light of the fact that the research report herein was hypothesis driven, we carefully selected variables to include (and not to include) as potential confounders based on existing theory and previous empirical findings.

Because boys tend to spend more time gaming than girls (e.g., Greenberg, Sherry, Lachlan, Lucas, & Holmstrom, 2010; Lemmens et al., 2011a) and because boys display lower levels of social competence than girls (e.g., Pečjak, Puklek Levpušček, Valenčič Zuljan, Kalin, & Peklaj, 2009), we adjusted our analyses for gender (before we conducted gender specific analyses). We also discount effects of family socioeconomic status (SES) in light of evidence that less advantaged families are at greater risk of a multitude of problems (e.g., poor family functioning and marital conflicts) that are shown to influence children's social competence (Conger, Conger, & Martin, 2010) and research indicating SES to be related to gaming behavior in some studies (e.g., Fairclough, Boddy, Hackett, & Stratton, 2009). A third factor which we controlled for was whether children played games with friends. Children who game with friends may have more opportunity to practice social skills than children who game alone or with strangers, and gaming may only be an extension of their face-to-face social life. Some research indicates that social versus solitary gaming may make a difference: cooperative gaming is associated with prosocial behavior among university students (Greitemeyer & Cox, 2013) and social gamers spend more time on gaming (Eklund, 2015). Finally, as it has been reported that (a) high body mass index (BMI) in girls is associated with more gaming (Desai et al., 2010), and (b) that social competence correlates negatively with BMI (Sapienza, Schoen, & Fisberg, 2017), we also adjust for BMI.

## Method

### *Study Design*

The present work is based on data from the second through fifth waves of the Trondheim Early Secure Study (Steinsbekk & Wichstrøm, 2018), which was launched in 2007 when the participating children were 4 years of age (T1); retesting was performed biennially. The project was approved by the Regional Committee for Research Ethics, Mid-Norway.

### *Procedure and Participants*

Parents of the 2003 and 2004 birth cohorts in Trondheim, Norway ($N$ = 3,456) were invited to participate in a study of child development by means of an invitation mailed to their homes prior to the routine community health checkup for 4-year olds that is a free service to all Norwegian children. In total, 3,358 families (97%) attended the health checkup, where a nurse provided them with more detail regarding the study and secured written informed consent to participate. Parents ($n$ = 176) with inadequate proficiency in Norwegian were excluded; nurses failed to ask 166 parents to participate. A total of 2,475 parents consented (82.1% of those eligible).

Upon receiving the initial invitation to participate, parents completed the Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997), a screening tool for mental health problems, which they brought with them to the health clinic. To ensure oversampling of children with emotional and behavioral problems or at heightened risk of developing them, SDQ total problem scores were divided into four strata. The likelihood of being included in the study increased with an increasing SDQ score. By following the aforementioned procedures, 1,250 of the consenting families were drawn to participate, and we succeeded in interviewing 994 at T1. The dropout rate from consent to interview did not vary by SDQ strata ($\chi^2 = 5.70$, $df = 3$, $p = .13$) or gender ($\chi^2 = 0.23$, $df = 1$, $p = .63$). Altogether, 792 children (50% boys, 50% girls) participated in follow-up assessment 2 years later (T2) at age 6. Four years later (T3), at age 8, 696 (48.9% boys) children participated. Six years later (T4), at age 10, 700 (48.0% boys) children participated. Finally, 8 years later (T5), at age 12, 662 (48.2% boys) children participated. We omitted 4-year-olds (T1) from the present report because of minuscule amount of gaming reported at this particular age ($M = 6.6$ min per day). Thus, our focus was on measurements obtained at ages 6, 8, 10 and 12 (T2, T3, T4 and T5). A total of 873 children had valid values on at least one observation and thus constituted the analytical sample. Teachers of the participating children received information about the study and were asked to fill out questionnaires regarding the child's social competence. The completed questionnaires were returned to the study by mail.

