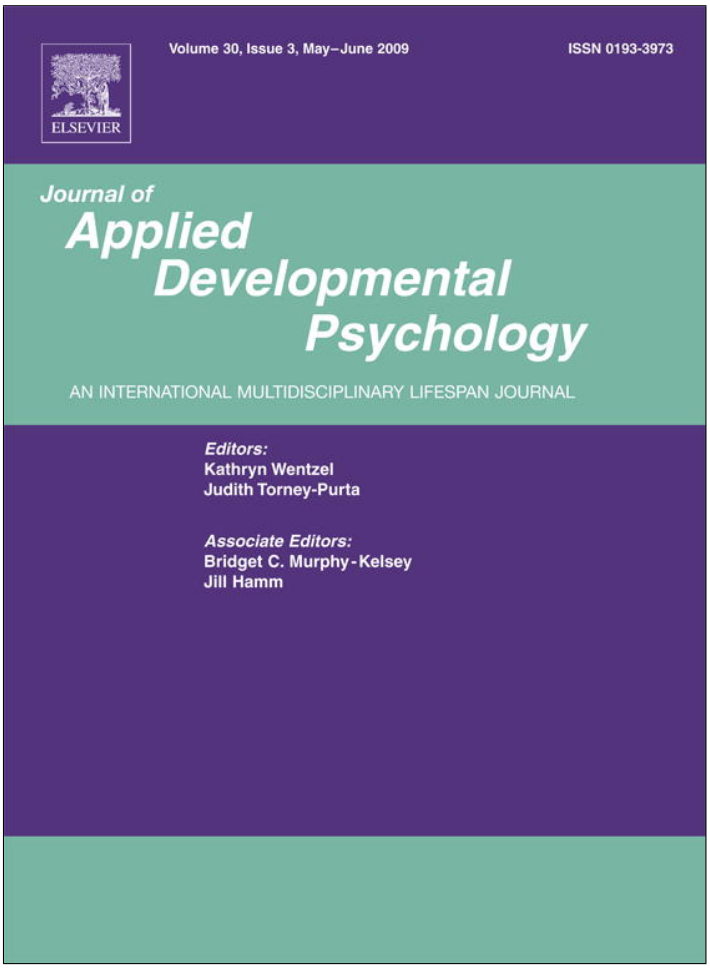

Journal of Applied Developmental Psychology 30 (2009) 250–264

Contents lists available at ScienceDirect

Journal of Applied Developmental Psychology

Preadolescent girls' and boys' virtual MUD play ☆

Sandra L. Calvert *, Gabrielle A. Strouse, Bonnie L. Strong, David A. Huffaker, Sean Lai

Children's Digital Media Center Consortium, Department of Psychology, Georgetown University, 37th & O Streets, NW, Washington, DC 20057, United States

ARTICLE INFO

Available online 20 February 2009

Keywords:
Computers
Gender
Play
Identity
Social interaction

ABSTRACT

Same and opposite-sex pairs of preadolescents interacted twice in a MUD, a virtual domain where they created characters known as avatars and socially interacted with one another. Boys interacted primarily through rapid scene shifts and playful exchanges; girls interacted with one another through written dialogue. Opposite-sex pairs lagged behind same-sex pairs in playful exchanges in part because the forms they used to interact with one another were somewhat incompatible with playful exchanges. Gender bending, defined as children creating an avatar of a different sex than one's own, occurred about 13% of the time. Even so, children still acted much the same way as they did when presenting themselves as an avatar of their own sex. The results suggest that MUDs are a useful virtual space for researchers to examine classic developmental questions about sex differences in play styles, social interaction patterns, identity expression, and modes of thought. At an applied level, MUDs can provide a virtual play space for preadolescent children to discover who they are, as well as a 21st century place to interact with their friends.

1. Introduction

Children live and develop in a gender-based world. From the moment of birth, children's names and the way that they are dressed connote their biological sex (Calvert, 2002). With development, children construct their personal identity partly by whether they are a girl or a boy, which is related to other gender-based behaviors, such as play patterns and friendship choices (Bjorklund & Pellegrini, 2000; Ruble, Martin, & Berenbaum, 2006).

But there is a new 21st century online world that children are living and developing in that can allow a relative freedom from cultural constraints on how children present themselves and interact with others (Valkenburg, Schouten, & Peter, 2005). For instance, if one creates and presents oneself online as a virtual character (i.e., an avatar), social pressures by the peer group to follow prescribed gender norms are difficult to enforce. In fact, children can easily change their gender identity online by altering the biological sex of their avatar (Calvert, 2002).

In an earlier study (Calvert, Mahler, Zehnder, Jenkins, & Lee, 2003), we documented gender differences in the online play and interaction styles of unfamiliar pairs of preadolescent children in a multi-user domain (MUD), an online space where children constructed avatars, assumed fantasy roles, and interacted with one another. Using avatars to "stand in" for them, boy pairs adapted a playful interaction style whereas girl pairs were more likely to chat with each other. Mixed-sex pairs moderated their interaction styles with boys playing less and talking more, while girls played more and talked less than when in same-sex pairs. Gender bending, in which boys present themselves as a girl, and girls present themselves as a boy, was extremely rare.

☆ This research was supported by a grant from the National Science Foundation (Grant #0126014). We gratefully acknowledge their contribution to this research. We thank the children, schools, teachers, and parents who participated in this research. We also thank Dr. Tiffany Pempek, Edward Gonzales, Jr., Sean Zehnder, Brian Mahler, Mickey Lee, Katherine Murray, Emily Conger, Robert Ellis, and Lisa Alvy for their assistance.

* Corresponding author. Tel.: +1 202 687 3968.
E-mail address: calverts@georgetown.edu (S.L. Calvert).

0193-3973/$ – see front matter.
doi:10.1016/j.appdev.2008.12.005

In the present study, we replicate earlier findings and extend previous analyses to same- and mixed-sex pairs of children who knew one another. Our major question was: Does it matter if children know one another when they interact online in a MUD, or are interaction styles similar if children are the same biological sex, regardless of prior face-to-face interactions? To answer this question, we also include qualitative descriptions of their computer interactions in order to understand how the gender composition of pairs influences discourse and play.

1.1. Gender-based worlds: from the playground to online MUDs

Gender is a multi-dimensional construct. To organize the literature, scholars have separated gendered constructs such as concepts, identity, preferences, and behaviors and crossed them with the gendered content areas of biological sex, activities and interests, personality characteristics, gender-based social relationships, styles, and values (see Huston, 1983; Ruble et al., 2006). One reason to organize the literature in this way is to link various constructs and content areas in systematic ways. Because gender differentiation involves a set of variables relevant to the self, we focus on the links among the gendered variables of categorical sex, gender identity, same-sex playmates, and gender-typed activities (Ruble et al., 2006). Specifically, we describe how boys and girls display maleness or femaleness in avatar construction, an index of their gender identity, in relation to their gender-related play, and their interaction styles as a function of gender-pair composition.

