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Patrick Pössel
University of Louisville

Simone Seemann
University of Tuebingen

Stefanie Ahrens
University of Tuebingen

Martin Hautzinger
University of Tuebingen

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Testing the causal mediation component of Dodge's social information processing model of

social competence and depression

Patrick Pössel, Simone Seemann, Stefanie Ahrens, and Martin Hautzinger

University of Tuebingen

Lead author & corresponding address:

Patrick Pössel

Department of Clinical and Physiological Psychology

University of Tuebingen

Christophstr. 2

72072 Tuebingen

Germany

Tel.: +49-7071-2977181; FAX: +49-07071-360205

e-mail: patrick.poessel@uni-tuebingen.de

Abstract

In Dodge's model of "social information processing" depression is the result of a linear sequence of five stages of information processing (Dodge, 1993). These stages follow a person's reaction to situational stimuli, such that each stage of information processing mediates the relationship between earlier and later stages. Because support for the social information processing model of depression has mainly come from retrospective examination of the literature (Dodge, 1993), we conducted a three wave prospective study including 92 adolescents without lifetime or current depression. Depressive symptoms and information processing were assessed by using well established measures employed in previous studies. The social information processing model was supported by cross-sectional results of our study. Based on prospective data we could only partially support the mediation hypotheses of the model. We discuss our unexpected results in light of limitation, including applied measures and sample characteristics.

Keywords: social information processing, depression, adolescents, longitudinal design

Acknowledgements

Testing the causal mediation component of Dodge's social information processing model of social competence and depression

Depressive disorders in adolescence are a widespread problem; a multitude of studies report a lifetime prevalence of 15 to 20% among minors (individuals younger than 18 years old) (Birmaher et al., 1996). Depressive symptoms at young age increase the probability of the development of major depression (e.g., Weissman, et al., 1999) and other psychopathology later in life (Birmaher et al., 1996). Depressive disorders are also accompanied by psychosocial impairments, such as difficulties in school (e.g., lower mean grades, difficulties in relationships with teachers, and siblings; Birmaher et al., 1996). Finally, depressive disorders are often chronic; depression that develops during adolescence tends to persist into adulthood (Harrington, Fudge, Rutter, Pickles & Hill, 1990).

There are a wide range of models that describe the development and maintenance of depression (see Abramson, Alloy & Metalsky, 1989; Beck, 1976); however, very few of these models originated from a developmental psychopathology perspective. One of these models is the "social information processing model," which describes the development and maintenance of both depression and aggression (Dodge, 1993). Although the revised version of the model, developed by Crick and Dodge (1994), may be applied to externalizing disorders, the original version is still used to describe internalizing disorders (see Harrist, Zaia, Bates, Dodge & Pettit, 1997) and was therefore applied in this study.

In the social information processing model, behavior is viewed as the end product of a sequence of information processing steps. This sequence, which is precipitated by a situational stimulus, can be seen as a repeating, conscious or unconscious process in social interaction. The social information processing model comprises five steps. In the first stage, or the *encoding stage*, selective perception detects relevant aspects of the stimulus. For example, depressed

children and adolescents process information with a bias towards aspects that are consistent with a negative self-schema (Beck, 1976). In the second step, *mental representation,* these important aspects are stored in short-term memory. Aspects of a stimulus are encoded in memory according to their significance to the individual, which depends on attribution style as well as other factors (Abramson et al., 1989). In the second stage, depressed adolescents tend to interpret negative stimuli as global and stable.

During the third step, *response accessing*, one or more possible emotional or behavioral reactions are initiated. Each mental representation relates to a series of possible reactions, such as verbalization, physical activity, endocrine secretion, arousal of the autonomic systems, and affective changes.

In the next stage, *response evaluation & selection,* the individual evaluates the prepared reactions on the basis of moral values, acceptability, and/or anticipated consequences. Depressed adolescents may decide that social withdrawal is the least negative response. If one of the prepared reactions fit the evaluation criteria, it will be initiated in the final step called *enactment*. According to Dodge (1993), action can be defined as verbalization, motor activity, autonomic activity, and other responses.

Although presented separately above, these information processing steps occur simultaneously. Thus, children encode new information while they select responses for and react to earlier stimuli. The pathway from a stimulus to the corresponding behavioral response, however, is hypothesized to occur linearly in time, and the processing steps for each stimulus should follow a specific, sequential order (Crick & Dodge, 1994; Dodge, 1993; Figure 1). The social information processing model may therefore be best described as a mediational model in which each stage mediates the relationship between processing in the preceding and subsequent stages.