### *Measures*

#### *Time Engaged in Electronic Gaming*

The amount of time children spent gaming (using tablets, PCs, game consoles, phones) was based on a parent-administered interview at age 6 and age 8 (T2 and T3), the Preschool Age Psychiatric Assessment (Egger & Angold, 2004). Parents provided information on how often children played electronic games, in terms of both days per week and average time spent per day (in hours and minutes). Parents were asked whether the child had access to computers, Gameboys, XBOX or other gaming consoles. Children themselves were interviewed at ages 10 and 12 (T4 and T5) concerning how many hours and minutes they played during a typical weekday, and on how many such days in a typical week they played. To facilitate children's recall, we asked about hours and minutes played before school (number of days per week), during school time (number of days per week), after school, before dinner (number of days per week) in the evening (number of days per week) and during night (number of days per week). The same questions were asked and answered with respect to weekend days. Average game time per day was multiplied by number of days of gaming in a week. These data yielded a continuous index of time spent gaming per day (see Table 1 for descriptives).

Table 1
*Sample Characteristics and Descriptives*

| Characteristics % ($n$ = 873) | |
|---|---|
| Gender of child | |
| Male | 50.2 |
| Female | 49.8 |
| Gender of parent informant | |
| Male | 18.1 |
| Female | 81.9 |
| Ethnic origin of biological mother | |
| Norwegian | 93.0 |
| Western countries | 3.3 |
| Other countries | 4.4 |
| Ethnic origin of biological father | |
| Norwegian | 91.2 |
| Western countries | 5.8 |
| Other countries | 3.3 |

Children were given the following instructions by the research assistant before answering how much time they spent gaming:

> By gaming we refer to games mostly played online, where other players participate. However, it is not a requirement that other players participate. When answering questions about time spent gaming, don't forget to include as well time spent on games that are played on computers, devices and consoles such as Smart phones, tablets, Playstation and Nintendo where you are not online. Do not include board games and games similar to that, and do not include time spent on the Internet for school purposes, pure social media sites or sexual online pages.

#### *Social Competence*

Teachers evaluated children's social competence using the Social Skills Rating System (SSRS; Gresham & Elliott, 1990a). The teacher version of the SSRS measures three dimensions; cooperation (e.g., the child complies to directions given by the teacher), assertion (e.g., the child exhibits confidence in social settings) and self-control (e.g., the child is able to control and regulate his/hers behavior). The SSRS is widely used and has good reliability and validity in both international (Gresham & Elliott, 1990b) and Norwegian samples (Frostad & Pijl, 2007). The 30 SSRS items are rated on a 4-point frequency scale: (0) *never*, (1) *sometimes*, (2) *often*, (3) *very often*. We applied the SSRS total scale by combining all three dimensions of social competence ($\alpha$ = .80–.97, between waves).

*Socioeconomic Status*

We used The International Standard Classification of Occupations (ISCO; ILO, 1990) to measure parental SES. ISCO is based on two main principles of classification; (a) Skill level is determined by the level of formal and technical skills required for the occupation (i.e., years of formal education). (b) Skill specialization in an occupation is defined by the field of knowledge required, use of tools/machinery, the materials worked on or with, and the kind of goods and services produced. The degree of independence and routine when performing the job, as well as the amount of manual labour is also considered in the classification of an occupation (Statistics Norway, 1998). The level of occupational status ranged from 1 (*unskilled manual workers*) to 6 (*leaders*). When children were 6 years old, 1% of the parents were (1) unskilled workers, 15% were (3) skilled workers, 37% were (4) lower professionals, 36% were (5) higher professionals, and 11% were (6) leaders. SES was operationalized as the higher occupational status of the two parents when there were two parents. We measured SES when children were 6, 8, and 10 years of age using the same measurement system.

*Body Mass Index*

We measured the children's weight in kilograms with a digital scale (Tanita BC20MA [Tanita Europe B.V., Amsterdam, The Netherlands]); height in meters was measured using the Heightronic Digital Stadiometer (QuickMedical Model 235A [QuickMedical. Medical Equipment and Supplies, Issaquah, WA]). Correction for indoor clothing (0.5 kg) was applied. BMI was calculated as $kg/m^2$.

*Gaming Context*

Children were asked how often they played games with their friends. The question had a five-point frequency scale: (1) *always*, (2) *most of the times*, (3) *sometimes*, (4) *rarely*, (5) *never*, which was reverse-coded in the analyses. The children were asked this question at T3 and T4. We had no such data on T2.

## *Data Analysis*

We conducted the primary data analysis in two phases; structural equation modeling was first used to evaluate cross-sectional and longitudinal relations between time spent gaming and social competence, adjusting for the covariates, for all children in the sample. This analysis was followed by multi-group comparisons to determine whether the findings varied by gender.