1.1.1. Biological sex and gender identity

Children label themselves as a boy or a girl in the first two years of life (Ruble et al., 2006). Over the course of the many years that follow, youth also construct a gender identity, which reflects their personal sense of maleness or femaleness, in part, through their behavioral self-presentation as a male or female (Ruble et al., 2006).

Although biological sex is difficult for children to disguise in face-to-face interactions, children can alter their apparent sex, and hence their gender identity, by engaging in gender bending in a computer presentation (Calvert, 2002). Approximately 18%–51% of adolescents report pretending to be another person online (Griffiths, Davies, & Chappell, 2004; Gross, 2004; Lenhart, Rainie, & Lewis, 2001; Valkenburg et al., 2005) and they report various reasons for doing so. For instance, Gross (2004) found that 51% of her adolescent sample reported being someone else online with 47% of the total sample pretending to be someone older, and 10% reporting gender bending. Of those who reported pretend identities, 48% did so as a prank, 16% to protect their privacy or avoid age restrictions on sites, and 11% to explore their identity. Similarly, Valkenburg et al. (2005) found that approximately 41% of her 9- to 18-year old Dutch sample experimented with their identity and about 10% reported gender bending. Gross (2004) found that 57% of those who reported pretending to be someone else did so when a friend, sibling, or other family member was present. Her findings indicate that online identity alterations typically involve social rather than isolated solitary activity, suggesting that identity experiments are more likely to take place with familiar peers than with strangers.

Gender identity can be expressed in various ways, such as screen names or the sex of the avatar that children or adolescents construct. For example, adolescent screen names such as Snowbunny, Immaculate ros, TJHockeyGUY41, or Hotgrl321Hot in online chatrooms reflect gendered and sexualized communications about identity (Subramanyam, Greenfield, & Tynes, 2004). Moreover, in a space that can easily be anonymous, common initial interactions reveal spontaneous disclosures or queries about age, sex, or location (a/s/l), indicating the importance of personal information about a/s/l in online discourse (Greenfield & Subramanyam, 2003). Rather than being a safe haven from gender-based norms, online discourse appears to move gender-based conversations and interactions to another space.

In contrast to our knowledge about teens, we know little about whether younger children engage in gender bending. The transition from preadolescence to adolescence may be an especially important time to examine developmental transitions as youth are at the cusp of exploring their gender in a more mature way that might affect how they present themselves to opposite-sex peers (Valkenburg et al., 2005). In our initial study of preadolescent youth who did not know each other, we found high levels of gendered information about online screen names and the gender that children chose for their avatar in our MUD. Specifically, 99% of the avatars created matched the child's own biological sex, and 42% of the children chose gender-typed names such as Julia and Ryan (Calvert et al., 2003). In the present study we asked if familiarity with peers, as found in the Gross (2004) study, leads to more gender bending than we found in our study of unfamiliar peers.

1.1.2. Gendered play styles, gendered relationships, and temperament

Play provides important short- and long-term benefits for children, including opportunities for them to develop a sense of mastery and self-efficacy as they experiment with different roles and activities (Bjorklund & Pellegrini, 2000). Gender-based play and playmate preferences emerge during the toddler and preschool years. The middle childhood years bring increased levels of gender-segregated play that continues until adolescence (Ruble et al., 2006).

Gender differences in children's interaction styles are clearly evident in children's play with same-sex peers (Else-Quest, Hyde, Goldsmith, & Van Hulle, 2006). During the early grade school years, for example, boys are more likely to play ball games and engage in fantasy play while girls are more likely to play sedentary games and talk (Blatchford, Baines, & Pellegrini, 2003; Pellegrini, Blatchford, & Baines, 2004). At age 11, ball games continue to be especially popular with boys, as is just talking to friends is for girls (Blatchford, 1996). Although chase games in which children try to tag one another are popular among both boys and girls, they are more popular with boys (Blatchford, 1996; Blatchford et al., 2003; Pellegrini et al., 2004).

Consistent with these findings, a meta-analysis of gendered communication found significant though small effects for girls to be more talkative than boys, particularly during the middle childhood years, (Leaper & Smith, 2004). The style of interaction also varies with gender, with boys using more dominant, power-based approaches to communication, and girls choosing more affiliation goals

when expressing themselves (Gleason & Ely, 2002). Girls also enjoy reading and writing more than boys do, in part because boys view these activities as passive (Gleason & Ely, 2002), a perception that may be explained in part by boys' tendency to demonstrate more surgency in temperamental dispositions, and hence, to prefer high intensity stimuli and activities such as rough and tumble play (Else-Quest et al., 2006). It may be that gender differences in play activities, which are partly based on sex differences in temperament, lead to differences in language styles (Gleason & Ely, 2002) and in gendered interactions and roles (Else-Quest et al., 2006).

In the information age, a new kind of virtual playground has emerged. In our initial study (Calvert et al., 2003), similar play patterns styles emerged in our MUD that are seen on real playgrounds. In particular, preadolescent boys engaged in more games in the MUD than girls did, while preadolescent girls chatted with one another more than boys did. Similar play and discourse patterns are also reported for online Dutch youth (Valkenburg et al., 2005). Boys in our study also displayed stylistic differences in play such as rapid action (moving their avatars around on the screen) and frequent changes in scenes (moving from one scene to another), styles that may be indicative of the temperamental trait of surgency in which stimuli are preferred that offer high levels of novelty, complexity, and incongruity (Else-Quest et al., 2006). Both girls and boys used coded language, abbreviations of words and phrases such as "u r" for "you are," a style that is also used by adolescents in teen chat rooms (Subramanyam et al., 2004). Mixed-sex pairs moderated their play styles: boys talked more and moved their avatars less while girls moved their avatars more and talked less than when in same-sex pairs. Based on our findings, we concluded that children were altering their preferred interaction styles in order to bridge the gender divide that is typical of middle childhood (see Ruble et al., 2006). To explore this transition further, the current study includes a qualitative description of how mixed-sex pairs transit from same-sex to opposite-sex interactions.

1.2. The present study

The present study replicates our earlier findings of unfamiliar peers, and explores preadolescent children's interactions with same- and opposite-sex peers that they know in a novel MUD setting, a little studied virtual environment. We were particularly interested in the following questions: 1) what kinds of characters do children create to "stand in" for them in MUD interactions, with particular attention paid to gender bending?; 2) how do same-sex, opposite-sex, and mixed-sex pairs of children who know one another interact in a MUD?; and 3) when considered in relation to our earlier study (Calvert et al., 2003), is biological sex more important than familiarity with peers in determining play styles and gender bending?

