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## **Precursors and Underlying Processes of Adolescents' Online Self-Disclosure: Developing and Testing an “Internet-Attribute-Perception” Model**

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*This study developed and tested an "Internet-attribute-perception" model that explains how self-disclosure develops in instant messaging (IM) interactions. Following hyperpersonal communication theory, two attributes of computer-mediated communication (i.e., reduced nonverbal cues and controllability) were assumed to be responsible for increased online self-disclosure in IM. However, our model posed that any actual effects of these attributes would depend on users' perceptions of the relevance of these attributes. Furthermore, our model posed that these perceptions would mediate the relationship between personality characteristics (i.e., private and public self-consciousness, and social anxiety) and online self-disclosure. Using structural equation modeling on a sample of 1,203 Dutch adolescents, we found that adolescents' perceptions of the relevance of reduced nonverbal cues and controllability encouraged their feelings of disinhibition, which in turn increased their online self-disclosure. As expected, private and public self-consciousness and social anxiety stimulated adolescents' perceptions of the relevance of reduced nonverbal cues and controllability, but did not directly influence online self-disclosure. The study shows the vital role of users' perceptions of CMC attributes in Internet-effects research.*

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Instant Messaging (IM) has become a pervasive phenomenon in the past few years, especially among adolescents. IM is a synchronous, largely text-based communication tool that allows Internet users to exchange messages. Although some adolescents use IM to talk with strangers, IM typically involves non-anonymous communication with one's existing network of friends (Grinter & Palen, 2002; Gross, 2004). In the US, 75% of online adolescents use IM, and for most adolescents IM has become more important than e-mail (Hu, Wood, Smith, & Westbrook 2004; Lenhart, Madden, & Hitlin, 2005).

Both survey research into the uses and effects of IM (Hu et al., 2004; Leung, 2002; Schiano et al., 2002; Valkenburg & Peter, 2007) and experimental studies on the effects of computer-mediated communication (CMC; Bargh, McKenna, & Fitzsimons, 2002; Joinson, 2001; Tidwell & Walther, 2002) have repeatedly demonstrated that CMC stimulates self-disclosure. Self-disclosure may be defined as disclosing intimate information about the self (Derlega, Metts, Petronio, & Margulis, 1993). The enhanced self-disclosure in CMC is often explained with Walther's (1996) hyperpersonal communication theory (e.g., Gibbs, Ellison, & Heino, 2006; McKenna & Bargh, 2000; Peter & Valkenburg, 2006). This theory poses that CMC facilitates "hyperpersonal" communication, that is, communication that is more intimate than face-to-face communication.

According to hyperpersonal communication theory, two structural attributes of CMC encourage interactants to engage in more intimate exchanges in CMC settings than in face-to-face settings (Tidwell & Walther, 2002; Walther, 1996). The first attribute is CMC's reduced nonverbal cues. CMC is typically characterized by reduced visual, auditory, and context cues, such as social status cues (Kiesler, Siegel, & McGuire, 1984). The second structural attribute assumed to enhance online self-disclosure is the controllability of CMC.<sup>1</sup> The controllability of CMC allows users the time to review and edit their messages and to consider responses (Walther & Parks, 2002). Although controllability seems more important in asynchronous CMC, such as e-mail, it also applies to synchronous CMC, such as IM (cf., Tidwell & Walther, 2002). In IM, messages are only sent upon pressing "Enter" and responses do not necessarily have to be immediate. Walther (1996) posits that, because of CMC's reduced nonverbal cues and controllability, interactants get absorbed in the communication task. Reduced nonverbal cues and controllability reduce people's inhibitions when interacting through CMC. This disinhibitive effect of CMC may in turn result in increased online self-disclosure (Jessup, Connolly, & Tansik, 1990; Kiesler et al., 1984; Walther, 1996).

Reduced nonverbal cues and controllability may be central in explaining the enhanced online self-disclosure. However, in most CMC research

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<sup>1</sup>Walther refers to this attribute as "asynchronous communication" (1996, p. 29). However, we found the term controllability to be more appropriate because even synchronous CMC allows more time and control to construct messages than face-to-face communication.

based on hyperpersonal theory, these attributes are usually seen as structural, fixed aspects of CMC that are only implicitly assumed (e.g., Bargh et al., 2002; Tidwell & Walther, 2002). Nevertheless, recent survey research on online communication has shown that Internet users can differ greatly in their perceptions of the relevance of CMC attributes (Peter & Valkenburg, 2006; Tsai, 2004; Tsai & Lin, 2004). Furthermore, in contemporary media effects research, it is widely acknowledged that users' perceptions of a medium may intervene with effects of that medium (e.g., Rubin, 2002). Therefore, it is not only important to operationalize user perceptions about CMC attributes, but also to investigate how potential differences in these perceptions may affect CMC outcomes. A first aim of our study is to investigate (a) how users differ in their perceptions of the relevance of CMC attributes and (b) how these perceptions influence differences in online disinhibition and self-disclosure.

Hyperpersonal communication theory offers a valid explanation of how CMC may stimulate disinhibition and self-disclosure. However, the theory has paid little attention to user factors that may play a role in shaping online communication and its outcomes. In the past years, Internet research has increasingly focused on the influence of personality factors on the uses and outcomes of the Internet (Gross, Juvonen, & Gable, 2002; Kraut et al., 2002; McKenna & Bargh, 2000). It has been shown, for example, that socially anxious adolescents use the Internet differently and experience different outcomes from the Internet than non-socially anxious adolescents (Gross et al., 2002; Valkenburg & Peter, 2007). Furthermore, personality characteristics significantly predict adolescents' perceptions of the attributes of online communication (Peter & Valkenburg, 2006).

