British Journal of Psychology (2000), **91**, 295–310 *Printed in Great Britain*

Negative correlates of computer game play in adolescents

John Colwell* and **Jo Payne**

Psychology Academic Group, School of Social Science, Middlesex University, UK

There is some concern that playing computer games may be associated with social isolation, lowered self-esteem, and aggression among adolescents. Measures of these variables were included in a questionnaire completed by 204 year eight students at a North London comprehensive school. Principal components analysis of a scale to assess needs fulfilled by game play provided some support for the notion of 'electronic friendship' among boys, but there was no evidence that game play leads to social isolation. Play was not linked to self-esteem in girls, but a negative relationship was obtained between self-esteem and frequency of play in boys. However, self-esteem was not associated with total exposure to game play. Aggression scores were not related to the number of games with aggressive content named among three favourite games, but they were positively correlated with total exposure to game play. A multiple regression analysis revealed that sex and total game play exposure each accounted for a significant but small amount of the variance in aggression scores. The positive correlation between playing computer games and aggression provides some justification for further investigation of the causal hypothesis, and possible methodologies are discussed.

The era of computer games[1] began in 1972 with Pong, a computerized table tennis game, and since then the growth, both in terms of hardware systems and computer games software, has been phenomenal. Alongside this growth there has been much interest by a variety of commentators (e.g. Koop, 1982; Miller, 1993; Neustatter, 1991), in possible positive and negative consequences of computer game playing, mainly because the prime users are adolescents and children.

Positive aspects which have been identified include classroom learning (Silvern, 1986), language teaching (Hubbard, 1991), fostering friendship (Rutkowska & Carlton, 1994) and an aid in therapy with children (Gardner, 1991; Spence, 1988). Negative aspects relate to addiction (Anderson & Ford, 1986), physical symptoms such as soreness in joints (Loftus & Loftus, 1983), social isolation (Selnow, 1984), self-esteem (Dominick, 1984), and aggression (Cooper & Mackie, 1986). The focus of attention has been on those negative aspects, because of the possible causal role of playing computer games, and this, with the exception of physical symptoms and

* Requests for reprints should be addressed to Dr John Colwell, Psychology Academic Group, School of Social Science, Middlesex University, Queensway, Enfield EN3 4SF, UK (e-mail: j.colwell@mdx.ac.uk).

[1] The term computer games will be primarily used in this report, because the area of interest is home game playing. Such games appeared initially in arcades: they were referred to as video games, and the use of this term has persisted. Both terms are used loosely in the literature to refer to use in either location.

addiction, is the area of interest in the present research. While there is some evidence of the existence of 'computer junkies' (see Griffiths, 1993, for a discussion), very heavy players appear to comprise a minority of the computer game playing population in the UK (Colwell, Grady, & Rhaiti, 1995). Therefore the prime interest was in those variables likely to have more general impact, namely friendship and social isolation, self-esteem and aggression.

Friendship

Computer games may fulfil needs normally met through social interaction, and so lead to social isolation (Zimbardo, 1982). Indeed it is reported that 'teachers feel that some children may be retreating into the fantasy world of computer games as a way of avoiding the problems with which the real world presents them' (Miller, 1993, p. 2). The notion of 'electronic friendship' was investigated among 244 10–14-year-old children by Selnow (1984), using an adapted version of a 'catalogue of needs' scale, developed by Greenberg (1974) for watching television. Principal components analysis of the data produced five factors: video games preferred to friends, learn about people, companionship, action and solitude/escape. An index of arcade video game playing was found to correlate positively with each of the five factors, and Selnow saw this as support for the electronic friendship hypothesis. Data for each sex were not given. However, as Provenzo (1991) pointed out, video game arcades in the United States fulfil a social function as meeting places, especially for young males, and therefore the obtained correlations should come as no surprise. Such arcades have not attained the same social significance in the United Kingdom, and playing computer games at home would seem to have much greater potential to be associated with social isolation. However Lin and Lepper (1987) found no relationship between teacher ratings of sociability and arcade or home game play.

Selnow's (1984) needs scale, adapted for computer games, was used in a questionnaire survey of 120 11–17-year-old comprehensive school children by Colwell *et al*. (1995). A strong positive relationship between 'computer games being preferred to friends' and playing computer games was obtained for boys, and this supports the 'electronic friendship' hypothesis. However, paradoxically, playing computer games (for boys) also correlated positively with the number of times friends are seen outside school. One explanation, supported in other research (e.g. Rutkowska & Carlton, 1994), is that computer game play is a social activity. Scores (in the Colwell *et al*. study) on the 'preference to friends' factor are much weaker in girls: they do not relate to computer game play, and also no relationship was found between computer game play and sociability.