Our hypotheses were as follows:

(1) Although we expected children to select an avatar of their own sex to represent them in the MUD, we also expected more children to choose opposite-sex avatars than in our prior study because they knew one another this time (Calvert et al., 2003; Gross, 2004);
(2) based on the literature on children's play (Blatchford, 1996; Blatchford et al., 2003; Valkenburg et al., 2005), we expected pairs of boys to take a more playful stance in relation to one another in virtual interactions than would pairs of girls or opposite sex pairs;
(3) based on our earlier study (Calvert et al., 2003) and the research on temperamental differences favoring boys in surgency (Else-Quest et al., 2006), we expected pairs of boys and opposite sex pairs to interact using more scene changes and movement than pairs of girls;
(4) based on the literature on children's discourse and play (Blatchford, 1996; Blatchford et al., 2003; Leaper & Smith, 2004; Valkenburg et al., 2005), we expected pairs of girls to use more words in their interactions than pairs of boys or opposite-sex pairs; and
(5) based on the literature on gender differentiation, we explored the links among gendered variables related to the self, such as categorical or biological sex, gender identity, same-sex playmates, and gender-typed play activities and interaction styles (Ruble et al., 2006).

2. Method

2.1. Participants

Participants were 126 fifth grade children (61 boys; 65 girls) from five schools (3 private; 2 public) and a boys' and girls' club located in the Washington, DC area. Mean age was 10 years, 11 months (range 9 years, 0 months to 14 years, 2 months). There were 74 Caucasian (59%), 25 African American (20%), 7 Latino (6%), 4 Asian or Pacific Islander (3%), 4 South Asian (3%), and 12 children from mixed or unknown ethnicities (10%).

Participants were stratified by sex, then randomly selected from a class roster and paired with a same-sex or opposite-sex student from their school. Children came from several classes across their grade level. While the students were generally familiar with one another, they did not necessarily know one another well. There were 20 boy pairs, 22 girl pairs, and 21 boy/girl pairs who participated in two, 10-minute sessions, yielding 126 total sessions. We conducted two separate sessions to examine consistency and change in how children presented their avatar and interacted over time.

2.2. The MUD

As described in a previous study (Calvert et al., 2003), we designed our own MUD using Macromedia Flash to create a cartoon-like environment in which children could interact with one another. When children entered our MUD, there was a space where

they initially created an avatar. First children chose a name, then a sex, and finally a costume (wizard, firefighter, soccer player, normal kid in a t-shirt and jeans, or punk kid in a leather jacket) for their character.

The next part of the MUD consisted of the space in which children interacted with one another. The top 2/3 of the computer screen displayed the area in which the avatars interacted. The child could move the avatar by dragging and dropping the character within the scene. In the bottom 1/3 of the screen was a control panel with a scene menu, an emoticon menu, and a text box. The text box allowed children to type in messages to one another that appeared in speech bubbles above their avatars' heads. A running text commentary was also maintained at the bottom right side of the screen.

Clicking on the icons in the scene menu led to a change in place. Children could click on visual images of a stage, beach, city, outer space, castle, and park, and their characters would be transported individually to those scenes. Clicking on the emoticon menu of facial expressions (i.e., happy, sad, angry, afraid, silly, and bored) altered the avatar's facial expressions and body posture. The *happy face* was the default option. A running clock in the bottom right corner of the page kept track of how much time remained in a session. Data about the avatars' behaviors were automatically stored in a computer data base using MySQL, a database application.

2.3. Procedure

Children in the MUD were connected via a wireless intranet. One laptop was used by each child and one by a researcher, who set up and monitored the sessions. Before the session began, one experimenter set up the computer interface while the other experimenter (the helper) got the first child from a classroom. The helper introduced himself or herself to each child as the child was being escorted from class and then introduced that child to the other experimenter in the experimental setting. The first experimenter helped the first child log onto the computer and turned on a Camtasia program, a visual tracking program which recorded children's screen activities in the MUD. Meanwhile the helper picked up the second child, brought that child to the setting, helped them log onto the computer, and turned on their Camtasia recording. To ensure that children knew who their partners were, children participated in the same room though they either had a partition between them and/or their backs to one another. An experimenter sat between them.

Children were told that in the study they would play in a computer setting called a MUD in two different 10-minute sessions. In the MUD, they could move their character with their mouse, change emotions, choose various scenes, and write text messages. Children were asked that all communication be spoken and acted out by their characters, to keep the language clean, and to have fun.

Each child then constructed an avatar by choosing a name, a boy or a girl character, and one of five costumes. After children created an avatar, they entered the stage scene. Once both children were connected to the MUD, they used their avatars as they desired. Throughout each session, children interacted with one another by moving their characters, changing scenes, “speaking” to one another via written dialogue, changing emotions, and playing. Because each controlled their avatars separately, children were free to move to different scenes where they could not see one another. However, because the written dialogue scrolled in a text box in the control panel, they could still communicate by sending each other messages even if not in the same visual scene.

2.4. Dependent measures

Because the MUD program automatically scored many of the dependent variables, scorers exported much of the data, such as movement, scene changes, emoticon changes, and the number of words spoken. For activities not captured directly by the MUD program, such as role play and game play, researchers used the Camtasia files to score children's activities during each of their two sessions. Coded language and the number of words were scored from transcripts of the sessions. At least 20% of the sessions were scored for reliability for each dependent variable that was scored manually. Using Cohen's kappa, interobserver reliability was .86 for game play, and .72 for role play. These scores range from good to excellent (Fleiss, 1981). Interobserver reliability for screen names, computed as 2 times the number of agreements divided by the total number of scores, was 90%.

2.4.1. Avatar construction

The screen name, avatar sex, and the costume and role selected for the avatar by each participant was examined for each session. Screen names were classified as masculine (e.g., eric, bountyboy), feminine (e.g., alice, groovygatorgirl), or neutral (e.g., pizza).

2.4.2. Scene changes

Scene changes were scored automatically by the program. A scene was “on” when a player selected it and “off” when a player selected a different scene. The frequency of scene changes was recorded by the MUD program.

2.4.3. Movement

Characters were moved around the screen by dragging them with a mouse. The MUD program computed movement by summing the duration of times between the on-click and off-click of the mouse for each movement.

2.4.4. Emotional expressions

Specific emotional expressions were considered “on” when a character displayed an emotional expression and “off” when a character displayed a different emotional expression. The frequency of emotions selected was recorded electronically.

2.4.5. Game play and role play

Game play episodes involved interactions where two children created their own game. Game play could be initiated by a verbal comment or movement by one of the characters. Based on previous research (Calvert et al., 2003), we looked for the following kinds of games: *peek-a-boo*, a game where the children hid their characters behind each other and then popped out; *hide-and-seek*, a chase game where one child clicked to different scenes while the other child attempted to find them; and *copy cat*, where one child's avatar copied the movements, speech, and/or emotion changes of the other child's avatar. Children in the current study also adapted *Simon Says* to the MUD setting, where one child told the other child to do an action, and the child made his or her avatar do so; and *I'm Taller than You*, where children moved their avatars vertically up the screen to be taller than the other avatar.