Several media theories, such as the uses and gratifications approach, have tried to explain the predictive value of personality characteristics for media perceptions (e.g., Rosengren, 1974; Rubin, 2002; Sherry, 2001). Personality characteristics are usually seen as relatively stable patterns of an individual's thoughts, emotions, and behavior (e.g., Funder, 2001; Oliver, Kim, & Sanders, 2006). These stable patterns of thoughts, emotions, and behavior are significant determinants of an individual's wants and needs (Katz, Blumler, & Gurevitch, 1974; Rosengren, 1974). For example, people high in private self-consciousness generally have a higher need for self-disclosure (Franzoi & Davis, 1985). In some cases, media can be used to fulfill these personality-induced needs. For example, CMC is often used to fulfill one's need for self-disclosure (Leung, 2002; McKenna & Bargh, 2000). If an individual perceives that a certain medium is appropriate to fulfill a particular need (e.g., self-disclosure), he or she will attach more relevance to this medium and the attributes of that medium that fulfill these needs (Katz, Blumler, & Gurevitch, 1974).

From this reasoning it follows that personality characteristics may shape perceptions of the relevance of media and media attributes. This has been confirmed for media in general (Finn, 1997; Sherry, 2001; Weaver, 2003) and



& Furman, 1987). Adolescents who are unable to self-disclose are usually lonely and have lower levels of self-esteem and well-being than their peers who are more apt at self-disclosure (Collins & Miller, 1994). Therefore, adolescents are a very suitable group to investigate the role of IM in the development of self-disclosure.

## DEVELOPING AN “INTERNET-ATTRIBUTE-PERCEPTION” MODEL

### Disinhibition and Online Self-Disclosure

Interpersonal outcomes of online communication, including online self-disclosure, are usually attributed to online disinhibition (Jessup et al., 1990; Walther, 1996). Disinhibition refers to the loss of constraints that a person experiences when behavior is no longer controlled by concerns about self-presentation or judgments by others (Joinson, 1998). Disinhibition is a psychological state in which a person feels less inhibited to exhibit certain behavior (Jessup et al. 1990; Joinson, 2001; Kiesler et al., 1984; Matheson & Zanna, 1988). In CMC research, disinhibition is often considered a precursor of online self-disclosure (Coleman, Paternite, & Sherman, 1999; Joinson, 1998; Kayany, 1998; McKenna & Bargh, 1998; Walther, 1996). However, the concept has usually only been implicitly assumed in CMC research and has never been empirically tested. This study presents a first step to fill this research gap by investigating the relationship between online disinhibition and online self-disclosure. Our first hypothesis, which is visualized by path H1 in Figure 1, states that:

H1: The more disinhibited adolescents feel in IM interactions, the higher their levels of online self-disclosure.

### Perceptions of CMC Attributes

Both the reduced nonverbal cues and the controllability of CMC may facilitate online disinhibition and self-disclosure (Walther, 1996). Reduced nonverbal cues may diminish inner constraints and evaluation by others, leading to disinhibited behavior (Jessup et al., 1990). Controllability may allow adolescents greater control over their self-presentation (McKenna & Bargh, 2000; O’Sullivan, 2000; Walther, 1996). As a consequence, it may stimulate adolescents to feel more at ease to discuss intimate topics that they usually would not disclose in real life (Bargh et al., 2002). Our Internet-attribute-perception model assumes that adolescents who attach more relevance to the reduced nonverbal cues and controllability of IM will feel more disinhibited and, subsequently, will self-disclose more online than adolescents who attach less relevance to these attributes. These assumptions lead to the following

hypotheses, visualized by paths H2 and H3 in Figure 1:

- H2: Adolescents who perceive the reduced nonverbal cues of IM interactions as more relevant will feel more disinhibited when using IM, and will subsequently self-disclose more easily.
- H3: Adolescents who perceive the controllability of IM interactions as more relevant will feel more disinhibited when using IM, and will subsequently self-disclose more easily.

### Personality Characteristics Affecting Perceptions of IM Attributes

In our model, the effects of private self-consciousness, public self-consciousness, and social anxiety on online disinhibition are mediated by adolescents' perceptions of the reduced nonverbal cues and controllability of IM. We selected these three personality factors for three reasons. First, they are particularly important in adolescence (Harter, 1999; Steinberg, 2001). Second, they are related to adolescents' online and/or offline self-disclosure (Cheek & Buss, 1981; Franzoi & Davis, 1985; Gross et al., 2002; La Greca & Lopez, 1998). Third, it has recently been found that specific personality characteristics are more relevant to media perceptions than more general characteristics such as extraversion. These general traits are often too broad to yield significant results (Hall, 2005).

We expect private self-consciousness to increase both the perceived relevance of reduced nonverbal cues and controllability. Private self-consciousness refers to the "dispositional tendency to focus attention on the more private and covert aspects of oneself" (Franzoi & Davis, 1985, p. 769). Adolescents high in private self-consciousness are typically more aware of their inner feelings, attitudes, and thoughts than those low in private self-consciousness, and are therefore better able and more motivated to disclose themselves. In face-to-face interactions, impressions are usually based on easily observed aspects of the self, such as nonverbal cues, and not on the more intimate aspects of the self (Hancock & Dunham, 2001; McKenna, Green & Gleason, 2002; Riggio & Friedman, 1996). Therefore, adolescents high in private self-consciousness may judge the reduced nonverbal cues and controllability of IM as more relevant because they feel that the impressions they make will be based on their self-disclosures and not on cues that are unintentionally given off. These adolescents may also judge the controllability of IM as more relevant because it gives them more time to reflect upon their inner feelings and how to communicate these feelings. Furthermore, self-disclosure to peers is sometimes risky (Buhrmester & Prager, 1995). The reduced nonverbal cues and controllability of IM may create some psychological distance that facilitates communication (e.g., Kiesler et al., 1984). This will especially appeal to those high in private self-consciousness because they are more motivated to disclose themselves.