The mediational model predicts that the processing of individual stimuli in one stage affects input into the next stage. If this hypothesis is correct, the interruption of depressive information processing at a particular stage may have positive short- (e.g., increased social engagement) and long-term (e.g., reduction of depressive symptoms) effects. Crick and Dodge (1994) do not make a causal interpretation of the Dodge (1993) model and do not hypothesize a full mediation model (Crick & Dodge, 1994); however, they do state that a mediational model would be most appropriate for understanding single-stimulus processing. Unfortunately, it is difficult to study single-stimulus processing at each stage, but if this theory correctly describes the phenomenon, a mediational model may be applied to examine the process. In this case, it would not be necessary to study the processing of a single stimulus and would suffice if the output of each stage were known.

Dodge's social information processing model for aggressive behavior among adolescents has been supported by empirical studies (Coie, Cillessen, Dodge, Hubbard, Schwartz, Lemerise & Bateman, 1999); however, the model for adolescent depression is mainly supported by post hoc interpretation of empirical studies. For example, studies that have assessed participants' cognitive schema with the self-referent encoding task paradigm (SRET; Kelvin, Goodyer, Teasdale, Brechin, 1999; Kuiper & Derry, 1982) were used to support the encoding stage of the social information processing model (Dodge, 1993). Studies investigating attributional style (e.g., Garber, Keiley & Martin, 2002; Robinson, Garber & Hilsman, 1995) may be categorized as testing the mental representation stage of the model.

A study from Quiggle, Garber, Panak and Dodge (1992), which was conducted on a general population sample of 220 children aged 9 to 2, indicated that children who scored high (CDI ≥ 13) on depressive symptoms evinced significantly more stimuli that are consistent with a negative self-schema (encoding), showed a more depressed attribution style (mental representation),

accessed (response assessing), and selected (response evaluation & selection) behaviors

consistent with social withdrawal more often than children with low depressive symptoms (CDI $\leq$

12). The enactment stage was not measured in this study because the Social Information

Processing Interview (SIPI), which was tailored to assess depressive information processing, did

not gather information about this stage. A prospective study involved 567 children over a 4-year

period and tested the participants once before the start of each school year, starting with the year

before entrance into kindergarten (Harrist et al., 1997). The children were divided into different

groups based on their play behavior, four of which represented withdrawal behavior and one

control group ($N = 417$). One of the four clinically symptomatic groups represented children rated

by their teachers as depressed ($n = 17$). In this study, however, only aggressive but not depressive

information processing tendencies were examined. The depressed group processed more

aggressive tendencies in the response evaluation and selection stage than the nonsymptomatic

group. In this way, depressed children may not respond well to provocations. Furthermore, boys

in the depressed group rated aggressive behavior more positively than boys in the control group.

This study has several shortcomings (e.g., small sample size, only aggressive behavior measured,

not all model stages examined) which limit the interpretation of the findings.

The current study was planned to test all stages of Dodge's model, the mediation hypothesis

in a projective design, and provided a replication of the Quiggle et al. (1992) study, with a focus

on the social information processing of "depressed children". It was hypothesized that the results

of the Quiggle et al. (1992) study would be replicated. Further, mediational hypotheses predict

that each stage of the information processing would mediate the relationship between its

preceding and subsequent stages and, finally, the experience of depressive symptoms.

Methods

Sample

Adolescents ($N = 100$) were randomly selected from a sample of 302 middle school students, aged 13 to 15 years old ($M = 13.58$; $SD = 0.56$), who attended public ($n=11$) or private ($n=1$) schools in a rural area of southwest Germany. Although data on social-economic status of the students is not available, a wide range of social classes is likely to be represented because students from schools in economically derived regions of the area. All participants took part in three testing periods at 2-month intervals. Adolescents with an elevated scores on the *Depression-Screening Questionnaire* (DSQ; Wittchen & Perkonigg, 1997), which indicates the presence of a current major depression diagnosis (Diagnostic and Statistics Manual, 4th Edition [DSM-IV], 1994), were excluded from the analyses. Due to ethical reasons, these adolescents were offered treatment.

Because the data from 8 participants were lost due to technical difficulties, analyses were conducted on the remaining sample of 92 participants (38 girls, 54 boys), which represents an acceptable sample size for mediational models (MacKinnon, Lockwood, Hoffman, West & Sheets, 2002). A median split was performed on self-reported depression to divide participants into a nondepressed and a depressed group ($Md = 0.50$) and to allow for between-groups testing.

Instruments

The *Self-report Questionnaire – Depression* (SBB-DES) is an instrument developed for children and adolescents to measure the severity of the symptoms of major depression and dysthymia according to the DSM-IV and ICD-10 criteria (Döpfner & Lehmkuhl, 2000). The SBB-DES consists of 26 items, each on a 4-point Likert scale, with higher numbers indicating higher depression. The summary score represents the mean of the items and has a possible range from 0 to 3. Internal consistency in this sample was $\alpha = 0.91$ (Cronbach's Alpha), and 4-month test-retest reliability reached $r = 0.53$.