Self-esteem

The suggestion by Long (1983), that success in playing video games can compensate for a weak self-image in males was not supported in research by Gibb, Bailey, Lambirth, and Wilson (1983). Self-esteem did not relate to weekly playing time or months of experience (home and arcade play combined). However, Dominick (1984), in a survey using Rosenberg's four-item self-esteem scale, obtained no effect for girls,

but a negative relationship with amount of time spent each week on arcade video game play for boys. The correlation for home play did not reach significance. Also the effect was most pronounced in those boys who went to arcades alone, and Dominick viewed such play as a substitute for social relationships, a fear also expressed by Miller (1993). This points to a possible link between self-esteem, social isolation and computer game play. More recently, Fling *et al*. (1992) found no evidence of a relationship between a combined measure of home and arcade play and self-esteem, though they suggested that this may have been due to the use of a different measure of self-esteem, Cooper-Smith's (1967) 25-item Form B inventory. Self-esteem in the Colwell *et al*. (1995) study was measured using Battle's Culture-Free Self-Esteem Inventory (Form A). Self-esteem was not related to home computer game play (arcades are not common in the United Kingdom, and play in them is infrequent), but for girls there was a negative relationship with needs met by game play. Those with low self-esteem scored high on computer games preferred to friends, companionship, and escape/solitude. One problem is that different measures of self-esteem have been used in the few relevant studies, and this makes it more difficult to account for the variations in results. Also results for home computer game play only have not always been presented.

Aggression

Initial concerns over possible negative consequences of playing computer games (e.g. Koop, 1982; Zimbardo, 1982) focused on the aggressive content of many games, and the effect on aggressive behaviour. Research (Bowman & Rotter, 1984; Provenzo, 1991) has confirmed the high incidence of games featuring aggressive content (destruction, killing, etc.), but, although concerns continue to be articulated, it is acknowledged that more research needs to be conducted before reaching conclusions (Miller, 1993). The intention is not to review the research evidence here (see Griffiths, 1997a, for a recent review), but to provide a context in which to place the present study.

There are parallels between television violence and violence portrayed in computer games (Silvern & Williamson, 1987), and similar theoretical explanations have been applied. Social learning theory (Bandura, 1986) predicts an increase in aggressive behaviour after exposure to aggressive media, whereas catharsis predicts a decrease (Feshbach & Singer, 1971). One argument is that the effect may be more pronounced with computer games. There is more control by the player, and more reward for acting aggressively (Schutte, Malouff, Post-Gorden, & Rodasta 1988; Silvern & Willamson, 1987). However, there is more realistic (as opposed to vicarious) acting out of behaviour, and this should lead to a larger reduction in the emotional drive of related behaviour (Silvern & Williamson, 1987).

Experimental studies have produced mixed results, but there is some evidence of a short-term increase in aggressive behaviour after playing an aggressive computer game. For example, Silvern and Williamson (1987) obtained baseline measures of aggression, fantasy, and prosocial behaviour, through observation of 28 4–6-year-old children whilst they played in pairs with toys during a 10-minute period. One day later each pair either watched a violent television cartoon (Road Runner), or played

a violent computer game (Space Invaders), followed by another 10-minute play session with the same toys. During a third session the following day, the treatments were reversed for each pair, and again free play with the toys was observed. Recordings of all play sessions were then coded for aggression, fantasy, and prosocial behaviour. Significantly more instances of aggressive behaviour were found after either watching the cartoon or playing the computer game compared to baseline. The treatment effects did not differ from each other. Also prosocial behaviour was significantly lower after either treatment compared to baseline levels, and again the treatment effects were not significantly different. Boys displayed more aggressive and less prosocial behaviour than girls, but the effects were observed in both.

However, in a similar study (Cooper & Mackie, 1986), 84 9–10-year-old children were rated for aggression in an individual 8-minute free play situation, by time spent playing with one of four types of toy (aggressive, skill, active, quiet) present in the room. Each child then played a high aggression computer game (High Command), a low aggression computer game (Pac-Man), or was put in a control condition (maze game), after which aggression in free play was assessed again. Boys spent significantly more time playing with the aggressive toy than girls, but that level was not increased by any of the experimental manipulations. In contrast, time spent by girls playing with the aggressive toy increased significantly after playing High Command. The possibility of a ceiling effect for boys is not supported since only around 15% of the available time was spent with the aggressive toy.

Correlational studies have also produced varying results, with positive correlations between aggression and video game play in some studies. For example, Fling *et al*. (1992), in a survey of 153 children (104 boys, 49 girls, 11–17 years old), included measures of frequency and length of both home and arcade game play, and aggression, using Dominick's (1984) 13-item scale. In addition, after examining this aggression scale, teachers were asked to rate the children on a 10-point scale on general aggression. An index of amount of play was computed by summing frequency of home play, frequency of arcade play, years of play, and duration of each play. Positive correlations were obtained between amount of play and both self-ratings ($r = \cdot 26$, $p < \cdot 01$) and teacher ratings ($r = \cdot 25$, $p < \cdot 01$) of aggression. Correlations by sex are not provided, but aggression scores for boys, in both self and teacher ratings, were significantly higher than scores for girls. However Gibb *et al*. (1983) in a sample of 280 12–34-year-olds found no correlation between a measure of hostility and weekly playing time (males, $r = \cdot 06$; females, $r = -\cdot 10$) or between hostility and months of experience (males, $r = \cdot 05$; females, $r = -\cdot 21$). In the Gibb *et al*. study arcade and home play were combined, but Lin and Lepper (1987) kept them separate. Frequency was used as the measure of game play, and teachers rated each of 234 9–11-year-old children for aggression on a 7-point Likert scale. A significant positive correlation between arcade play and aggression was obtained for males ($r = \cdot 26$, $p < \cdot 01$), but the effect was weaker for females ($r = \cdot 17$). There was no correlation between home play and aggression for males ($r = \cdot 09$), but a weak negative correlation was obtained for females ($r = -\cdot 16$).