The cross-lagged models were tested in Mplus 7.0 (Muthén & Muthén, 1998–2012). To detect potential bidirectional effects, all dependent variables were regressed on all variables (including the control variables) from the prior time point; for example, time spent gaming at age 12 was regressed on social competence, time spent gaming, gender, BMI, gaming with friends and SES at age 10. Cross-time covariances were also included in the model at all time points, and the residuals at T5 were allowed to correlate.

Given the stratified sample used in this study, all parameters were weighted by a factor corresponding to the number of children in the population in a specific stratum divided by the number of participants in that stratum. Thus, children scoring low on SDQ were "weighted up" and high scorers on the SDQ were "weighted down" to yield corrected population estimates. The range of missing values varied from 14% for gaming at T2 to 33% for social competence at T3 (no missing for gender). The full information maximum likelihood estimation (FIML) was used to handle the missing values (Enders, 2010), and parameters were estimated by means of maximum likelihood estimation with robust standard errors (Petersen, 2009). FIML uses all available data, but does not compute/insert missing values as in multiple imputation. The FIML approach provides less biased estimates than complete case analysis, and may perform better than multiple imputation (Allison, 2012). Model fits were judged based on criteria defined by Hu and Bentler (1999), including the comparative fit index (CFI) and the Tucker–Lewis index (TLI) > .90, root mean square error of approximation (RMSEA) < .06, and standardized root mean square residuals (SRMR) < .05. Gender-specific effects were examined by comparing model fit of a model where a specific path of interest was fixed to be equal between girls and boys with the fit of a model where they were freely estimated, using the Model Test procedure in Mplus.

# Results

## *Preliminary Analyses*

Descriptives of study variables are presented in Table 1. At all ages, girls had a higher mean score

Table 2
*Descriptives of Study Variables*

| Study variables | Min–max | Boys | | Girls | |
|---|---|---|---|---|---|
| | | *M* | *SD* | *M* | *SD* |
| Social competence, age 6 | 18–87 | 55.75 | 13.46 | 60.51 | 12.50 |
| Social competence, age 8 | 24–90 | 57.62 | 13.33 | 64.60 | 12.96 |
| Social competence, age 10 | 18–87 | 55.79 | 13.10 | 62.38 | 13.47 |
| Social competence, age 12 | 23–88 | 61.27 | 13.48 | 68.44 | 11.93 |
| Gaming, age 6 | 0–3.50 | .46 | .48 | .24 | .26 |
| Gaming, age 8 | 0–4.53 | .85 | .72 | .52 | .54 |
| Gaming, age 10 | 0–6.57 | 1.23 | 1.11 | .78 | .98 |
| Gaming, age 12 | 0–9.39 | 2.11 | 1.53 | .83 | 1.11 |
| Socioeconomic status (SES) age 6 | 1–6 | 4.55 | .92 | 4.437 | .98 |
| SES age 8 | 1–6 | 4.71 | .97 | 4.62 | .98 |
| SES age 10 | 1–6 | 4.75 | .91 | 4.74 | .97 |
| Gaming with friends age 8 | 1–5 | 2.98 | .82 | 2.46 | .91 |
| Gaming with friends age 10 | 1–5 | 3.19 | .82 | 2.65 | .95 |
| BMI age 6 | 12.09–27.47 | 15.64 | 1.46 | 15.59 | 1.52 |
| BMI age 8 | 12.73–30.61 | 16.54 | 1.87 | 16.71 | 2.06 |
| BMI age 10 | 13.29–33.44 | 17.49 | 2.40 | 17.60 | 2.63 |

*Note.* Gaming = hours per day. BMI = body mass index.

than boys on social competence. Moreover, as expected, boys played games far more than girls at all time points, and boys played with friends more often than did girls at ages 8 and 10 (see Table 2).

Correlations between gaming and other study variables are displayed in Table 3. Many of these suggest that gender, SES, BMI and gaming with friends could influence the relations between gaming and social competence, and thus should be accounted for in the analyses. Note in this regard that greater gaming at a younger age was associated with less social competence later and that, reciprocally, greater social competence at a younger age was associated with less gaming at a later age. At all ages more gaming was associated with gaming with friends. Lower SES at age 10 was associated with more gaming at age 12 and higher SES was at several time points associated with greater social competence. In addition, higher BMI was associated with lower social competence at age 6. At ages 8 and 10 being a girl was negatively correlated with gaming with friends. More gaming at age 6 was associated with lower BMI at age 8, whereas more gaming at age 8 was correlated with lower BMI at ages 6 and 8.