Role play was defined as suspending reality to engage in a role-based imaginary interaction that had a thematic strand (see Calvert et al., 2003). Role play was scored when an action or language signaled that one or both of the characters were involved in pretense. The indicator could be related to the scene or to the child's onscreen identity. Much of the role play involved actions that complimented dialogue (e.g., the character moves to the basket and pretends to shoot an imaginary ball while calling out "Slam dunk!"). Sometimes students role-played through speech-only (e.g., "I'm riding my nimbus" while in the space scene) or action-only interactions (e.g., moving around in a surfing action while in the beach scene). Role play also occurred when a student linked the avatar on screen to their real-world knowledge (e.g., "I'm a firefighter."). Observers scored whether role play or game play was present or absent in each session.

2.4.6. Dialogue

Character dialogue was scored by the MUD program, which automatically summed the total number of words spoken by each character.

2.4.7. Coded language

Scorers examined children's written transcripts to determine how often coded language was used. These included codes such as *lol* for "laughing out loud", and *ur* for "you are" (Calvert et al., 2003; Greenfield & Subramanyam, 2003).

3. Results

3.1. Overview: analyses of MUD social interactions

In our previous study (Calvert et al., 2003), children were always with unfamiliar peers and the unit of analysis was the individual. Because children interacted in a constant pair structure, the pair was the unit of analysis in the current study. Scores were averaged for each pair of children for each dependent variable. The dependent variables focused on how children interacted with one another, including children's play (role play, game play) as well as the visual and verbal codes of communication (i.e., scene changes, movement, emoticon use, number of words, and use of coded language). Descriptive analyses were conducted on dependent variables. The presence or absence of game play and role play was analyzed using chi square analyses. Time spent moving, the number of emoticons chosen, the number of scenes visited, the number of words communicated, the number of coded word phrases, and the number of queries used were analyzed, in turn, by a 3 (sex pair: boy pair vs. opposite-sex pair vs. girl pair) × 2 (session order) ANOVA, with session order as a repeated measure.

3.2. Frequency of game play and role play activities

In contrast to our first study in which game play and role play occurred in only 27% of the sessions of unfamiliar peers (Calvert et al., 2003), play often occurred in children's MUD interactions when they knew each other. Game play occurred in 48% of the first sessions and in 75% of the second sessions. Role play occurred in 51% of the first sessions and in 59% of the second sessions.

The first sessions of boy pairs were more likely to contain game play than were the first sessions of girl pairs or opposite-sex pairs, and the first session of girl pairs was more likely to contain game play than the first session of opposite-sex pairs, $\chi^2(2, N = 63) = 9.85$, $p = .007$, Cramer's $V = .395$ (Session 1 Game play: Boy pairs = 25% absent vs. 75% present; Girl pairs = 57.1% absent vs. 42.8% present; Opposite-sex pairs = 72.7% absent vs. 27.3% present). The second sessions of boy and girl pairs were equally likely to contain game play, and same-sex pairs were significantly more likely to play games than were opposite-sex pairs, $\chi^2(2, N = 63) = 6.06$, $p = .048$, Cramer's $V = .310$ (Session 2 Game play: Boy pairs = 20% absent vs. 80% present; Girl pairs = 28.6% absent vs. 71.4% present; opposite-sex pairs = 59% absent vs. 41% present). In our study of unfamiliar peers, game play also favored boy pairs, but girl pairs had not been more likely to engage in role play than were opposite-sex pairs (Calvert et al., 2003).

No significant sex differences occurred in the presence or absence of role play in the first session when children knew one another. However, there was a trend for boy pairs to role play in their second sessions more than opposite-sex or girl pairs, $\chi^2(2, N = 63) = 5.68$, $p = .058$, Cramer's $V = .300$ (Session 2 Role play: Boy pairs = 20% absent vs. 80% present; Girl pairs = 47.6% absent vs. 52.4% present; opposite-sex pairs = 54.5% absent vs. 45.5% present). By contrast, role play occurred more often in boy–boy sessions than in girl–girl or girl–boy peer compositions when children did not know each other (see Calvert et al., 2003).

A prototypical boy–boy session with game play, role play, and coded language is presented to illustrate the interaction. However, the verbal transcript does not adequately capture all that was taking place in the MUD because these boys interacted

with a “clickerati” style in which they manipulated the iconic scene change and emoticon menus. For instance, at the end of this transcript, Boy 2 is playing with the emoticon menu when talking about feelings.

Boy 1: hey

Boy 2: I shall make u disappear

Boy 2: move down

Boy 2: I can't see what ur writing

Boy 1: really try and catch me

Boy 2: k

Boy 1: go to space

Boy 2: I'm here

Boy 2: u can't find me

Boy 1: stop pointing out the obvious

Boy 1: found you

Boy 1: found you

Boy 2: stop pointing out the what

Boy 1: HAhahahahahahahahahahahahahahahahahahahahahahahahahahahahahahahahahahahahahahahahahahahahhha

Boy 2: where r u

Boy 1: let's take a stroll in the park

Boy 1: I am in the space

Boy 2: ur slow

Boy 1: Noooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooo

Boy 2: yessssssssssssssssssssssssssssssssssssssssssssssssssss

Boy 1: bye bye

Boy 2: nooooooooooooooooooooooooooooooo

Boy 2: do u like missing computer class

Boy 1: nooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooo

Boy 2: where r u

Boy 2: ur a FIREFIGHTER

Boy 2: NO

Boy 2: UR SUPPOSED TO SAVE ME REMEMBER

Boy 2: BOO HOO

Boy 2: BOO HOO

Boy 2: BOO HOO

Boy 2: BOO HOO

Boy 2: BOO HOO

Boy 2: BOO HOO

Boy 2: BOO HOO

Boy 2: UR HAPPY

Boy 2: IM DEPRESSED

Boy 2: I NEED A SHRINK

Boy 2: NOW IM MAD

Boy 2: U CANT SEE ME

The sessions of opposite-sex pairs were least likely to show role play or game play. Verbal transcripts of the sessions were analyzed to explore why opposite-sex pairs of children played less well together. A repeated measures ANOVA revealed that the effect for sex type approached significance with somewhat more questions, specifically variations of "where are you?", occurring in the opposite-sex pairs, $F(2, 60) = 3.012$, $p = .057$, during the second session. Post hoc LSD comparisons revealed that there were more questions about the other child's location in boy–girl pairs ($M = .72$, $SD = .12$) than in boy pairs ($M = .30$, $SD = .12$), $p = .017$. Girl pairs fell between these means, $M = .49$, $SD = .12$.