We therefore hypothesize:

H4: Private self-consciousness is positively related to the perceived relevance of the reduced nonverbal cues (H4a) and the controllability (H4b) of IM interactions.

We also expect public self-consciousness to be positively related to both the perceived relevance of reduced nonverbal cues and the controllability of IM. While private self-consciousness refers to the inner aspects of self, public self-consciousness is the awareness of how one appears in the eyes of others (Fenigstein, Scheier, & Buss, 1975, p. 523). Because the reduced nonverbal cues may lower concern about evaluation of others (Matheson & Zanna, 1988), adolescents high in public self-consciousness may consider IM's reduced nonverbal cues to be more relevant than those low in public self-consciousness. Furthermore, adolescents high in public self-consciousness are usually more sensitive to the impressions they make on others, and the controllability allows them more time and opportunity to optimize their self-presentation (Fenigstein et al., 1975; Tobey & Tunnell, 1981).

H5: Public self-consciousness is positively related to the perceived relevance of the reduced nonverbal cues (H5a) and the controllability (H5b) of IM interactions.

Social anxiety resembles public self-consciousness, but while public self-consciousness only refers to the awareness of how one appears to others, social anxiety also implies that one is worried about it and, consequently, inhibited in social interactions (La Greca & Lopez, 1998). In studies of self-consciousness, private self-consciousness, public self-consciousness, and social anxiety consequently emerge as three separate factors (e.g., Cramer, 2000; Fenigstein et al., 1975; Mittal & Balasubramanian, 1987).

We expect a positive relationship between social anxiety and the perceived relevance of the reduced nonverbal cues and the controllability of IM interactions. Because the socially anxious are inhibited in social interactions, they self-disclose less than those who are lower in social anxiety (Meleshko & Alden, 1993). The reduced nonverbal cues in IM may diminish these constraints because socially anxious people may feel less scrutinized by others during IM. Indeed, it has been found that those high in social anxiety prefer online self-disclosure over self-disclosure in face-to-face communication (McKenna et al., 2002; Stritzke, Nguyen, & Durkin, 2004). Furthermore, the socially anxious are less assertive and prefer settings in which their interactions can be prepared ahead of time (Arkin & Grove, 1990). Therefore, they may find the control over message construction in IM more relevant than those low in social anxiety. Our last hypothesis, depicted as



H6a and H6b in Figure 1, is:

H6: Social anxiety is positively related to adolescents' perceived relevance of the reduced nonverbal cues (H6a) and the controllability (H6b) of IM interactions.

### Online versus Offline Self-Disclosure

Online self-disclosure can only be studied adequately when one's tendency for self-disclosure in offline interactions is taken into account. After all, adolescents who more easily disclose in face-to-face-interactions may also do so more frequently on the Internet. In this case, our model would explain adolescents' general tendency to self-disclose and not their specific tendency to self-disclose online. To avoid this possible confound, our dependent variable—online self-disclosure—will be controlled for offline self-disclosure.

Taking adolescents' offline disclosure into account also provides us with the opportunity to compare the relative frequency of online and offline self-disclosure. Our study can provide a first insight into the ratio of online and offline self-disclosure within different subgroups. For example, female adolescents generally self-disclose more than male adolescents (Dindia & Allen, 1992; Miller, Berg, & Archer, 1983). In addition, self-disclosure in same-sex adolescent interactions (i.e., males to males and females to females) is usually higher than self-disclosure in cross-sex adolescent interactions (i.e., female to male; Hacker, 1981). However, it is as yet unknown how males versus females and same-sex versus cross-sex self-disclosure compare when considering online self-disclosure. Therefore, we pose two final research questions:

RQ1: How do adolescents' levels of online self-disclosure relate to their levels of offline self-disclosure?

RQ2: To what extent do levels of online self-disclosure differ for boys and girls and for cross-sex and same-sex self-disclosure?

## METHOD

### Sample and Procedure

We conducted a survey among 1,340 adolescents between 10 and 18 years of age ( $M = 14.10$ ,  $SD = 2.06$ , 49% girls). Ninety percent reported using IM. The analyses in this paper are based on these adolescents ( $N = 1,203$ ). The adolescents were recruited from six schools in urban areas in the Netherlands. Three of these schools were elementary schools; the 10- to 12-year olds were sampled there. The three remaining schools were secondary schools.

Two of these schools represented lower secondary professional education, and provided 48% of the secondary-school respondents. One school represented higher general secondary education. The schools thus covered all educational levels in the Netherlands.

After we had obtained parental consent, a research assistant administered paper-and-pencil questionnaires in the classroom. We ensured that adolescents had sufficient privacy to fill in the questionnaires. The 10% of respondents who had indicated that they had never used IM were asked only to provide their age and gender. Completing the questionnaire took about 30 minutes.

## Measures

*Online self-disclosure.* Our measure of self-disclosure was based on earlier scales that measure intimate self-disclosure (Jourard, 1971; Miller et al., 1983). Cross-sex and same-sex self-disclosure was measured separately by asking respondents to indicate their level of self-disclosure to boys and girls, and then recoding these scores based on the respondents' gender.