### *Reciprocal-Effects Analyses*

The autoregressive structural model with cross-lagged paths across the longitudinal measures of gaming and social competence, as well as cross-sectional covariance was fitted first. It is viable that gaming and teacher reports of social competence are influenced by factors appearing at one time of reporting (e.g., mood-of-the-day effects, vacations yielding more time available to game). These factors might not necessarily affect reporting at the next wave, hence 2-year stability in social competence and gaming may be deflated. We therefore added second- and third-order regression paths with regards to gaming (i.e., gaming at age 6 and 8 predicting gaming at age 12, gaming at age 6 predicting gaming at age 10) and second-order regression paths for social competence (i.e., social competence at age 8 predicting social competence at age 12, and social competence at age 6 predicting social competence at age 10). After adjustment for gender and autoregressed measures of SES from prior time points, results revealed adequate model fit: $\chi^2(df = 26, n = 873) = 65.86$, $p < .001$, CFI = .97, TLI = .94, RMSEA = .04, SRMR = .03.

Inspection of the paths in Figure 1 shows moderate stability in hours spent gaming and moderate-to-high stability in social competence. More importantly, *greater social competence at ages 8 and 10 predicted lower levels of gaming 2 years later.* Also noteworthy is that girls scored higher on social competence at age 6, and boys spent more time gaming at age 6.

Due to the number of parameters in the full model, additional confounders (BMI and gaming

Table 3
*Correlations Between Study Variables*

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Gaming, age 6 | — | .16** | .19*** | .25*** | −.10* | −.04 | −.09* | −.08 | −.29*** | −.03 | −.006 | −.07 | .12** | .17*** | .00 | −.07* | −.06 |
| 2. Gaming, age 8 | | — | .35*** | .32*** | −.02 | −.09* | −.10* | −.13** | −.25*** | −.02 | −.05 | −.04 | .12** | 18*** | −.12** | −.11** | −.07 |
| 3. Gaming, age 10 | | | — | .46*** | −.21*** | −.25*** | −.22*** | −.21*** | −.23*** | −.07 | −.06 | −.08 | .13** | .23*** | −.02 | .00 | .04 |
| 4. Gaming, age 12 | | | | — | −.25*** | −.28*** | −.27*** | −.26*** | −.43*** | −.07 | −.04 | −.11* | .08 | .21*** | −.01 | .04 | .09 |
| 5. Social competence, age 6 | | | | | — | .58*** | .45*** | .39*** | .18*** | .12** | .07 | .08 | .08 | −.07 | −.10* | −.07 | −.07 |
| 6. Social competence, age 8 | | | | | | — | .62*** | .54*** | .26*** | .19*** | .13** | .18*** | −.05 | −.12** | −.08 | −.08 | −.09 |
| 7. Social competence, age 10 | | | | | | | — | .58*** | .24*** | .11* | .13** | .08 | −.06 | −.08 | −.02 | −.06 | −.07 |
| 8. Social competence, age 12 | | | | | | | | — | .27*** | .04 | .06 | .08 | −.07 | −.12* | −.02 | .00 | .01 |
| 9. Gender | | | | | | | | | — | −.06 | −.05 | .00 | −.28*** | −.29*** | −.02 | .04 | .02 |
| 10. Socioeconomic status (SES) age 6 | | | | | | | | | | — | .60*** | .52*** | .01 | −.06 | .04 | −.01 | −.05 |
| 11. SES age 8 | | | | | | | | | | | — | .60*** | .08 | −.01 | .07 | −.07 | −.01 |
| 12. SES age 10 | | | | | | | | | | | | — | .04 | −.10* | −.01 | −.03 | −.07 |
| 13. Gaming with friends age 8 | | | | | | | | | | | | | — | .21*** | −.02 | .02 | .02 |
| 14.Gaming with friends age 10 | | | | | | | | | | | | | | — | .02 | .02 | .03 |
| 15. BMI age 6 | | | | | | | | | | | | | | | — | .87*** | .80*** |
| 16. BMI age 8 | | | | | | | | | | | | | | | | — | .87*** |
| 17. BMI age 10 | | | | | | | | | | | | | | | | | — |

*Note.* Boys = 1, Girls = 2. BMI = body mass index.
*$p < .05$, ** $p < .01$, ***$p < .001$.