These inconsistent results would seem to reflect the paucity of research, and studies have differed on a number of dimensions, e.g. age group and measures used. This underlines the need for more research, which, given that causation implies

correlation, initially should attempt to determine the existence of the correlates of playing computer games at home. The intention in the present study was to gather data on friendship and social isolation, self-esteem, and aggression, and to assess the relations between these variables and home computer game play.

Method

Participants

The participants were 204 children (91 boys and 113 girls) at a comprehensive school in North London. Their ages ranged from 12–14 years old ($M = 12{\cdot}7$ years).

Questionnaire

Part 1, designed for players, included the following computer game play items (codes shown in brackets):

Years of play: How long have you been playing regularly on a games system?
Less than 6 months (1) 6 months to 1 year (2) 1–2 years (3) more than 2 years (4)

Frequency: In an average school week how many times do you play on a games system?
Less than once (1) 1–2 times (2) 3–5 times (3) every day (4) more than once a day (5)

Duration: On average, when you play, how long do you play for?
Less than $\frac{1}{2}$ hour (1) $\frac{1}{2}$ hour to 1 hour (2) 1–2 hours (3) 2–3 hours (4) more than 3 hours (5)

Children's perceptions of parental attitudes consisted of three 5-point scales (coded 1–5) to measure (a) concern over amount of play time (no—always), (b) attempts to control time (never—always), and (c) approval of computer games (strongly disapprove—strongly approve). They were also asked for the game system(s) used and to name their three favourite computer games. Selnow's (1984) needs scale, adapted for computer games, shown below, was included. An extra item, 'the best way to spend my time' was added, which was thought would help to locate the central role of playing computer games. Each item asked for a response on a 5-point scale, from strongly disagree to strongly agree.

Factor 1 (computer games preferred to friends)
Playing computer games is better than being with people
Playing computer games is more exciting than being with people
It's more fun playing computer games than being with friends

Factor 2 (learn about people)
When I play with computer games it's like being with another person

Factor 3 (companionship)
Computer games are good company for me
Playing computer games helps me forget I'm alone
Playing computer games is almost like being with a friend

Factor 4 (action)
Playing computer games gives me something to do when I haven't got anything else to do
Playing computer games gives me things to do rather than watching others do things
Playing computer games makes me feel part of the action

Factor 5 (solitude)
Playing computer games is a chance for me to be by myself
I play computer games because it lets me think by myself

Extra item
Playing computer games is the best way I can think of to spend my time

Part 2 asked for demographic data, along with Rosenberg's (1965) 7-item self-esteem scale, with items such as 'I feel I have a number of good qualities'. Aggression was measured using Dominick's (1984) 13-item scale, which consisted of three subscales. There were 6 items on manifest physical aggression (e.g. 'If somebody hits me first I let them have it'), 3 items on aggressive behavioural delinquency (e.g. been in fights with several people on each side), and 4 items on hypothetical aggressive reactions (e.g. Suppose someone played a really dirty trick on you, would you?). A measure of friendship consisted of one question asking for the number of good friends in the class.

The questionnaires were anonymous, in order to encourage honesty. Children may have been reluctant to give honest answers if they thought that their questionnaires could be identified. Therefore all the data were self-report, since ratings by others on certain scales would have meant loss of anonymity. However, it was felt that more accurate data could be provided personally, with the use of standardized scales, because only respondents have knowledge of all their behaviour. The use of ratings by others (e.g. a form teacher) may have led to questions regarding validity of the judgments.

Procedure

The questionnaire was administered to year eight students by their form tutor during a form period. They were given brief instructions on how to fill it out. It was made clear that the questionnaires were anonymous, that there were no right or wrong answers, and students were asked to answer questions honestly. The fact that they would be looked at by researchers at Middlesex University only was also emphasized.

Results

Summary data on computer game playing and parental attitudes are shown in Table 1.[2] Computer games were played by 91·7% of participants (96·7% of boys and 87·6% of girls), with home video systems being most popular (67·1%), although all game players had access to at least one type of game hardware at home (handheld, video, or pc). In addition 19·2% of participants (30·7% of boys and 9·1% of girls) played in arcades as well. The most popular duration of play (39·2%) was between one half and one hour, and 16·1% played for more than two hours at a time. The most popular frequency (30·7%) was 1–2 times each week, with 18% of participants saying that they played computer games more than once a day, and 51·7% had been playing for more than two years.

There was also evidence of sex differences. Boys played more often than girls, and they played for longer. Few children (11·3%) indicated that their parents thought that they spent too much time playing computer games, and only 15·5% reported attempts to control. Even fewer parents (6·1%) were said to disapprove of computer games. Children appeared to play equally with friends, family, and by themselves, and less than half preferred computer games to other activities.

Zero order correlations between game play measures are shown in Table 2. It can be seen that the significant correlation between frequency and duration ($r = ·35$, $p < ·01$) found in the whole sample, is significant for boys ($r = ·40$, $p < ·001$) but not for girls ($r = ·14$), though the difference between the correlations does not quite reach significance ($p < ·06$, two-tailed). Also there is a positive correlation between number of years of play (years) and frequency for boys ($r = ·43$, $p < ·001$), which is significantly higher ($p < ·005$, two-tailed) than that obtained for girls ($r = -·04$).

[2] The analysis was conducted on 187 players, with a small amount of missing data on most scales. The effect of this was to reduce sample sizes in computations involving several variables, given that the missing data did not relate to the same players on each of the variables.