Respondents were first asked to think of a boy with whom they regularly communicated via IM. Next, they were asked to indicate how much they disclosed to this boy about the following seven topics: "My personal feelings," "the things I am worried about," "my secrets," "being in love," "sex," "moments in my life I am ashamed of," and "moments in my life I feel guilty about." Items were measured on a 5-point scale ranging from 1 (*I tell nothing about this*) to 5 (*I tell everything about this*).

Respondents were subsequently asked to think of a girl with whom they regularly communicated via IM. They were asked to fill in the aforementioned seven items with this girl in mind. Cronbach's alpha for online self-disclosure to both boys and to girls was .93. Both scales were then recoded to cross-sex and same-sex self-disclosure scales based on the respondent's gender. For female respondents, self-disclosure to girls was recoded into same-sex self-disclosure and self-disclosure to boys was recoded into cross-sex self-disclosure. For male respondents, self-disclosure to girls was recoded into cross-sex self-disclosure, and self-disclosure to boys was recoded into same-sex self-disclosure.

*Offline self-disclosure.* The above-described procedure was also used to measure offline self-disclosure. Cronbach's alphas were .92 for offline disclosure to girls and .93 for offline disclosure to boys. Based on the respondents' gender, offline self-disclosure to boys and offline self-disclosure to girls were then recoded into cross-sex and same-sex offline self-disclosure, following the same procedure we used for online self-disclosure.

We specifically asked adolescents to think of a girl or boy with whom they regularly communicated online or offline. We posed the question in this way because we did not want the adolescents only to think of a best friend.

Because self-disclosure with best friends is typically high, there would not be enough variance in the two self-disclosure scales. Likewise, if we would have specifically prompted adolescents to think of the same boy and girl twice, for online and offline self-disclosure, there also might not be enough variance in the two self-disclosure scales. To control for the closeness of the girl or boy our respondents thought of, we asked them to indicate how close they felt to the girl or boy they had in mind, on a scale from 1 (*very close*) to 5 (*not close at all*). For all four disclosure measures, over 90% of respondents scored 1 (*very close*), 2 (*close*), or 3 (*somewhat close*). The percentages were roughly evenly divided among these three categories. In other words, not every adolescent thought of a best friend, but most thought of someone who was close to them.

*Online disinhibition.* Disinhibition refers to the experience of feeling less constrained to exhibit certain behavior (Joinson, 1998). Based on this definition, we operationalized online disinhibition with three items: (1) "During IM, I feel less constrained to use certain words than in a face-to-face meeting," (2) "During IM, I feel less restricted to talk about certain things than in a face-to-face meeting," and (3) "During IM, I feel more free to talk about things than in a face-to-face meeting." Online disinhibition was measured on a 5-point scale ranging from 1 (*completely disagree*) to 5 (*completely agree*). The three items formed a one-dimensional scale, with a Cronbach's alpha of .77.

*Perceived relevance of reduced nonverbal cues.* Reduced nonverbal cues refer to the absence of visual, auditory, and social context cues, such as status cues (Kiesler et al., 1984; Walther, 1996). Three items measured the perceived relevance of these cues. Respondents were asked to indicate to what extent they considered it important that during IM: (1) "... others cannot see what I look like," (2) "... others cannot hear how my voice sounds," and (3) "... others cannot see what clothes I wear." The response categories for these items ranged from 1 (*very unimportant*) to 5 (*very important*). The first two items relate to the absence of visual and auditory cues. We included the third item to represent status cues because in adolescence, clothing is an important reflection of social status and is a cue that is easily observed face-to-face (De Bruyn, 2005; Shook, 1997). Cronbach's alpha of the scale was .72.

*Perceived relevance of controllability.* We measured controllability with two items. The first item reflected the increased time and control users have over message construction in CMC, and the second item reflected the possibility to consider responses (Walther & Parks, 2002, p. 541). We asked respondents to what extent they considered it important that, during IM: (1) "... I have more time to think about what I want to say," and (2) "... I have time to think about how I say something." The response categories ranged from 1 (*very unimportant*) to 5 (*very important*). Cronbach's alpha of the scale was .87.

*Private and public self-consciousness.* The Fenigstein Self-Consciousness Scale (Fenigstein et al., 1975) was used to assess private and public self-consciousness. The scale has successfully been employed to measure private and public self-consciousness among adolescents (Rankin, Lane, Gibbons, & Gerrard, 2004). Based on research regarding the factor structure of the scales (Cramer, 2000; Dillard & Hunter, 1989), we left out four items (1, 3, 9, 22) from the original private self-consciousness scale and two items from the public self-consciousness scale (17, 21). Examples of items from the private self-consciousness scale include: “I reflect about myself a lot,” and “I am generally attentive to my inner feelings.” Examples of items from the public self-consciousness scale are: “I usually worry about making a good impression,” and “I am concerned about the way I present myself.” Response categories for the items ranged from 1 (*completely disagree*) to 5 (*completely agree*). A factor analysis with varimax rotation yielded two independent factors with an explained variance of 55%. Cronbach’s alpha was .80 for the private self-consciousness scale and .83 for the public self-consciousness scale.

*Social anxiety.* We measured social anxiety with four items from the “Social avoidance and distress–new people subscale” of the Social Anxiety Scale for Adolescents (La Greca & Lopez, 1998). From the original 18-item scale, we selected the four items with the highest factor loadings. The items were: “I get nervous when I meet new people,” “I feel shy around people I don’t know,” “I get nervous when I talk to peers I don’t know very well,” and “I feel nervous when I’m around certain people.” The response categories for the items ranged from 1 (*completely disagree*) to 5 (*completely agree*). The items formed a one-dimensional scale, with a Cronbach’s alpha of .77.