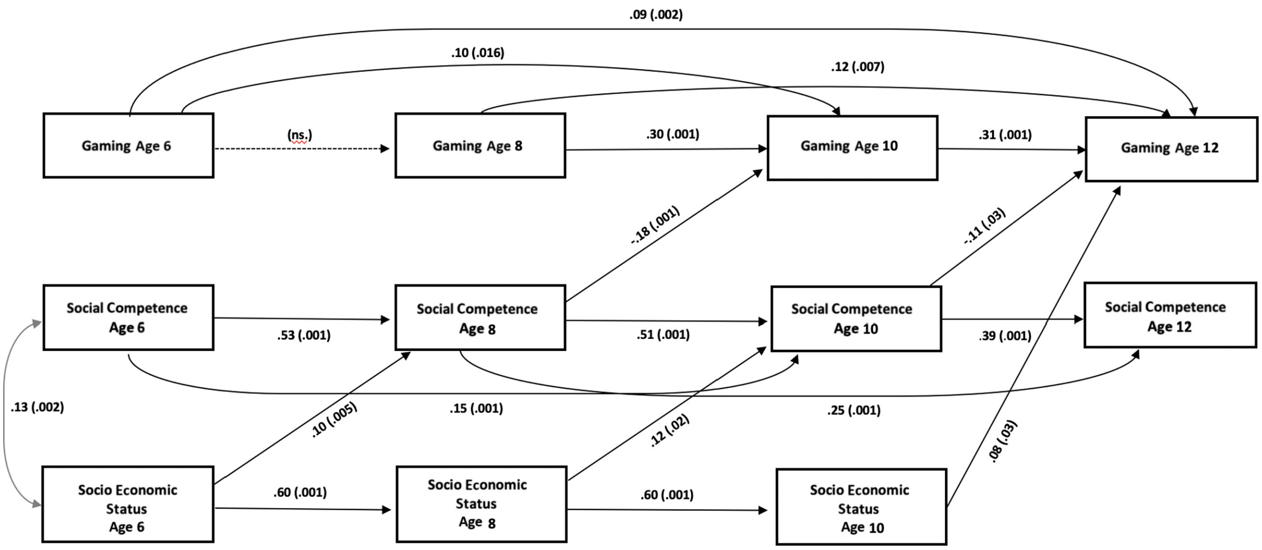


*Figure 1.* All children.
*Note.* Only significant paths are displayed in the model. [Color figure can be viewed at wileyonlinelibrary.com]

with friends) were entered on a forward basis. No significant predictive pathways from either BMI or gaming with friends to social competence or gaming were detected, and their inclusion did not alter the prospective relationship between social competence and gaming. In consequence, they were therefore not included in the subsequent analyses.

### *Differential Effects by Gender*

Testing for gender-specificity revealed that the results for the boy-girl models were not the same (see Figures 2 and 3). With regard to effects of social competence, greater social competence at ages 8 and 10 predicted less gaming 2 years later for boys ($\beta = -.14$, $p = .02$ and $\beta = -.12$, $p = .04$), but this association achieved conventional levels of significance only when social competence was assessed at age 8 for girls ($\beta = -.23$, $p = .001$). Prediction from age-10 social competence proved to be marginal for girls ($\beta = -.11$, $p = .051$). There were no significant difference between boys and girls from age 8 to 10 and 10 to 12 on these predictor-outcome associations (effect of social competence