Table 1. Means, standard deviations, and the results of *t* test analyses of sex differences, for computer game playing measures

	Whole sample		Boys		Girls			
Measure	*M*	SD	*M*	SD	*M*	SD	*t* (d.f.)	*p*
Frequency of play	3·06	1·22	3·47	1·29	2·69	1·03	4·54(163.65)[a]	·001
Duration of play	2·57	0·99	2·79	1·06	2·36	0·86	3·03(181)	·003
Years of play	3·21	1·06	3·19	1·07	3·23	1·06	−0·29(183)	
Game exposure	28·22	22·77	35·68	26·17	21·27	15·83	4·02(142.88)[a]	·001
Parental attitudes								
Spend too much time	2·00	1·18	2·35	1·32	1·69	0·98	3·80(153.33)[a]	·001
Try to control	1·98	1·20	2·11	1·25	1·86	1·14	1·41(181)	
Approve of play	3·36	0·93	3·29	1·08	3·45	0·73	−1·19(183)	

[a] Unequal variances.
Note. N = (180–186) for *t* test analyses.

Table 2. Zero order correlations between measures of game play

	Whole sample			Boys			Girls		
	Frequency	Years of play	Game exposure	Frequency	Years of play	Game exposure	Frequency	Years of play	Game exposure
Duration	·35**	·22*	·75**	·40**	·17	·73**	·14	·27*	·72**
Frequency		·19*	·74**		·43**	·80**		−·04	·57**
Years of play			·60**			·67**			·60**

*$p < ·01$; **$p < ·001$.
Note. N = 180–184 (whole sample); 82–85 (boys); 98–99 (girls).

Years of play correlates positively with duration ($r = ·27$, $p < ·007$) for girls, but this correlation, though higher, does not differ significantly from the same correlation obtained for boys ($r = ·17$). A measure of 'total dose' of game playing[3] (game exposure) was computed through the product of frequency, duration and years of play, and again a sex difference was obtained, with significantly higher scores for boys.

Friendship

The majority of children (75·2%) claimed to have four or more good friends in the class, but a small minority (5·2%) said that they had none. Friendship did not relate to any of the computer play variables for the whole sample or for girls (see Table 4).

[3] Patterns of play can vary over time, and so there may be measurement error in the total dose measure.

However, for boys there was a negative correlation between game exposure and number of good friends ($r = -\cdot22$, $p < \cdot05$), though this correlation did not differ significantly from that obtained for girls ($r = \cdot06$). The partial correlation between game exposure and number of good friends, controlling for sex does not reach significance ($r = -\cdot10$, $p < \cdot2$).

Principal components analysis with varimax rotation was conducted on the needs scale items, and three factors were extracted with eigenvalues $> 1\cdot0$, which accounted for 56·2% of the variance. However, an inspection of the scree plot suggested the existence of two factors. The items are shown in Table 3, along with factor loadings in excess of ·4.

Table 3. Principal components analysis of the needs scale items

Item	Factor 1	Factor 2
Playing computer games helps me to forget I'm alone	·84	
I play computer games because it lets me think by myself	·71	
Playing computer games makes me feel part of the action	·66	
When I play computer games it is like being with another person	·65	
Playing computer games is almost like being with a friend	·62	
Playing computer games is a chance for me to be myself	·61	
Computer games are good company for me	·54	
Playing computer games lets me do things rather than just watch others do things	·47	
Playing computer games is better than being with people		·84
It's more fun to be playing computer games than playing with friends		·80
Playing computer games is more exciting than being with people		·75
Playing computer games is the best way I can think of to spend my time		·61

Note. $N = 181$.

Eight items loaded highly on Factor 1, which accounted for 33·8% of the variance. This factor included items from Selnow's companionship, solitude, learn about people, and action items, and it seemed to be reflecting a need to be alone, but at the same time having substitute friendship (computer games) and something to do. This factor was labelled 'companionship'. Computer games are not preferred to real friends, but they fulfil a similar function while alone. Factor 2 includes all the 'computer games preferred to friends' factor items, as well as the new item 'best way to spend time', and it accounts for 14·1% of the variance. The label 'prefer to friends' is retained. Cronbach's alpha coefficients were ·82 for Factor 1 and ·79 for Factor 2. Separate analyses for boys and girls separately resulted in extraction of the same two factors.

The zero order correlations between measures of game play, the needs factors, and friendship are shown in Table 4. There is no evidence that the factors are related to

friendship in the whole sample or for boys and girls separately. Also they do not relate to game play in girls, but, for boys, companionship correlates positively with frequency of play ($r = \cdot32$, $p < \cdot003$, duration ($r = \cdot36$, $p < \cdot001$), and exposure ($r = \cdot33$, $p < \cdot003$). A similar but weaker pattern is obtained between 'prefer to friends' and the three play variables. However, despite the trend for higher correlations for boys compared to girls, only one correlation difference (the correlation between companionship and duration) reaches significance ($p < \cdot009$).