## RESULTS

### Zero-Order Correlations between Variables Included in the Model

Table 1 provides the zero-order correlation matrix of the variables included in the model. In the table, the variable online self-disclosure is the average of online cross-sex self-disclosure and online same-sex self-disclosure. Offline self-disclosure is the average of offline cross-sex self-disclosure and offline same-sex self-disclosure.

### Testing the Model

The hypothesized model (Figure 1) was tested with structural equation modeling (SEM) using AMOS 5.0 (Arbuckle, 2003). SEM allows for testing theory-based causal models with correlational data, and combines this with the

**TABLE 1** Pearson Product-Moment Correlations of Independent and Dependent Variables

	1	2	3	4	5	6	7	8	M	SD
1. Online self-disclosure									2.27	0.94
2. Disinhibition	.22*								2.95	1.02
3. Reduced nonverbal cues	.05	.24*							2.03	0.82
4. Controllability	.13*	.28*	.38*						3.01	1.19
5. Private self-consciousness	.23*	.19*	.21*	.28*					2.88	0.80
6. Public self-consciousness	.12*	.26*	.27*	.29*	.46*				2.38	0.86
7. Social anxiety	.00	.19*	.21*	.28*	.28*	.47*			2.13	0.80
8. Offline self-disclosure	.71*	.06	.03	.10*	.26*	.10*	.03		2.51	0.94
9. Gender (boys = 0)	.19*	-.04	.10*	.11*	.15*	.14*	.16*	.27*	1.51	0.50
10. Age	.26*	-.02	-.01	.10*	.08*	.01	.04	.40*	14.22	1.99

Note. \* $p < .01$

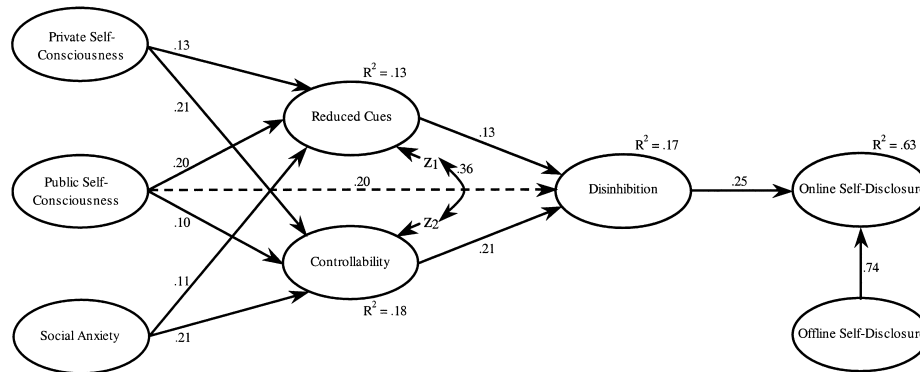
possibility to correct for measurement error by estimating latent variables from manifest indicators (Byrne, 2001). All variables in our model in Figure 1 represented latent variables, which were estimated from two manifest indicators. For each latent variable, except for online and offline self-disclosure, item parcels served as indicators. These item parcels were created using a procedure suggested by Russell et al. (1998). First, we factor analyzed the items meant to measure each variable. Based on the sizes of the factor loadings, we alternately assigned each item to the first or second item parcel. For example, for social anxiety, the four items yielded one factor with factor loadings being .66, .62, .59, and .50. The items ranked 1 and 3 (i.e., .66 and .59) on the factor formed the first item parcel, and the items ranked 2 and 4 (i.e., .62 and .50) formed the second item parcel.

It is advised to use item parcels rather than individual items to estimate latent constructs, because (a) item parcels lead to more parsimonious models and (b) individual items usually violate the assumption of multivariate normality. Creating item parcels is allowed only when the underlying construct is unidimensional, that is, when all items load on one factor (Kishton & Widaman, 1994; Russell et al., 1998).

The latent construct online self-disclosure was estimated from two indicators: One indicator was the 7-item scale measuring online cross-sex self-disclosure, and the other was the 7-item scale measuring online same-sex self-disclosure. The latent construct offline self-disclosure was measured similarly: One indicator represented offline cross-sex self-disclosure to girls and one represented offline same-sex self-disclosure.

Please note that, for reasons of visual clarity, the measurement models (i.e., the factor analytic models) are not shown in Figure 2. However, all measurement models adequately represented the data; the factor loadings for all constructs were above .57.

In our hypothesized model and analyses, the dependent variable online self-disclosure was controlled for offline self-disclosure by including the latter



**FIGURE 2** Structural equation model of our hypothesized “Internet-attribute-perception” model underlying adolescents’ online self-disclosure. Ellipses represent latent constructs estimated from two indicators each; coefficients are standardized betas or correlations and are significant at least at  $p < .05$ . The measurement models are not shown.

as a predictor of online self-disclosure.<sup>2</sup> The beta coefficient of the path from offline to online self-disclosure was  $.74$ ,  $p < .001$ . In addition, the error terms of online and offline cross-sex self-disclosure were allowed to co-vary, as were the error terms of online and offline same-sex disclosure (not shown in Figure 2). Because the items used to measure online and offline self-disclosure are very similar in content, not correlating the error terms may inflate the relation between the latent constructs (see Reddy, 1992; Russell et al., 1998 for an explanation of why correlating errors is desirable in such cases).

In our hypothesized model we expected reduced nonverbal cues and controllability to be correlated, as both attributes allow users greater control over the cues they communicate. However, because in SEM it is impossible to model covariation among endogenous variables, we allowed the disturbance terms of reduced nonverbal cues and controllability ( $Z_1$  and  $Z_2$ ) to co-vary. The correlation between the disturbance terms was  $.36$ ,  $p < .001$ .