According to a SBB-DES sum calculated for the current sample, all participants with SBB-DES scores of $\geq$ 1.23 (10% of our sample) were considered "clinically relevant." Participants with scores ranging from 0.51 to 1.22 were assigned to the depressed group and those with a value $\leq$ 0.50 were placed in the nondepressed group.

Stages of social information processing. The computerized version of the self-referent encoding task paradigm (SRET; Kelvin et al., 1999; Kuiper & Derry, 1982) and the word lists established by Maes et al. (1998) were used in the encoding stage analyses. The word lists, which consisted of 50 positive and negative adjectives and were comparable on emotional valence, meaning and fluency, were distributed to the participants. The emotional valence and meaning were assessed using the precedents established in the Maes et al. (1998) study. Fluency was established during a pilot study, such that only words typically used by German adolescents between 13 and 17 were included in the study. During the SRET session, participants were instructed to indicate whether the respective adjective applied to them ("yes") or not ("no"). Next, participants' ability to recall the adjectives was tested. Yes-rated generated as well as yes-rated and recalled adjectives were combined into separate proportions for positive and negative adjectives (e.g., number of yes-rated and recalled adjectives divided by number of generated yes-rated adjectives; Kuiper & Derry, 1982). These proportions have a range of 0 to 1 and represent the percentage of correctly recalled adjectives for positive and negative adjectives, respectively. A higher proportion of positive adjectives indicate more positive self-schema (*encoding*) while a higher proportion of negative adjectives indicates more negative self-schema.

At the end of the SRET, the participants listened to three minutes of the song "Taschenrechner" from the German rock band, Kraftwerk, in order to restore a neutral mood.

In order to measure the mental representation stage, the participants completed the German version of the Automatic Thoughts Questionnaire-Revised (ATQ-R; Kendall, Howard & Hays,

1989; Pössel, Seemann & Hautzinger, 2004). The English-language version of the questionnaire, which was developed for adults, has been used with adolescents ages 12 and older (e.g., Garber & Hilsman, 1992). The ATQ-R includes the subscales "negative self-statements" (12 items), "well-being" (5 items), and "self-confidence" (4 items) and consists of 21, 4-point items. A higher summary score in the subscale "negative self-statements" indicate more negative automatic thoughts, whereas higher scores in the subscales "well-being" and "self-confidence" indicate more positive automatic thoughts. In this sample, internal consistency ranged from 0.75 to 0.86 (Cronbach's Alpha), and 4-month test-retest reliability ranged from $r = 0.41$ to 0.57.

The *response accessing* stage was measured using the Stress Processing Questionnaire for Children and Adolescents (Stressverarbeitungsfragebogen von Janke und Erdmann angepasst für Kinder und Jugendliche; SVF-KJ; Hampel, Petermann, & Dickow, 2001). The SVF-KJ consists of 36 items regarding coping with a difficult/stressful situation with peers and in school. High scores on a 5-point Likert scale indicate a lack of coping strategies and therefore higher levels of stress. The items are defined in terms of positive (20 items) and negative (16 items) coping strategies. In the current sample, internal consistency reached $\alpha = 0.91$ for positive coping strategies and $\alpha = 0.93$ for negative coping strategies (Cronbach's Alpha). 4-month test-retest reliability coefficients for positive and negative coping were $r = 0.59$ and $r = 0.67$, respectively.

The *response evaluation and selection* stage was measured using a revised form of the Hopelessness Scale (H-R Scale; Beck, Weissman, Lester & Trexler, 1974; Krampen, 1994). The 20-item scale has been evaluated for youth ages 13 and older and has been previously used to assess the response evaluation stage (see Dodge, 1993). Unlike the dichotomous English H-R Scale version the answer format of the German HR Scale is on a 6-point Likert scale on which higher scores indicate greater hopelessness. Given the increased response range, the German scale tends not to have a skewed distribution when used in nonclinical populations and is thus

ideal for use with a general population (Krampen, 1994). In the current sample, internal

consistency was $\alpha = 0.62$ (Cronbach's Alpha), and 4-month test-retest reliability reached $r =$

0.56.

The *enactment stage* was measured using the Social Withdrawal scale of the Youth Self-

Report (Achenbach, 1991; Arbeitsgruppe Deutsche Child Behavior Checklist, 1998). This 7-item

measure (3-point Likert scale) collects information on the social withdrawal that is typical among

depressed adolescents. Higher scores indicate more withdrawal behavior. In the current sample,

internal consistency reached $\alpha = 0.65$ (Cronbach's Alpha), and 4-month test-retest reliability was

$r = 0.43$.

Mood induction. A visual analogue scale (Visuell-Analog Skala; VAS) determined whether

the mood induction during the SRET was successful. Using this measure, the participants

reported their level of sadness, happiness, anger, and anxiety (Kelvin et al., 1999).