Table 4. Zero order correlations between game play, number of friends, needs met by playing computer games, and self-esteem

	Frequency	Duration	Years of play	Game exposure	Number of friends	Self-esteem
			Whole sample			
Companionship	·25***	·22**	·02	·24***	−·01	−·07
Prefer to friends	·24***	·19**	·05	·25***	−·10	−·09
Number of friends	−·07	·01	−·07	−·10		·02
Self-esteem	−·02	·09	−·01	·03		
			Boys			
Companionship	·32**	·36***	·04	·33**	−·03	−·20
Prefer to friends	·22*	·18	·07	·23*	−·15	−·19
Number of friends	−·15	−·03	−·13	−·22*		−·02
Self-esteem	−·21*	−·00	−·02	−·11		
			Girls			
Companionship	·13	·02	·00	·09	·09	·12
Prefer to friends	−·01	·04	·01	·04	·03	−·18
Number of friends	·03	·09	−·01	·06		·09
Self-esteem	·03	·04	·01	·04		

*$p < \cdot05$; **$p < \cdot01$; ***$p < \cdot001$.
Note. $N = 171$–184 (whole sample); 77–86 (boys); 94–99 (girls).

Self-esteem

Correlations between self-esteem (alpha coefficient ·70) and measures of game play are shown in Table 4. Self-esteem did not relate to any of the game playing variables for the whole sample. However, a significant but low negative correlation was obtained between self-esteem and frequency of play in boys ($r = -\cdot21$, $p < \cdot05$). This correlation did not differ significantly from that obtained for girls ($r = \cdot03$). Also for boys there were similar low, though not significant, negative correlations between self-esteem and companionship ($r = -\cdot20$) and the prefer to friends ($r = -\cdot19$) needs factors. The partial correlation between game exposure and self-esteem, controlling for sex, is not significant ($r = -\cdot05$, $p < \cdot48$).

Aggression

The results of a count of favourite games which contained aggression (killing, punching, destroying, etc.) are shown in Table 5. Most children (73·2%) nominated none or one aggressive game out of three, and more boys chose aggressive games than girls, $t(164,57) = 4{\cdot}69$, $p < {\cdot}001$.

Table 5. Number of favourite games chosen with aggressive content

Number	0	1	2	3
Boys	23·3[a]	36·0	26·7	14·0
Girls	48·9	38·3	8·5	4·3
All	36·1	37·2	17·5	9·3

[a] Percentages given.
Note. $N = 180$ (86 boys and 94 girls).

Cronbach's alpha coefficients were ·76 for physical aggression, ·71 for aggressive delinquency, and ·70 for hypothetical aggression. All three aggression scales correlated highly and significantly with each other: physical aggression with aggressive delinquency ($r = {\cdot}70$, $p < {\cdot}001$), physical aggression with hypothetical aggression ($r = {\cdot}70$, $p < {\cdot}001$), and aggressive delinquency with hypothetical aggression ($r = {\cdot}60$, $p < {\cdot}001$). A total aggression score was computed, following McLeod, Atkin, and Chaffee (1978), by combining all three subscales. The alpha coefficient for this 13-item scale was ·88. Zero order correlations between measures of game play and aggression scores, and number of aggression games are shown in Table 6. Total aggression scores correlated significantly with game exposure ($r = {\cdot}29$, $p < {\cdot}001$), but frequency of play was associated more highly ($r = {\cdot}28$, $p < {\cdot}001$) than duration of play ($r = {\cdot}21$, $p < {\cdot}007$) and years of play ($r = {\cdot}07$).

Boys produced significantly higher total aggression scores than girls, $t(176) = 3{\cdot}83$, $p < {\cdot}001$, and there were sex differences in contributions to the correlation between total aggression scores and exposure to computer game play. The highest correlation for boys was for frequency of play ($r = {\cdot}20$, $p < {\cdot}08$), whereas for girls it was for duration of play ($r = {\cdot}19$, $p < {\cdot}08$). However, differences between correlations for boys and girls were not significant. The partial correlation, controlling for sex, between aggression and game exposure is significant ($r = {\cdot}18$, $p < {\cdot}03$). Also, those above the median for exposure were significantly more aggressive ($t(157) = -4{\cdot}21$, $p < {\cdot}001$) than those below the median.

A preference for aggressive games was not related to total aggression scores ($r = {\cdot}14$). However, it related positively to frequency of play in boys ($r = {\cdot}27$, $p < {\cdot}01$), and this correlation differed significantly ($p < {\cdot}015$) from that obtained for girls ($r = -{\cdot}09$). In addition there was some evidence of a negative relation between this preference and game exposure in girls ($r = -{\cdot}20$, $p < {\cdot}06$), and again it differed significantly ($p < {\cdot}05$) from the correlation for boys ($r = {\cdot}18$). An index of exposure

Table 6. Zero order correlations between measures of game play, total aggression (aggression), number of aggressive games named, and total time spent playing games with aggressive content (total aggressive play)

Measure	Aggression	Number of aggressive games	Total aggressive play
		Whole sample	
Years of play	·07	−·11	·50***
Frequency	·28***	·21**	·70***
Duration	·21**	·10	·64***
Game exposure	·29***	·13	·88***
Total aggressive play	·30***		
Aggression		.14	
		Boys	
Years of play	·12	−·01	·58***
Frequency	·20	−·27*	·80***
Duration	·07	·11	·60***
Game exposure	·17	·19	·89***
Total aggressive play	·22		
Aggression		.10	
		Girls	
Years of play	−·07	−·20	·52***
Frequency	·14	−·09	·42***
Duration	·19	−·13	·61***
Game exposure	·19	−·19	·83***
Total aggressive play	·11		
Aggression		−.06	

*$p < ·05$; **$p < ·01$; ***$p < ·001$.
Note. $N = 155–184$ (whole sample); 74–85 (boys); 81–99 (girls).

to computer games with aggressive content (game exposure × number of aggressive games) correlated positively with aggression ($r = ·30$, $p < ·001$) for the whole sample. However, the correlation was stronger for boys ($r = ·22$, $p < ·06$) than for girls ($r = ·11$), although the two correlations did not differ significantly from each other.