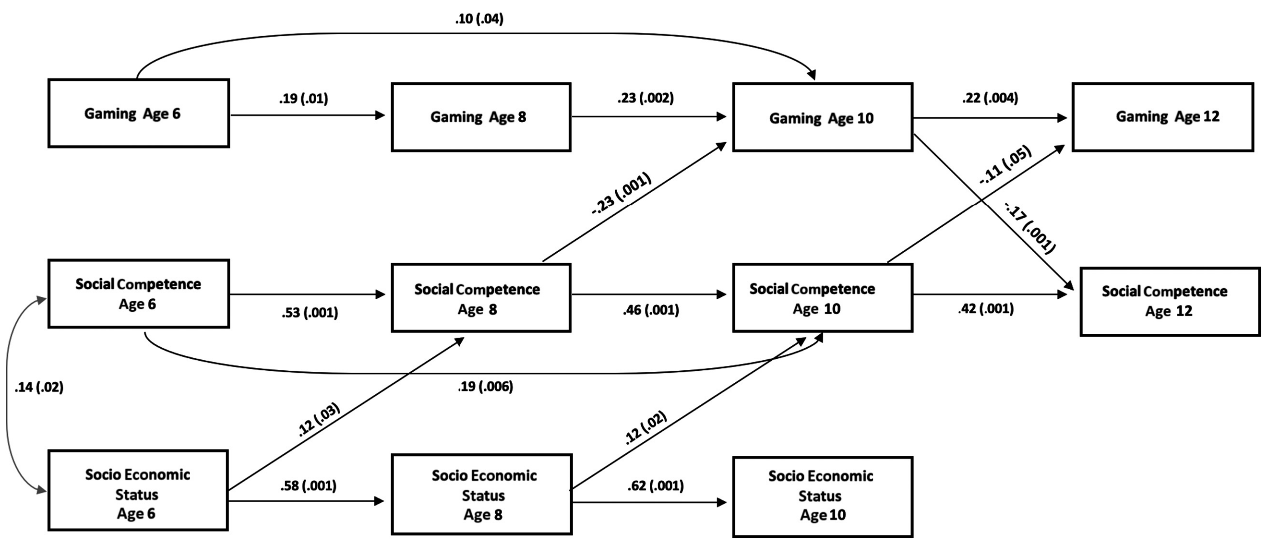


*Figure 2.* Girls.
*Note.* Only significant paths are displayed in the model.

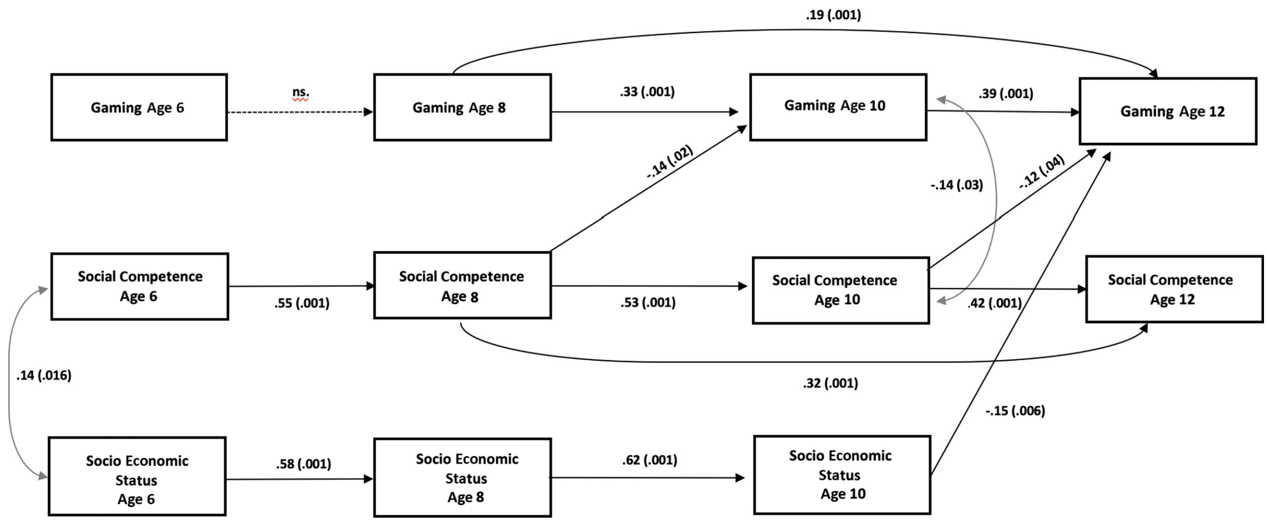


*Figure 3.* Boys.
*Note.* Only significant paths are displayed in the model. [Color figure can be viewed at wileyonlinelibrary.com]

on future gaming), Wald = 0.30 $df = 1$, $p = .58$, and Wald = 0.42 $df = 1$, $p = .52$, respectively. However, higher levels of gaming at age 10 predicted lower social competence at age 12 for girls ($\beta = -.17$, $p = .001$), but not for boys ($\beta = .04$, $p = .51$), resulting in a significant difference between boys and girls regarding this predictor-outcome relation, Wald = 7.85, $df = 1$, $p = .005$.