One-way ANOVAs examined individual children's behavior in the boy–girl pairs to see who was looking for the other child. Both boys and girls in opposite-sex pairs were equally likely to search for one another in the first session. By the second session, however, girls were far more likely to be looking for boys than boys were to be looking for girls, $F(1, 42) = 7.767$, $p = .008$, Girl $M = 1.00$, $SD = 1.04$ vs. Boy $M = .29$, $SD = .56$. A prototypical boy–girl session follows, in which the boy unsuccessfully tries to play a virtual hide-and-seek chase game with the girl, and the girl asks where he is and wants him to talk to her.

Girl: where are you

Boy: in the park

Girl: hi.

Boy: hi

Girl: I'm glad it's working this time!

Boy: now i'm in the beach

Girl: hello!

Girl: tag you're it.

Boy: I'll be in space

Girl: where?

Girl: never mind.

Boy: tag you're it

Girl: aaaahhhh!

Boy: I'm on stage

Girl: like your outfit!!! ha!HA!HA!

Boy: i'll be changing places a lot now

Boy: try to catch me

Girl: you've got to tell me where you're going

Girl: aha

Boy: I told you to try to catch me

Girl: arg

Girl: this is impossible!

Girl: write something else!

Boy: fine I'm at the castle

Girl: thank you.

Girl: do you have IM at home?

Boy: i'm going to go to the city

Girl: do you have IM at home

Boy: try to find me now

Girl: oh my gosh, stop!

Girl: I can't find you

Girl: this is boring

Boy: I'm at the park ok!

Girl: we only have 5 s

3.3. Scenes visited

Consistent with our study of unfamiliar peers (Calvert et al., 2003), the repeated measures ANOVA computed on the number of scenes visited yielded a main effect of sex pair, $F(2, 60) = 3.57$, $p = .03$. As expected, LSD post-hoc follow-ups revealed that boy pairs changed scenes more often than girl pairs, *Ms* (*SEs*) = 44.81 (6.53) vs. 20.44 (6.37), respectively. In the current study, opposite-sex pairs ($M = 31.80$, $SE = 6.23$) did not differ in the number of scene changes from either of the same-sex pairs. By contrast, opposite-sex pairs had been less likely to change scenes than same-sex pairs when children were with an unfamiliar peer (Calvert et al., 2003).

3.4. Avatar movement

The repeated measures ANOVA computed on the duration of time in seconds that children moved their avatars around the screen approached significance for session, $F(1, 60) = 3.12$, $p = .08$. Children moved their avatars somewhat more in the second than in the first session than the second session, *Ms* (*SEs*) = 12.53 (1.5) vs. 10.56 (1.07), respectively. The prediction favoring boy pairs over girl- and mixed-sex pairs in moving their avatars, which we found in our MUD study of unfamiliar peers (Calvert et al., 2003), was not significant.

3.5. Emoticons used

The repeated measures ANOVA computed on the frequency of emoticons expressed yielded no significant effects for peers who knew each other. By contrast, boy pairs changed emotions more frequently than did girl or mixed-sex peers who were strangers (Calvert et al., 2003).

3.6. Words communicated

The repeated measures ANOVA computed on the total number of words communicated yielded a main effect of sex pair, $F(2, 60) = 3.32$, $p = .04$, and session, *Wilks Lambda* $(1, 60) = 26.76$, $p < .001$. Children wrote more words in the second than in the first session, *Ms* (*SEs*) = 62.93 (29.38) vs. 51.95 (27.51), respectively. Consistent with our study of unfamiliar peers (Calvert et al., 2003), LSD post-hoc

follow-ups revealed that girl pairs wrote more than boy pairs, *M*s (*SE*s) = 69.27 (5.72) vs. 49.55 (5.86), respectively. Opposite-sex pairs, $M = 53.32$, $SE = 5.72$, did not differ in word production from either of the same-sex pairs when children knew one another, but unfamiliar mixed-sex pairs wrote significantly more words than boy pairs, though still less than girl pairs (Calvert et al., 2003). A prototypical girl–girl session of familiar peers with dialogue as the main communication form follows.

Girl 1: [Girl 2] meet me in space!

Girl 1: [Girl 2]?

Girl 1: Whats up?

Girl 2: what do u WANT TO BE WHEN U GROW UP

Girl 1: I dunno? r u hungry?

Girl 2: VERY

Girl 1: i AM STARVING

Girl 2: HAHAHA

Girl 2: I WANNA BE A LAWYER

Girl 1: wHAT DID U ORDER? LOL!

Girl 2: CHICKEN PP

Girl 1: I SORTA THINK I AM GONNA BE AN ATTORNEY!

Girl 1: U NO! GO TO COURT!

Girl 1: I WANT FOOD!

Girl 2: I THOUGHT U WANTED TO BE A PRO SOCCER PLAYER

Girl 2: MEET ME AT THE PARK

Girl 1: wELL I DID BUT THERE IS NO WPSL ANYMORE!

Girl 2: NO BEACH

Girl 2: SORRY

Girl 1: iTS OK! tHERES NO WOMENS LEAGUE 4 SOCCER ANYMORE THOUGH!

Girl 2: NO 1 IS AT THE BEACH EXCEPT US LOL

Girl 2: LOL*

Girl 1: sO I CAN'T BE A SOCCER PLAYER!

Girl 2: U COULD IF U WANT

Girl 1: i LOVE SOCCER!

Girl 2: WANT*

Girl 1: yUP! OF COURSE! I GUESS!

Girl 2: LOOOOOOOOOOOOOOOOOOOOL

Girl 1: iS THERE A WAY I COULD?!

Girl 2: STOP CRYING

Girl 2: GOOD

Girl 1: U STOP!

Girl 2: I DID

Girl 2: LOL

Girl 1: dO U HAVE A CRUSH ON SOMEBODY? DON'T TELL ME JUST SAY YES OR NO!

Girl 2: NOOOOOOO WAY

Girl 1: I SORTA DO! BUT I AM NOT TELLING!

Girl 1: 2

Girl 2: PLEASE I WONT TELL ANY one PROMISE

Girl 1: 10 SECONDS

3.7. Coded language

The repeated measures ANOVA computed on coded language scores yielded a main effect of session, *Wilks Lambda* (1, 60) = 4.16, p = .046. Pairs used more coded language in the second than the first session, *Ms* (*SEs*) = .08 (.01) vs. .06 (.01), respectively. Unlike our study of unfamiliar peers in which there were no gender differences in coded language (Calvert et al., 2003), boy pairs in the second session who knew each other were more likely to use coded language than were girl or mixed-sex pairs, *Wilks Lambda* (2, 60) = 3.35, p = .042. See Fig. 1.

3.8. Avatar construction

Avatar construction was used as an indicator of gender identity as it reflected how a child chose to present his or her virtual character, or self, to others. We examined avatar construction in three ways: 1) avatar name; 2) avatar costume; and 3) avatar sex. Each participant was examined individually since avatar construction was made prior to the virtual peer interaction. We were interested in the gender of avatars in relation to the child's biological sex.