Multiple linear regression analysis

A standard multiple regression procedure was employed in order to ascertain the proportion of explained variance in aggression. The dependent variable was aggression and independent variables were game exposure, number of aggressive

games, and sex. Frequency, duration, number of years of play, and total time spent playing games with aggressive content were not included as predictors due to problems with multicollinearity and singularity. Also the prime interest was in the effect of a 'total dose' of game play. Analyses of the data for boys and girls separately did not reach significance. The results for the whole sample are shown in Table 7. Two variables, sex and game exposure, each accounted for a proportion of the total of 10·5% explained variance, and both were significantly predictors of aggression.

Table 7. Multiple regression analysis: predicting aggression

Predictor	Beta	Unique variance
Sex	−·22**	3·9%
Game exposure	·19*	3·1%
$R = ·35$; $R^2 = ·105$		

*$p < ·02$; **$P < .01$.
Note. $N = 155$.

Discussion

The popularity of playing computer games in the United Kingdom, reported in earlier studies (Colwell *et al*., 1995; Griffiths & Hunt, 1995), was confirmed in the present study. The frequently obtained sex difference, with boys playing more than girls, was also repeated. There was evidence of a low negative relationship between a 'total dose' of computer game play and the number of good friends which boys have in the class, and therefore it could be argued that there is some support for the 'social isolation' hypothesis. These findings (for boys) would seem to contradict those of earlier studies (e.g. Colwell *et al*., 1995; Lin & Lepper, 1987). However, sociability was assessed by Lin and Lepper (1987) using teacher ratings of popularity and friendliness, and these did not relate to game play; Colwell *et al*. (1995) asked how often friends are seen outside school, and this variable correlated positively with game play for boys ($r = ·20$, $p < ·05$). The difference in findings may be due to variations in measures of sociability, but they could also be due to variations in the measure of computer play. Lin and Lepper (1987) used frequency of play, and the correlation with sociability ($r = -·10$) for boys was similar to the corresponding correlation in the present study ($r = -·15$). Colwell *et al*. (1995) used frequency × duration, and the obtained correlation ($r = ·20$) for boys is not significantly different from the corresponding one derived from the present data ($r = -·08$).

The suspicion is that sociability and playing computer games are causally linked, and this being the case, an increased effect with increased exposure would be expected. Therefore, an index of total 'dose' would seem to be the optimal measure of game play, in order to test for evidence to support a causal hypothesis. The suggestion of a negative relationship between game play and sociability for boys questions Griffiths's (1997b) conclusion, that the fears concerning the link between computer game play and social isolation are groundless. Clearly more research is

required, which will need to address the problem of how to obtain a 'best' measure of social isolation. However, the findings on computer game play and friendship for girls are consistent with those of earlier studies.

The evidence for 'electronic friendship' was reported by Selnow (1984), with the use of his adapted needs scale. An analysis of the present data on needs resulted in two factors (both relating to friendship), in contrast to five (two friendship) obtained by Selnow, with only one, 'prefer to friends', fully in common. Neither factor was related to the number of good friends in the class, and so there is no evidence to suggest that the satisfaction of friendship needs through computer game play can lead to social isolation.

The 'prefer to friends' factor correlated significantly with game play in boys, a result also obtained by Colwell *et al*. (1995), whereas Selnow (1984) implied that the relation held for boys and girls (no details of sex differences were published). The other friendship factor obtained, 'companionship', was similar to, but wider than, the companionship factor reported by Selnow, and it also related to game play in boys. It suggests an active, companionship role for computer games whilst alone. The aim of this research was to investigate the possible negative consequences of computer game play. However these data provide further clues on why computer games are played.

Self-esteem in boys was negatively related to frequency of play, suggesting more frequent play with lower self-esteem. Previous research on home play (Colwell *et al*., 1995; Dominick, 1984), or a combined measure of home and arcade play (Fling *et al*., 1992; Gibb *et al*., 1983), found no relationship between play and self-esteem. These last two studies were carried out in the United States, where video game arcades are common, and there may be different reasons for arcade compared to home play. However, self-esteem was correlated with weekly playing time (frequency × duration) in the Gibb *et al*. study, and the corresponding correlation in the present study does not reach significance ($r = -\cdot17$, $p < \cdot13$). The non-significant relationship in the Colwell *et al*. study also used the frequency × duration measure. Fling *et al*. used frequency and total exposure, and neither correlated with self-esteem. However, both play variables were a combination of home and arcade play, and data are not provided for each location. Finally, in Dominick's study, the obtained correlation ($r = -\cdot14$) for boys was between amount of time spent each day at home on game play, equivalent to frequency × duration, and self-esteem (Rosenberg's four-item scale). This is very similar to the corresponding correlation in the present study ($r = -\cdot17$), which also used Rosenberg's scale (7-item). The present results for self-esteem and game play are therefore not inconsistent with results of previous research, and the importance of comparing 'like with like', is underlined.