## Discussion

In this first study to examine reciprocal relations between time spent gaming and social competence in children across middle childhood, we first considered two contrasting hypotheses concerning possible associations between gaming and social competence: (a) that more time spent gaming would predict deficiencies in social competence, more so for girls and (b) that it would predict improved social competence. Then we hypothesized (c) that limited social competence would predict more gaming. The first hypothesis received support in that more gaming at age 10 predicted lower social competence at age 12, and this proved true for girls only. We found no support for the second hypothesis. The third hypothesis was supported in that greater social competence predicted less gaming at later ages.

Our findings regarding social competence and gaming are inconsistent with Lemmens et al. (2011b) who discerned no prospective association between time spent gaming and social competence. However, they did find that poorer social competence predicted pathological gaming. The latter finding is in line with more recent evidence showing that limited social skills at age 8 predict more age-10 Internet gaming disorder symptoms (Wichstrøm, Stenseng, Belsky, von Soest, & Hygen, 2019). Collectively, these studies, including the present, strongly suggest—given the observational character of the research—that social competence may be a key factor when it comes to accounting for why some children game more than others.

The first question that needs to be addressed with respect to the findings reported herein is why spending more time gaming seems to have a detrimental effect on the social competence of girls but not boys. Girls tend to play in smaller groups than do boys, and their relationships are often more intimate (Hartup, 1992). Boys, on the other hand, tend to play in larger groups than do girls (Rose-Krasnor, 1997). Thus, it might be that girls who game lose out on something very influential—more intimate interaction with a close friend or a few friends. Being in large groups may be less influential in shaping social competence, so time spent gaming could thus have less effect on this aspect of their development. In other words, given the differences in boys' and girls' social lives with peers, time spent gaming may carry less of a developmental "cost" for boys.

Additionally, because studies of gaming, including the current investigation, find that boys spend substantially more time gaming than do girls (e.g., Greenberg et al., 2010; Lemmens et al., 2011a), it could be that gaming is more integrated in boys' play culture and thus plays an important part of boys' socialization. Because girls' gaming is less socially normative, other girls may be less accepting of girls who game a lot. Thus, girls who game may not only have fewer in-person girls to game with, but also to a greater extent be excluded from nongaming social interaction with same-aged girls, and the socialization that follows.

With regard to our third hypothesis which received empirical support—that poorer social competence would predict more future gaming—several plausible explanations come to mind. According to the *need to belong hypothesis* (Baumeister & Leary, 1995), people have an underlying fundamental need to establish and maintain positive and longlasting relationships. Thus, children who struggle socially due to their limited social skills might be more inclined to go online to connect with other children because online communication is easily accessible and perhaps experienced as psychologically safer than face-to-face interactions. In this regard, consider the arguments of Sioni, Burleson, and Bekerian (2017) who studied adults involved in MMORPGs. They contend that for those who struggle with face-to-face interaction, gaming may fulfill the needs for social interaction and approval. In this respect, gaming might serve as a alternative route to social interaction and connectedness for some children, such as children with autism (Stone, Mills, & Saggers, 2019) or social phobia (Sioni et al., 2017). Online communication differs from face-to-face communication in several ways. In online games children are allowed to be anonymous, a certain set of more or less strict rules limit the interaction and the gaming, nonverbal cues (e.g., of uncertainty, embarrassment) are limited. For all these reasons players may feel they have more control over the social exchanges that take place. In consequence, for children who find real-life interaction difficult, it may be easier to engage in online interaction.

*Escapism* may also be relevant to understanding this study's findings. Escapism in the context of gaming involves "using the online environment to avoid thinking about real life problems" (Yee, 2006, p. 774). One of the fundamental features of electronic games is their ability to capture gamers' complete attention using dramatic graphics, lighting and sound combined with intriguing, exciting, captivating or thrilling plots that help players enjoy themselves (Ho, Lwin, Sng, & Yee, 2017). As a result, gaming may serve as an *escape* from reality, at least while playing. In fact, there is evidence that escapism is an important motivation for playing online games (Kuss & Griffiths, 2012). Prior work report that 15% of 10 year olds admitted that they gamed to relieve negative mood or escape from thinking about bad things (Wichstrøm et al., 2019). Hence, children who struggle socially may turn to gaming as an escape.