<sup>2</sup>We also ran our model without controlling for offline self-disclosure. This model also yielded an acceptable fit,  $\chi^2(63, N = 1203) = 183.39$ ,  $p < .001$ , CFI = .98, RMSEA = .040 (90% CI: .033, .047),  $\chi^2/df = 2.91$ . None of the structural parameters in our model changed (e.g., the relationship between disinhibition and self-disclosure was still  $\beta = .25$ ,  $p < .001$ ). The explained variance of self-disclosure was 10%. However, this model could be significantly improved by adding a relationship ( $\beta = .27$ ,  $p < .001$ ) between private self-consciousness and online self-disclosure,  $\chi^2_{\text{change}}(1, N = 1203) = 48.06$ ,  $p < .001$ ,  $TLI_{\text{change}} = .011$ . This model yielded a better fit,  $\chi^2(62, N = 1203) = 135.32$ ,  $p < .001$ , CFI = .99, RMSEA = .031 (90% CI: .024, .039),  $\chi^2/df = 2.19$ . The relationship between private self-consciousness and online self-disclosure provides a good example of why we controlled for offline self-disclosure. If we would not have included offline self-disclosure in our model, we could have mistakenly concluded that there is a relationship between private self-consciousness and *online* self-disclosure, while there is actually a relationship between private self-consciousness and *general* self-disclosure (Franzoi & Davis, 1985).

We used two indices to evaluate the fit of our models: the root mean square error of approximation (RMSEA) and the comparative fit index (CFI). Particularly in the case of large samples, these indices are considered as informative criteria in SEM. A good model fit is expressed in an RMSEA value less than .06 and a CFI value greater than .95 (Byrne, 2001). In addition, we also report the chi square index. However, a widely recognized problem with this index is that the model fit is seriously underestimated in analyses with larger samples (see Byrne, 2001, for a review of methodological references). To address this problem, the relative chi-square ( $\chi^2/\text{df}$  ratio) has been recommended. A  $\chi^2/\text{df}$  ratio of less than 3.0 is considered an acceptable fit (Kline, 2005).

The initial model fit the data well,  $\chi^2(86, N = 1203) = 198.15, p < .001$ , CFI = .986, RMSEA = .033 (90% CI: .027, .039),  $\chi^2/\text{df} = 2.30$ . However, the modification indices and the values of the expected parameter changes showed that the model could be improved significantly by adding a path from public-self-consciousness to disinhibition,  $\chi^2_{\text{change}}(1, N = 1203) = 30.46, p < .001$ ,  $\text{TLL}_{\text{change}} = .005$ . Because such a relationship is theoretically plausible, we decided to include this path in our final model. After all, adolescents who do not care about how they appear to others may also be uninhibited to say certain things. Therefore, it is reasonable to assume a relation between public self-consciousness and disinhibition, regardless of whether nonverbal cues and controllability are judged important (Ryan & Kuczkowski, 1994). The final model fit the data even better,  $\chi^2(85, N = 1203) = 167.69, p < .001$ , CFI = .990, RMSEA = .028 (90% CI: .022, .035),  $\chi^2/\text{df} = 1.97$ . We could not make any further meaningful modifications to the model, and we accepted this model as our final model. Figure 2 shows the final model, including the explained variance of each dependent variable.<sup>3</sup> All parameters in the model are either correlations or standardized betas.

Our first hypothesis predicted that disinhibition would positively influence online self-disclosure. This hypothesis was confirmed,  $\beta = .25, p < .001$  (see Figure 2). Adolescents who felt less disinhibited in IM interactions had higher levels of online self-disclosure. Hypothesis 2 predicted a positive effect of perceived relevance of reduced nonverbal cues on feelings of disinhibition. Hypothesis 3 predicted a positive effect of perceived relevance of controllability on feelings of disinhibition. Both hypotheses were confirmed ( $\beta = .13, p = .002$  and  $\beta = .21, p < .001$ , respectively). Adolescents who perceived the reduced nonverbal cues and the control over time during IM to be more relevant, were more likely to feel disinhibited when using IM.

Hypotheses 4a and 4b predicted positive relationships between private self-consciousness and perceived relevance of reduced nonverbal cues and perceived relevance of controllability. Both hypotheses were confirmed ( $\beta =$

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<sup>3</sup>Note that the high explained variance of online self-disclosure of 63% is due to the relationship between offline self-disclosure and online self-disclosure.

.13,  $p = .004$ , for Hypothesis 4a, and  $\beta = .21$ ,  $p < .001$  for Hypothesis 4b). Hypotheses 5a and 5b were also confirmed: There was a positive effect of public self-consciousness on reduced nonverbal cues,  $\beta = .20$ ,  $p < .001$ , and controllability,  $\beta = .10$ ,  $p = .04$ . As predicted in Hypothesis 6a and 6b, there were positive paths from social anxiety to both reduced nonverbal cues,  $\beta = .11$ ,  $p = .02$ , and controllability,  $\beta = .21$ ,  $p < .001$ . Finally, there were two significant correlations that are not depicted in the model: one from private self-consciousness to offline self-disclosure,  $r = .37$ ,  $p < .001$ , and another from public self-consciousness to offline self-disclosure,  $r = .14$ ,  $p < .001$ .