3.9. Avatar name

Avatar names were classified as masculine, feminine, or neutral. As seen in Table 1, boys chose masculine or neutral names whereas girls chose feminine names, $\chi^2(1, N = 128) = 45.51$, $p < .001$, Cramer's $V = .596$.

3.10. Avatar costume

Children chose their avatars from a menu of 5 preset choices. As seen in Table 2, there were sex differences in the roles that children selected for their avatars in the first session, $\chi^2(1, N = 126) = 16.67$, $p = .002$, Cramer's $V = .364$, but not in the second

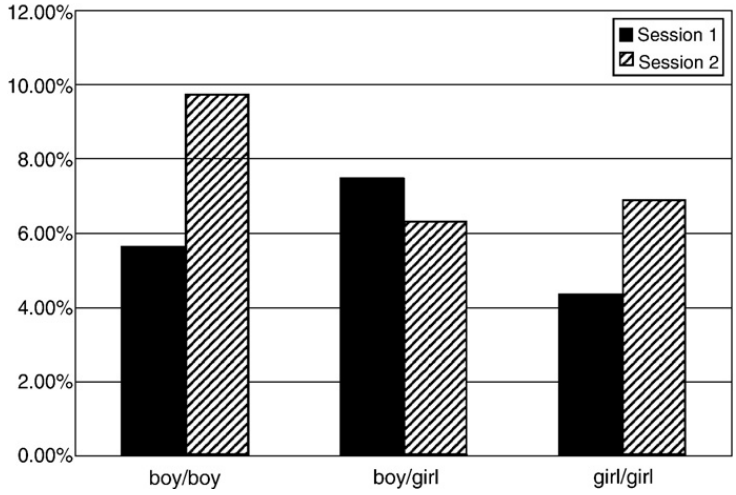

Fig. 1. Percent of coded language by sex pair and session.

Table 1
Number of gender-stereotyped avatar names created by preadolescent girls and boys.

	Masculine	Feminine	Neutral	Total
Girl	10	40	16	66
Boys	30	3	29	62
Total	40	43	45	128

Table 2
Percent of avatar roles selected by preadolescent boys and girls by session.

		Punk	Athlete	Wizard	Normal kid	Fire-fighter
Boy	Time 1	41%	25%	13%	12%	10%
	Time 2	34%	18%	21%	10%	16%
	Total	38%	22%	17%	11%	13%
Girl	Time 1	19%	46%	3%	25%	8%
	Time 2	22%	18%	22%	22%	11%
	Total	21%	32%	13%	24%	10%

session, $\chi^2(1, N = 126) = 5.97$, $p = .201$, Cramer's $V = .218$. In session 1, girls chose the athlete costume most, and boys chose the punk kid costume the most. There was more diversity in costume selection in the second session. Girls shifted from selecting an athlete in the first session to selecting a wizard in the second session. Boys shifted from selecting a punk kid or an athlete during session one to selecting a wizard or a firefighter in session two. Patterns of selecting a kid in jeans and t-shirt were consistent for both sexes across sessions.

3.10.1. Avatar sex and gender bending

Because our previous study of children who were strangers indicated almost no gender bending (Calvert et al., 2003), we were especially interested in whether children who knew each other would make the sex of their avatars different from their own biological sex. Children who knew each other typically selected a sex for their character, an index of gender bending, that was consistent with their own biological sex, session 1: $\chi^2(1, N = 126) = 92.80$, $p < .001$, Cramer's $V = .858$, session 2: $\chi^2(1, N = 126) = 51.57$, $p < .001$, Cramer's $V = .640$. Nonetheless, when considered in relation with the findings from our first study, we find that children gender bend more often with familiar than with unfamiliar peers, where only 1% of children engaged in gender bending. Gender bending amongst familiar peers occurred in 13% of the total sessions, and it more than doubled between the first and second sessions from 8% to 18%.

Gender bending was almost twice as frequent for girls than for boys: 21 (16%) of girls versus 11 (9%) boys swapped sexes when constructing their avatars. Although gender bending occurred more often in opposite-sex and girl pairs than in boy pairs, same-sex pairs increased in gender bending over time more than opposite sex pairs did. For opposite sex pairs, an average of 17% of children gender swapped: 3 boys and 4 girls in Session 1 and 2 boys and 5 girls in Session 2. For same-sex girl pairs, an average of 14% of children gender swapped: 3 girls in Session 1 and 9 girls in Session 2. For same-sex boy pairs, only 7.5% of children gender swapped: 0 boys in Session 1 and 6 boys in Session 2. These findings suggest that as children, particularly those in same-sex pairs, became more comfortable in the MUD setting, they are more likely to experiment with the sex of their avatars.

Next we computed Pearson correlations between the first and second sessions of children when gender bending occurred to investigate if children altered their behaviors to match those of the opposite sex. Pairs' patterns of interaction across sessions were significantly correlated for almost all dependent variables. For sessions where gender bending occurred ($n = 20$ pairs), the Pearson product moment correlations of pairs from the first session to the second session were $r(20) = .43$, $p = .059$ for scene changes; $r(20) = .72$, $p < .001$ for emoticon changes; $r(20) = .86$, $p < .001$ for words written; $r(20) = .64$, $p = .003$ for movement; and $r(20) = .72$, $p < .001$ for coded language. For sessions where gender bending did not occur, ($n = 43$ pairs), the Pearson product moment correlations of pairs from the first session to the second session were similar: $r(43) = .47$, $p = .002$ for scene changes; $r(43) = .35$, $p = .02$ for emoticon changes; $r(43) = .81$, $p < .001$ for words written; $r(43) = .69$, $p < .001$ for movement; and $r(43) = .63$, $p < .001$ for coded language. We could not compute correlations for role play and game play because they were dichotomous variables. Overall, the results indicate that gender bending did not make boys act more like girls (i.e., talk more) or girls act more like boys (i.e., change scenes more).

A session where two boys were engaged in gender bending is presented below. Note that these boys chose boys' names (bart and bob) for the avatars, played games like hide and seek and peek-a-boo, and changed emoticons often even though they present as girl avatars. They also question each other's sexual identity and use power-based language in this interaction.

286 you're a girl!

287 you're a girl

286 are you gay?

286 tag, you're it

287 you're a lesbian

286 find me

287 let's play hide and seek

286 you're it

286 come on

286 you're it

286 find me

287 my name is bob and I'm a girl

286 my name is bart and I'm a girl too !@#$%

287 where are you

286 find me bitch

286 I'm sad bob I want to commit suicide can you help me

286 I'm still sad

286 YMCA!

286 come on bob do the ymca

287 put a smile on …. I mean "I'm lovin it

287 kgnaslgjhf;kjsan;j;onj

286 I know.. where you… live!

287 you're scary!!