The need for *mastery* and *accomplishment* may also help to account for the findings linking poorer social competence with increased gaming. Children who do not master social expectations and requirements may suffer from low self-esteem, which has been linked to more online activity (Aydm & San, 2011). By playing games—and thereby taking part in the gaming community—children may come to feel more competent and accomplished than would otherwise be the case in the face-to-face social world (Neys, Jansz, & Tan, 2014).

In accord with previous research (Fairclough et al., 2009), our findings also showed that lower SES predicted more gaming 2 years later, a result that seems in line with related SES evidence that may explain this result: less economically advantaged families provide more opportunities for sedentary behavior and fewer for physical activity (Tandon et al., 2012). And this itself could be due to greater limit setting on time spent gaming by higher SES parents (Määttä et al., 2017). To be noted, we only found an effect of SES at one time point, age 10 (on age 12 gaming). Admittedly, we have no clear answers as to why this was the case.

Our results revealed no significant pathways from the social context of gaming to social competence or time spent gaming, nor did the inclusion of social gaming affect the relationship between gaming and social competence. However, the social context of gaming was measured with only one item tapping frequency. Hence, other aspect of the gaming with peers context (e.g., friends being passive bystanders as opposed to active coplayers; the extent and the quality of the social interaction when gaming—as well as before and after) might still prove important.

Although we used a multiwave, longitudinal design, which enabled us to examine the relationship between gaming and children's social competence over time, our study is not without limitations. First, our sample consisted of a community sample of children averaging a rather limited amount of time spent on gaming. Second, our measure of gaming (self- and parent-reported) may be error-prone given the difficulty of estimating time spent gaming. Third, measuring time spent gaming is a limitation in itself because time spent does not include involvement and all the surrounding factors related to gaming.

Finally, despite our efforts to discount potential confounding factors we must acknowledge that the lack of control for factors other than SES, gaming with friends and children's BMI may have affected the results. For example, whether games are competitive or cooperative in nature may influence their impact. In a recent longitudinal study by Lobel, Engels, Stone, Burk, and Granic (2017) of children aged 7–11 years, results indicated that whereas cooperative gaming had no effect on prosocial behavior, competitive gaming predicted decreases in prosocial behavior among high-frequency gamers (i.e., children who played for 8.5 hr or more per week). Perhaps even more informative were the results of a meta-analysis by Greitemeyer and Mügge (2014) which revealed that playing violent video games predicted increased aggression and decreased prosocial functioning, whereas prosocial games had the opposite effect. Parental participation (Coyne, Padilla-Walker, Stockdale, & Day, 2011), parent–child relationship (Choo, Sim, Liau, Gentile, & Khoo, 2015), other child characteristics (e.g., psychopathology such as attention deficit hyperactivity disorder or autism (Mazurek & Engelhardt, 2013), or traits such as anxiety, neuroticism, sensation seeking, and aggression (Mehroof & Griffiths, 2010,) may also be important here.

### *Conclusion*

In summary, at least in the case of the children included in this study, the results of our investigation would seem to mitigate some concerns about adverse effects of gaming on children's development. Recall that at only one point in time was there evidence that more time spent gaming forecast poorer social competence—and for girls only. Intriguingly, the results just summarized raise questions about the much more consistent findings indicating that poorer social competence predicted more gaming. In light of the limited evidence of the adverse effects of gaming on social competence, there would seem to be grounds for questioning the concerns about the time that less socially competent children are spending gaming. That said, it must be acknowledged that this inquiry focused only on social competence. Conceivably, other developmental phenomena might be affected by time spent gaming in a negative or positive manner. Thus, the observation just made should not be over-generalized. Indeed, it should not be interpreted as indicating that higher quantity of gaming carries no untoward consequences, only that in this investigation—which was focused on social competence—this did not generally prove to be the case. Clearly, there is a need for more work focused on other aspects of behavioral and psychological functioning in relation to gaming, and there is a need for including more contextual measures that might moderate the effects of time spent gaming.

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