The low negative correlation between frequency of play and self-esteem would seem to provide some support for the possibility, discussed by Dominick (1984), that success in game play may raise self-esteem in boys, perhaps temporarily, though his negative correlation was between amount of weekly arcade play and self-esteem. However, although low self-esteem may be a reason for frequent play, game exposure is not related to self-esteem, and so there is no evidence of a cumulative effect of such play on self-esteem. Therefore a causal explanation, that play can raise self-esteem, is not supported.

Aggression correlated positively with total exposure to computer games (game exposure). However, the strongest contribution to this correlation was frequency of play for boys, and duration of play for girls. Fling *et al*. (1992) used the same self-report measure of aggression, and positive correlations were obtained with a combined measure (frequency) of home and arcade play, and with a measure of amount of play. It is not clear if the correlations held for each location and for boys and girls separately. Interestingly, teacher ratings were also used, and, as with self-ratings, a positive correlation was obtained. In contrast, Lin and Lepper (1987) found that teacher ratings of aggression correlated positively with frequency of arcade game play for boys, but not with frequency of home game play. There was no effect with girls.

In his review, Griffiths (1997a) concludes that it is too soon to draw any conclusions about the role of computer games in promoting aggressive behaviour. However, there appears to be a growing body of evidence to suggest that there is a relationship between playing computer games and aggression. Correlation does not mean causation. The simple explanation that aggressive children are drawn to play games with predominantly violent content is very compelling, although the lack of a relationship in this study, between aggressive favourite games and aggression scores, would seem to provide contradictory evidence. However, the positive correlation for boys between frequency of play and the number of favourite games with aggressive content is consistent with the causal hypothesis, given that frequency also correlates positively with aggression.

A significant proportion of the variance in aggression was explained by sex, with boys more aggressive than girls, and by the total amount of time spent playing computer games. The latter result provides some support for the notion that playing computer games, the large majority of which are aggressive in nature, may promote aggression. However, the correlational nature of the relationship between the two variables must be emphasized, as must the small amount of variance in aggression explained by amount of play. The remainder is likely to be accounted for by other factors, such as social learning during socialization (e.g. Bandura, 1986).

Any attempt to test for a causal link between computer game play and aggression in the real world would be wise to take account of lessons learnt from research into the effects of media violence. An enormous amount of experimental research has been carried out over the past 40 years, including laboratory experimentation (e.g. Lovaas, 1961), field experimentation (e.g. Leyens, Camino, Parke, & Berkowitz, 1975), and natural experiments (Phillips, 1986). In addition, attempts have been made to establish causality from a pattern of correlations (e.g. Belson, 1978; Eron, 1982). Freedman (1984, 1986), has pointed to wide variation, and inconsistency, in results obtained in the experimental studies, and to a number of methodological problems, which weaken internal and/or external validity. In addition, he argues that the causal hypothesis is not supported by the results of correlational studies. Although others disagree with Freedman's conclusions (e.g. Friedrich-Cofer & Huston, 1986), more neutral observers (e.g. Parliamentary Office of Science and Technology, 1993) conclude that the causal hypothesis is open to question. Given the serious problems with the use of experimentation, it is suggested that correlational research is the most promising available method for the investigation of the consequences of computer

game play. Two approaches to the establishment of a pattern of correlations to support causality may be used.

First, following Freedman's (1986, p. 375) reasoning, if exposure to game play causes aggression, it would be reasonable to expect a cumulative effect, and for correlations to increase with exposure. However, if the two variables are not causally linked, or if causality is in the reverse direction, and play results from someone's personality (e.g. aggressiveness), such an increase would not be expected (unless personality changes). Therefore future research could investigate the correlation between aggression and play at different exposure levels. Secondly, causal relationships could be investigated by using structural equation modelling on longitudinal data.

This research sought to investigate the concepts of friendship, social isolation, self-esteem, and aggression, in relation to computer game play in a sample of children. It is concluded that in general, such play may be linked to friendship, social isolation, and self-esteem among boys. Also, for boys, computer games can fulfil needs similar to that provided by friends, although there is no evidence that this will lead to social isolation. Computer game play accounts for some of the variance in aggression, and so there is justification for further investigation of the causal hypothesis.

Acknowledgements

We would like to thank Stephen Sutton, Peter Sneddon, and three anonymous reviewers for their constructive comments on earlier drafts of this article.

References

Anderson, C. A., & Ford, C. M. (1986). Affect of the games player: Short term effects of highly and mildly aggressive video games. *Personality and Social Psychology Bulletin*, *12*, 390–402.

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory.* Englewood Cliffs, NJ: Prentice Hall.

Battle, J. (1992). *Culture-Free Self-Esteem Inventory* (2nd ed.). Austin, TX: Pro-Ed.

Belson, W. (1978). *Television violence and the adolescent boy*. Hampshire: Saxon House.

Bowman, R. P., & Rotter, J. C. (1983). Computer games: Friend or foe? *Elementary School Guidance and Counselling*, *18*, 25–34.

Cooper-Smith, S. (1967). *The antecedents of self-esteem*. San Francisco, CA: W. H. Freeman.

Colwell, J., Grady, C., & Rhaiti, S. (1995). Computer games, self-esteem and gratification of needs in adolescents. *Journal of Community and Applied Social Psychology*, *5*, 195–206.