286 I'm a depressed person

287 I love you

286 I know your every move

287 you're such a hottie

286 I love you too come closer

287 kh;ghdjflkshjf;glf;1hgsjkghsk1fkhslfjhd1fkhg1skhg1fkhg1fkhg1

286 I want to kiss you

287 get away from me you creep

286 let's get jiggy with it

287 josh rules!!!!!!!!!!11

286 bart rules

3.10.2. Consistency in avatar construction

We examined how consistent children were in their creation of avatars from the first to the second session. The sex of children's avatars was consistent 81% of the time, and the type of character (e.g., athlete) was consistent 33% of the time. All aspects of the

avatar were kept the same 10% of the time. Thus, while there was some consistency in the characteristics of their avatars across the two sessions, there was still a considerable amount of change and experimentation in avatar construction, suggesting that children played with their virtual self-presentation.

3.10.3. Summary

Gender pairs differed by playfulness. The sessions of boy pairs typically included the most play, but the sessions of girl pairs increased in playfulness over time. By contrast, the play of opposite-sex pairs was less coordinated than that of same-sex pairs. Girls spent more time in search of boys in the second session than in the first, suggesting that over time, boys and girls who knew each other actually became worse at interacting with one another, not better as we had found in our first MUD study of unfamiliar peers.

4. Discussion

The purpose of this study was to describe the interactions of preadolescent boys and girls who knew each other when they were in a MUD, and to replicate and shed light on our previous findings about unfamiliar peers in this MUD setting. Our findings confirm the power of biological sex as organizers of social experiences during preadolescence when gender-segregated play is the norm (Bjorklund & Pellegrini, 2000; Blatchford et al., 2003). Rather than finding ways to moderate their own communication styles, as we had found in our study of unfamiliar peers, the verbal transcripts documented that boys and girls had considerable difficulty interacting with one another even though they knew each other. A second major finding was that familiarity with peers, not anonymity, brings more identity experimentation, including gender bending.

Consistent with previous research (Blatchford et al., 2003; Blatchford, 1996; Calvert et al., 2003), sex pairs differed in playfulness. Boy pairs often made up games like *hide and seek*, *Simon Says*, and *peek-a-boo* and tended to engage in more role play, patterns that we had found in our earlier study of unfamiliar peers (Calvert et al., 2003). While girl pairs who knew each other made up more games and escalated their role play activities over time, their dominant style of interaction was via written language, just as we had found for unfamiliar pairs of girls (Calvert et al., 2003). The clickerati style of moving from screen to screen that characterized chase games was incompatible with girls preferred mode of communication: writing to each other. Even the writing styles of boys differed in the current study: for children who knew each other, boy pairs used more coded language, a playful way of writing, than did girl- or mixed-sex pairs. Both girl and boys pairs had used coded language in our study of unfamiliar peers. The familiar pairs of girls and boys in the present study, however, were equally likely to move their avatars whereas boy pairs had moved their avatars more than girls when the peers were unfamiliar with one another (Calvert et al., 2003).

Familiarity also played a role in enhancing same-sex children's play with one another. While only 27% of children engaged in play activities when they didn't know one another, more than half of the children who knew each other engaged in game play and role play. The results suggest that familiarity raises the level of playfulness, but does not override the underlying patterns that favor boys in playing games. Moreover, opposite-sex peers had far more problems interacting with one another when they knew each other than when they were strangers.

In contrast to findings in our initial study of unfamiliar peers (Calvert et al., 2003), the quality of opposite-sex interactions became worse over time for familiar peers, with girls trying to get boys to talk while boys tried to get girls to play games, such as the chase games that characterize middle childhood (Blatchford, 1996). Two overlapping areas pinpoint problems in how mixed-sex children interact: their play styles and the form of their communication styles. Specifically, boys' computer interactions were characterized by playful, rapid scene changes, a style reflecting a “clickerati” approach to communication and a temperamental style of surgency in the preference for high intensity exchanges through perceptually salient qualities like change and incongruity (Else-Quest et al., 2006). These styles parallel boys' attentional interest in fast-paced television programs (Wright et al., 1984). However, in the virtual sphere, boys use fast-paced forms to interact, suggesting an internalization of the media code, rather than simply observing the form as they have traditionally done with television programs (see Calvert et al., 2003).

Girls in our MUD wanted boys to talk to them, a style relying on verbal modes of communication, while boys wanted girls to play. By the second session, girls were more likely than boys to ask “Where are you”, suggesting an imbalance of power in their virtual interactions brought about in part by boys playing hide-and-seek chase games. Our findings are consistent with research documenting power differences in language interactions with opposite-sex peers during preadolescence (Gleason & Ely, 2002).

It also appears that boys and girls in mixed-sex pairs had been putting forth more effort to interact with one another when they didn't know each other than when they did. In particular, boys changed scenes less and talked more when they didn't know their girl partner. These alterations in play and interaction styles were less likely to take place when boys and girls knew each other. Indeed, the boy–girl transcript highlights how frustrating it was for both the boy and girl to coordinate their different interaction styles: the boy wanted to click around and play chase games, and the girl wanted him to stay in the same scene and talk to her. Mixed-sex pairs had been least likely to change scenes when children did not know each other, suggesting adaptations to one another's styles (Calvert et al., 2003). Perhaps boys and girls are more willing to adapt when there is some mystery about who that other person is, and perhaps they might have been more willing to change their styles with familiar peers if they could have chosen a partner.

Our second goal was to examine the role of biological sex in how children constructed their avatar to “stand in” for them in MUD interactions. Experimentation with the avatar identity was a common practice. Only ten percent of children kept the name, costume, and sex of their avatar constant across both sessions. As children became more familiar with the MUD, they were more likely to experiment with their avatar, trying on different costumes, sexes, and names that can reflect various facets of identity (Curtis, 1997).

Gender bending was far more common in the current study of familiar peers than it was in our earlier study of unfamiliar peers (Calvert et al., 2003). In particular, we found gender bending in only 1% of preadolescent children who did not know each other compared to 13% of preadolescent children who experimented with their gender when they knew each other. In both studies, gender bending increased over time, but much more markedly in the current context of familiar peers. The research by Gross (2004) lends some insight into our findings. Specifically, Gross (2004) found that identity experimentation typically occurred in the presence of peers or family members such as siblings. Moreover, Gross (2004) found that 10% of adolescents reported gender bending, which is similar to the 13% average that we find here for our familiar peers who altered the gender of their avatar, and the 10% average of gender bending reported for Dutch preadolescent and adolescent youth (Valkenburg et al., 2005). In contrast with the argument that anonymity leads to more identity experimentation (Valkenburg et al., 2005), the findings from our studies and those of Gross (2004) suggest that both preadolescents and adolescents feel more comfortable experimenting with their identity when they know each other.