### Does our Model Hold for Boys and Girls and Younger and Older Adolescents?

Because gender and age turned out to be significantly related to most of the variables in our model (see Table 1) and are generally important in research with adolescents, we decided to test whether our model held for boys and girls and younger (10- to 12-year-olds), middle (13- to 14-year-olds), and older (15- to 18-year-olds) adolescents. We performed two multiple group analyses with gender and age as grouping variables. The unconstrained model for girls and boys fit the data well,  $\chi^2(170, N = 1203) = 276.38$ ,  $p < .001$ , CFI = .986, RMSEA = .023 (90% CI: .018, .028),  $\chi^2/df = 1.63$ . Imposing the cross-group constraints for the measurement and the structural models did not lead to a significant increase in chi-square,  $\chi^2_{\text{change}}(19, N = 1203) = 22.45$ ,  $p = .26$ ,  $\text{TLI}_{\text{change}} = -.001$ , indicating that the model fit equally well for boys and girls.

The unconstrained models for the three age groups also yielded a good fit,  $\chi^2(255, N = 1203) = 389.74$ ,  $p < .001$ , CFI = .983, RMSEA = .021 (90% CI: .017, .025),  $\chi^2/df = 1.53$ . The model in which both measurement weights and structural weights were constrained also yielded a good fit,  $\chi^2(293, N = 1203) = 443.74$ ,  $p < .001$ , CFI = .981, RMSEA = .021 (90% CI: .017, .025),  $\chi^2/df = 1.51$ . The increase in chi-square was low but significant,  $\chi^2_{\text{change}}(38, N = 1203) = 54.00$ ,  $p = .045$ ,  $\text{TLI}_{\text{change}} = -.001$ . A specific analysis on the structural model showed that only the relationship between offline and online self-disclosure was somewhat lower for the 15- to 18-year-olds than for the younger and middle adolescents. However, all betas were positive and significantly greater than 0.

### Online and Offline Self-Disclosure Compared

RQ1 and RQ2 asked how adolescents' online self-disclosure compares to their offline self-disclosure, and whether this would differ for boys and girls and for same-sex and cross-sex interactions. A mean comparison showed that, on average, adolescents tended to self-disclose less online ( $M = 2.39$ ,



**TABLE 2** Percentage of Boys and Girls who Self-Disclose More Online or More Offline in Cross-Sex and Same-Sex Interactions

	Total <i>n</i> = 1203 %	Girls <i>n</i> = 608 %	Boys <i>n</i> = 595 %
Cross-sex			
More Online	32	28 <sup>a</sup>	35 <sup>b</sup>
More Offline	35	34	35
Same-sex			
More Online	22	23	21
More Offline	55	61 <sup>a</sup>	49 <sup>b</sup>

*Note.* Subgroup comparisons with different superscripts are significantly different at least at  $p < .01$  (tested with  $\chi^2$  test).

$SD = 1.14$ ) than they do offline ( $M = 2.81$ ,  $SD = 1.13$ ) in same-sex interactions,  $F(1,1201) = 257.92$ ,  $p < .001$ ,  $\eta^2 = .18$ . This also held for cross-sex self-disclosure, where adolescents also disclosed slightly more offline ( $M = 2.21$ ,  $SD = 1.08$ ) than online ( $M = 2.16$ ,  $SD = 1.07$ ),  $F(1,1201) = 5.76$ ,  $p = .02$ ,  $\eta^2 = .005$ . The difference between online and offline self-disclosure was far greater for same-sex self-disclosure than for cross-sex self-disclosure,  $t(1202) = 13.01$ ,  $p < .001$ .

A more interesting picture emerges when we compare *how many* adolescents disclose themselves more online than offline in same-sex and cross-sex interactions. We created a new variable indicating the discrepancy between online and offline self-disclosure. This variable revealed that a considerable percentage of adolescents self-disclosed more online than offline, and that this particularly held for cross-sex interactions  $\chi^2(1, N = 1203) = 34.68$ ,  $p < .001$ . More specifically, in cross-sex interactions, 32% of adolescents self-disclosed more online than offline. In same-sex interactions, 22% of adolescents self-disclosed more online than offline (see Table 2).

There were significant gender differences. The percentage of boys (35%) who preferred online self-disclosure in cross-sex interactions is higher than the percentage of girls (28%). In same-sex interactions, boys (21%) and girls (23%) did not differ in their preference for online self-disclosure.

## DISCUSSION

In this paper, we developed and tested an Internet-attribute-perception model that may initially explain how IM stimulates online self-disclosure. The model was based on hyperpersonal communication theory in that the reduced nonverbal cues and controllability of IM would predict online self-disclosure. However, we posed that users' perceived relevance of these

attributes (i.e., reduced nonverbal cues and controllability) would play a central role in explaining online self-disclosure. Second, we assumed users' perceptions of reduced nonverbal cues and controllability to mediate the effects of personality characteristics (i.e., private self-consciousness, public self-consciousness, and social anxiety) on online self-disclosure.

All of our hypotheses were confirmed. Disinhibition predicted online self-disclosure, and all other variables were only indirectly related to online self-disclosure. Adolescents who perceived the reduced nonverbal cues and controllability of IM as more relevant were more disinhibited when using IM and subsequently self-disclosed more easily. These perceptions also explained individual differences in online self-disclosure. We found no direct relationships between the three personality characteristics and online self-disclosure. All effects of private self-consciousness, public self-consciousness and social anxiety on online disinhibition and online self-disclosure were mediated by adolescents' perceptions of IM attributes and disinhibition.

These results are an important first indication of the validity of our Internet-attribute-perception model. Perceptions of CMC attributes—thus not the attributes per se—determine CMC outcomes. After all, if the reduced nonverbal cues and controllability would have had homogeneous effects on online disinhibition and self-disclosure, we would not have found any significant effects of these perceptions on disinhibition and self-disclosure in IM. User perceptions may add to our understanding of the processes that underlie Internet use and its outcomes (Bargh, 2002). A recent study by Kalyanaraman and Sundar (2006) also demonstrated the important role of user perceptions in explaining the relation between customized Internet content and attitudes towards the content.