Cooper, J., & Mackie, D. (1986). Video games and aggression in children. *Journal of Applied Social Psychology*, *16*, 726–744.

Dominick, J. R. (1984). Videogames, television violence and aggression in teenagers. *Journal of Communication*, *34*, 136–147.

Eron, L. D. (1982). Parent–child interaction, television violence, and aggression in children. *American Psychologist*, *37*, 197–211.

Feshbach, S., & Singer, R. D. (1971). *Television and aggression: An experimental field study.* San Francisco, CA: Jossey-Bass.

Fling, S., Smith, I., Rodriguez, T., Thornton, D., Atkins, E., & Nixon, K. (1992). Video games, aggression, and self-esteem: A survey. *Social Behaviour and Personality*, *20*, 39–46.

Freedman, J. L. (1984). Effect of television violence on aggressiveness. *Psychological Bulletin*, *96*, 227–246.

Freedman, J. L. (1986). Television violence and aggression: A rejoinder. *Psychological Bulletin*, *100*, 372–378.

Friedrich-Cofer, L., & Huston, A. C. (1986) Television violence and aggression: The debate continues. *Psychological Bulletin*, *100*, 364–371.
Gardner, J. E. (1991) Can the Mario Bros help? Nintendo games as an adjunct in psychotherapy with children. *Psychotherapy*, *28*, 667–670.
Gibb, G., Bailey, J., Lambirth, T., & Wilson, W. (1983). Personality differences between high and low electronic video game users. *Journal of Psychology*, *114*, 159–165.
Greenberg, B. (1974). Gratifications of television viewing and their correlates for British children. In J. Blumler & E. Katz (Eds.), *The uses of mass communications* (pp. 71–92). Beverley Hills, CA: Sage.
Griffiths, M. (1993). Are computer games bad for children? *The Psychologist*, September, 401–407.
Griffiths, M. (1997a). Video games and aggression. *The Psychologist*, September, 397–401.
Griffiths, M. (1997b). Video games: The good news. *Education and Health*, *15*, 1, 10–12.
Griffiths, M., & Hunt, N. (1995). Computer game playing in adolescence. Prevalence and demographic indicators. *Journal of Community and Applied Social Psychology*, *5*, 189–193.
Hubbard, P. (1991). Evaluating computer games for language learning. *Simulation and Gaming*, *22*, 220–223.
Koop, E. (1982). Surgeon general sees danger in video games. *New York Times*, 10 November, p A-16.
Leyens, J. P., Camino, L., Parke, R. D., & Berkowitz, L. (1975). Effects of movie violence on aggression in a field setting as a function of group dominance and cohesion. *Journal of Personality and Social Psychology*, *32*, 346–360.
Lin, S., & Lepper, E. E. (1987). Correlates of children's usage of videogames and computers. *Journal of Applied Social Psychology*, *17*, 72–93.
Loftus, G. A., & Loftus, E. E. (1983) *Mind at play: The psychology of video games.* New York: Basic Books.
Long, M. (1983). True confessions of a pac man junkie. *Family Weekly*, January 2, 6–10.
Lovaas, O. I. (1961). Effect of exposure to symbolic aggression on aggressive behaviour. *Child Development*, *32*, 37–44.
McLeod, J. M., Atkin, C. K. & Chaffee, S. H. (1978). Television and adolescent aggression. In G. Comstock, S. Chaffee, N. Katzman, M. McComb, & D. Roberts (Eds.), *Television and human behaviour*. New York: Columbia University Press.
Miller, J. (1993). *Computer games*. Information Sheet. The Professional Association of Teachers.
Neustatter, A. (1991). Keyboard junkies. *The Independent on Sunday Review*, 17 November, 64.
Parliamentary Office of Science and Technology (1993). Screen violence. *The Psychologist*, August, 353–357.
Phillips, D. P. (1986). Natural experiments on the effects of mass media violence on fatal aggression: Strengths and weaknesses of a new approach. *Advances in Experimental Social Psychology*, *19*, 207–250.
Provenzo, E. (1991). *Video kids: Making sense of Nintendo.* Cambridge, MA: Harvard University Press.
Rosenberg, M. (1965). *Society and the adolescent self-image*. Princeton, NJ: Princeton University Press.
Rutkowska, J. C., & Carlton, T. (1994). *Computer games in 12–13 year olds' activities and social networks*. Paper presented at the British Psychological Society Annual Conference.
Schutte, N. S., Malouff, J. M., Post-Gorden, J. C., & Rodasta, A. L. (1988). Effects of playing videogames on children's aggressive and other behaviours. *Journal of Applied Social Psychology*, *18*, 454–460.
Selnow, G. W. (1984). Playing video games: The electronic friend. *Journal of Communication*, *34*, 148–156.
Silvern, S. B. (1986). Classroom use of video games. *Educational Research Quarterly*, *10*, 10–16.
Silvern, S. B., & Williamson, P. A. (1987). The effects of video game play on young children's aggression, fantasy, and pro-social behaviour. *Journal of Applied Developmental Psychology*, *8*, 453–462.
Spence, J. (1988). The use of computer arcade games in behaviour management. *Maladjustment and Therapeutic Education*, *6*, 64–68.
Zimbardo, P. (1982). Understanding psychological man: A state of the science report. *Psychology Today*, *16*, 15.

Received 19 May 1998; revised version received 25 October 1999