We were especially interested in the links among children's biological sex and their gender bending, an index of gender identity, and their gendered play and interaction styles. The actual biological sex of children influenced children's play styles and relationship patterns even when children gender swapped. Specifically, when children gender-swapped in one of the sessions and not the other, styles of interaction were still positively correlated across sessions. That is, when boys presented themselves as girl avatars and girls presented themselves as boy avatars, they still acted like their own gender, sometimes even adopting gendered names that were consistent with their biological sex. Our findings support the importance of categorical sex as a driver of children's gendered play activities and interaction styles (see Ruble et al., 2006).

One limitation of the current study was studying pairs in the MUD. MUDs generally allow many participants simultaneously (Curtis, 1997; Turkle, 1995, 1997) rather than constraining the number of players for experimental purposes. Boys play in larger peer groups than girls do (Maccoby, 1998; Pellegrini & Smith, 1993; Ruble et al., 2006) so studying pairs could suppress the normal peer interactions of boys. A second limitation is that children only visited the MUD twice. Experimentation with their avatars was increasing by the second session, suggesting interesting possibilities for studying children's identity construction and gender bending over time. Future research should alter the number of MUD participants to examine how various size groups of children interact as well as track children longitudinally.

In conclusion, Livingstone (2003) argued that researchers should go beyond Internet access and use patterns and study the kinds of social interactions and personal meanings that take place online. Virtual MUD settings can provide such an opportunity by providing a forum for observing the developmental transition from same-sex to opposite-sex peer interactions as well as how youth experiment with their gender presentations. Considerable sex-typing, which appeared to be driven by the biological sex of children, took place in our MUD, and communication with opposite-sex peers was often difficult for our preadolescent sample. Taken together, the results suggest that MUDs provide a space that reflects classic developmental issues concerning sex differences in children's play styles, social interactions, modes of thought, and identity construction.

References

Blatchford, P. (1996). 'We did more then': Changes in pupils/perceptions of breaktime (recess) from 7 to 16 years. *Journal of Research in Childhood Education*, *11*, 14–24.

Blatchford, P., Baines, E., & Pellegrini, A. (2003). The social context of school playground games: Sex and ethnic differences, and changes over time after entry to junior high. *British Journal of Developmental Psychology*, *21*, 481–505.

Bjorklund, D., & Pellegrini, A. (2000). Child development and evolutionary psychology. *Child Development*, *71*, 1687–1708.

Calvert, S. L. (2002). Identity construction on the Internet. In S. L. Calvert A. B. Jordan & R. R. Cocking (Eds.), *Children in the digital age: Influences of electronic media on development* (pp. 57–70). Westport CT: Praeger.

Calvert, S. L., Mahler, B. A., Zehnder, S. M., Jenkins, A., & Lee, M. (2003). Sex differences in preadolescent children's online interactions: Symbolic modes of self-presentation and self-expression. *Journal of Applied Developmental Psychology*, *24*, 627–644.

Curtis, P. (1997). MUDding: Social phenomena in text-based virtual realities. In S. Kiesler (Ed.), *Culture of the Internet* (pp. 121–142). Mahwah, NJ: Erlbaum.

Else-Quest, N., Hyde, J., Goldsmith, H., & Van Hulle, C. (2006). Gender differences in temperament: A meta-analysis. *Psychological Bulletin*, *132*, 33–72.

Fleiss, J. (1981). *Statistical methods for rates and proportions*, 2nd ed. NY: John Wiley.

Gleason, J., & Ely, R. (2002). Gender differences in language development. In A. V. McGillicuddy-De Lisi & R. De Lisi (Eds.), *Biology, society, and behavior. The development of sex differences in cognition*, *vol. 21*. (pp. 127–154) Westport, CT: Ablex.

Greenfield, P. M., & Subramanyam, K. (2003). Online discourse in a teen chatroom: New codes and new modes of coherence in a visual medium. *Journal of Applied Developmental Psychology*, *24*, 713–738.

Griffiths, M., Davies, M., & Chappell, D. (2004). Online computer gaming: A comparison of adolescent and adult gamers. *Journal of Adolescence*, *27*, 87–96.

Gross, E. (2004). Adolescent Internet use: What we expect, what teens report. *Journal of Applied Developmental Psychology*, *25*, 633–649.

Huston, A.C. (1983). Sex-typing. In P.M. Mussen (Series ed.) & E. M. Hetherington (Vol. ed.), Handbook of child psychology: Vol. 4. Socialization, personality, and social development (3rd ed., pp. 387–467). NY: Wiley.

Leaper, C., & Smith, T. E. (2004). A meta-analytic review of sex variations in children's language use: Talkativeness, affiliative speech, and assertive speech. *Developmental Psychology*, *40*, 993–1027.

Lenhart, A., Rainie, L., & Lewis, O. (2001). *Teenage life online: The rise of the instant-message generation and the Internet's impact on friendships and family relationships.* Washington D.C.: PEW Internet and Family Life.

Livingstone, S. (2003). Children's use of the internet: Reflections on the emerging research agenda. *New Media and Society*, *5*, 147–166.

Maccoby, E. E. (1998). *The two sexes: Growing up apart, coming together.* Cambridge, MA: Harvard University Press.

Pellegrini, A., Blatchford, P., & Baines, E. (2004). A short-term longitudinal study of children's playground games in primary school: Implications for adjustment to school and social adjustment in the USA and the UK. *Social Development*, *13*, 107–123.

Pellegrini, A., & Smith, P. (1993). School recess: Implications for education and development. *Review of Educational Research*, *63*, 51–67.

Ruble, D., Martin, C., & Berenbaum, S. (2006). Sex development. In W. Damon & R.M. Lerner (Series ed.) & N. Eisenberg (Vol. ed.), Handbook of child psychology: Vol. 3. Social, emotional and personality development (6th ed., pp. 858–932). NY: Wiley.

Subramanyam, K., Greenfield, P. M., & Gross, E. (2004). Constructing sexuality and identity in an online teen chatroom. *Journal of Applied Developmental Psychology*, *25*, 651–666.

Turkle, S. (1995). *Life on the screen.* New York: Simon and Schuster.

Turkle, S. (1997). Constructions and reconstructions of self in virtual reality: Playing in the MUDs. In S. Kiesler (Ed.), *Culture of the Internet* (pp. 143–155). Mahwah, NJ: Erlbaum.
Valkenburg, P., Schouten, A., & Peter, J. (2005). Adolescents' identity and experiments on the Internet. *New Media and Society*, *7*, 383–402.
Wright, J. C., Huston, A. C., Ross, R. P., Calvert, S. L., Rollandeli, D., Weeks, L. A., Raessi, P., & Potts, R. (1984). Pace and continuity of television programs: Effects on children's attention and comprehension. *Developmental Psychology*, *20*, 653–666.