Our research showed that hyperpersonal communication theory may be applied to everyday Internet research. The theory predicts that hyperpersonal effects such as self-disclosure are based on the reduced nonverbal cues and controllability of CMC. These attributes may also be applied to new CMC technologies such as IM by focusing on users' perceptions of these attributes. Future research may explain other hyperpersonal outcomes of online communication, such as flaming or cybersex. Other online communication technologies may also be classified in terms of reduced nonverbal cues and controllability. For example, controllability and reduced nonverbal cues also characterize e-mail. As a result, perceptions of these attributes may also predict outcomes of e-mail interaction.

Although perceptions of reduced nonverbal cues and controllability were found to predict online self-disclosure, other attributes of CMC may play a role. One such attribute may be the ability to structure self-presentation (McKenna & Bargh, 2000; Walther & Parks, 2002). Reduced nonverbal cues and controllability both imply a greater control and flexibility over the cues adolescents communicate, as indicated by the correlation between disturbance terms of the two attributes. To develop the ability to present one's self is crucial in adolescence (Leary, 1996; Steinberg, 2001), and self-presentation

is an important aspect of IM and other popular Internet technologies, such as MySpace (Lenhart et al., 2005). The ability to control self-presentation may therefore be an important attribute to take into account in future research.

Future research may also want to consider examining potential dimensions of reduced nonverbal cues. In line with hyperpersonal theory, in our study the reduction of visual, auditory, and social context cues was treated as one construct. In earlier text-based CMC technologies, such as Internet Relay Chat (IRC), this was less of an issue, because the absence of one cue implied the absence of the other cues. However, with the rise of modern technology, such as webcams and microphones, all cues can be manipulated separately. IM is still mainly text-based, but video, audio, and other cues are increasingly included in IM interactions (Peter, Valkenburg, & Schouten, 2007). With a webcam, IM interactants can add audio, video, or both. Future research should investigate the effect of the different cues that can be manipulated in new CMC technologies such as IM.

In our study, private self-consciousness, public self-consciousness, and social anxiety all proved to be relevant in explaining online self-disclosure via perceptions. We focused on these three personality characteristics because of their relevance to offline self-disclosure and because we thought it likely that they would be related to the perceptions of reduced nonverbal cues and controllability. However, other personality characteristics may play a role in explaining users' perceptions. Loneliness, for example, is often taken into account in Internet research (e.g., Leung, 2002), and may also affect online self-disclosure.

We predicted that disinhibition would be responsible for online self-disclosure, which is often hypothesized in CMC theories but hardly studied (Jessup et al., 1990; Walther, 1996). Our model showed that online disinhibition predicted online self-disclosure and that the remaining variables in our model (i.e., the personality characteristics and perceptions of IM attributes) were only indirectly related to online self-disclosure. Online disinhibition thus acts as a precursor to online self-disclosure. Further research should explore the role of disinhibition as an explanatory mechanism of other hyperpersonal effects that are implicitly associated with disinhibition, such as flaming and cybersex (Walther & Parks, 2002).

Our study has implications for those studying adolescent online behavior. Based on adolescents' personality characteristics, we may be able to explain which adolescents are attracted to online communication for self-disclosure. Furthermore, we may be able to explain the specific attributes of an online communication technology to which an adolescent is attracted. For example, socially anxious adolescents may find the nonverbal cues of text-only IM attractive, and may thus be less inclined to incorporate audio and video in their IM conversations.

Furthermore, about one in three adolescents indicated that he or she was better able to self-disclose online than offline. This held more strongly for self-disclosure in cross-sex interactions (32%) than in same-sex interac-

tions (22%). The ability to disclose intimate information about the self is a fundamental determinant of friendships and romantic relationship formation (Buhrmester & Furman, 1987). However, especially in early and middle adolescence, adolescents seem to be inhibited in disclosing themselves to the opposite gender (Hacker, 1981). The fact that a considerable group of adolescents self-disclosed more online than offline, especially when interacting with the opposite sex, suggests that for many adolescents, IM may be particularly helpful in their cross-sex self-disclosures. This seems to be even more so for boys (35%) than for girls (28%). Because boys generally have more difficulty self-disclosing than girls, they may especially benefit from IM's controllability and reduced nonverbal cues to stimulate their self-disclosure.

An important direction for further research is to investigate the long-term consequences of online self-disclosure for adolescents. We found that certain personality characteristics are positively related to perceptions of IM attributes, which, in turn, encourage adolescents' online self-disclosure. As discussed, the ability to self-disclose is a necessary condition for intimate relationship formation and a healthy development (Jourard, 1971). Future, preferably longitudinal, research should investigate the effects of IM-induced self-disclosure on relationship formation and well-being in adolescence.

Another important avenue for further studies lies in cross-cultural comparative research. The Netherlands is at present at the forefront of Internet-based communication technologies, and is therefore a unique spot to start investigating the social consequences of technologies such as IM. However, results may be different for other countries in which such technologies are not as pervasive as in the Netherlands. For example, the familiarity of Dutch adolescents with IM may have positively influenced their online self-disclosure.

Our Internet-attribute-perception model showed that adolescents differ in their perceptions of CMC attributes, and that these perceptions mediated the effects of personality characteristics on online self-disclosure in IM. Our model may be applied to other online communication technologies and may explain other hyperpersonal effects, such as flaming and friendship formation. More work is needed to distinguish the exact cues and attributes that determine a communication technology and classify them accordingly. However, perceptions are an important factor in explaining Internet outcomes such as self-disclosure. In our opinion, future research may benefit in studying Internet outcomes by combining structural attributes of CMC technologies with the perceptions of these attributes.

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