Procedure

Letters requesting participation in a depression prevention project for adolescents were sent to

the principals of the middle schools in the greater Tuebingen area (southwest Germany). Next,

consent forms were sent to all parents of the eighth-graders at the participating schools. Of the

qualifying adolescents ($N = 302$), 100 were randomly selected to participate in the current study.

The questionnaires were distributed and completed in classrooms during the normal school day,

and the SRET was conducted in individual computer sessions in our lab at the university.

Individual sessions began with detailed information regarding study procedures and obtaining

informed consent. Participants completed the first VAS to establish their baseline mood. Next

step was a mood induction (dysphoric mood) procedure (Kelvin, Goodyer, Teasdale, Brechin,

1999). Participants listened to a 3-minute segment of Prokofiev's "Alexander Nevsky-Russia

under The Mongolian Yoke," and were then asked to recall a situation in their lives in which they

were sad. Participants then completed another VAS and the SRET. Finally, to dissipate the

depressive mood, participants were instructed to focus on a recently occurring pleasant situation

and listened to three minutes of Kraftwerk's "Taschenrechner."

This procedure was repeated with participants at three individual meetings conducted at 2-

month intervals.

Data Analysis

For the measures that assessed both positive and negative elements (i.e., SRET, ATQ, SVF-

KJ), a "state of mind"[1] proportion was calculated (Schwarz & Garamoni, 1986). Higher state of

mind proportions reflected more positive than negative responses on the questionnaires and vice

versa. For example, more yes-rated and remembered positive adjectives and fewer yes-rated and

remembered negative adjectives, produced a higher is the state of mind proportion for the SRET.

This procedure allowed the mediational hypothesis to be tested by using one variable for each

stage of the model of Dodge (1993).

As recommended by Quiggle et al. (1992), participants were divided into high- and low-

depressive groups using a median split. Next, multiple independent-samples *t* tests were

conducted to examine whether the groups differed on social information processing variables.

Effect sizes were calculated using Hedges's *g* (i.e., mean of one group - mean of the other group,

divided by pooled standard deviation of both groups; Cohen, 1988). Effect sizes are displayed as

positive values when in agreement with the hypotheses and as negative values when not in

agreement.

Crick and Dodge (1994) suggested analyzing the linkages among the social information

processing stages, and thus, the mediation hypotheses were tested using several steps, each

involving three successive variables, in multiple regression analyses. The first series of regression

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[1] SOM = pos./(pos. + neg.)

analyses were conducted using the earliest stage of the information processing as the independent variable, the variable measuring the next stage as the mediator variable, and the variable measuring the last stage, as well as depressive symptoms, as the dependent variable (see Figure 2a). This process was repeated with all four stages of the social information processing model. Thus, each stage of the model could be tested as a potential mediator of the relationship between former and latter variables.

In the next step, the effect of the independent variable on its respective dependent variable was tested. Then, the effect of the independent variable was tested on the hypothesized mediator variable, and finally, the effect of the mediator on the dependent variable was tested. These analyses were repeated for the variables on all information processing levels. Finally, the number of mediators of each test was increased from one to four in order to a test the full mediation model with the variables of all stages.

During this stepwise testing, only the stages considered to be potential mediators (i.e., variables that were significantly predicted by their respective independent variables) were included in the regression analyses. This procedure follows and expands the practice suggested by Baron and Kenny (1986) and has been previously used by Gibb et al. (2001). According to the 3-wave procedure suggested by Cole and Maxwell (2003), the data at time 1 define the independent variable, the data at time 2 define the mediator variable(s) and the data at time 3 define the dependent variable (Figure 2b).

According to MacKinnon et al. (2002), a mediation effect would occur if the relationship between the IV and the DV via the mediator variable was significant[2]. Furthermore, Baron and Kenny (1986) as well as Gibb et al. (2001) expect that the addition of the mediator variable should reduce the significance of the DV effect on the IV. If the regression of the DV on the IV

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[2] $z' = B_{IVMV}B_{MVDV}/\text{square root } (B_{IVMV}^2 SEB_{MVDV}^2 + B_{MVDV}^2 SEB_{IVMV}^2)$

remains significant despite a reduction in the strength of the relationship, there is evidence of partial mediation. If the strength of the relationship is no longer significant, there is evidence of full mediation (Baron & Kenny, 1986). Following Hankin, Abramson, Miller and Haeffel (2004) controlling for prior values of dependent variables is often too conservative while testing a mediational model. Furthermore, it is not necessary to calculate predictive validity (Murphy & Davidshofer, 1998; Walsh & Nancy, 2001).

Analyses were carried out using the software package "SPSS for Windows 11".

<div align="center">Results</div>

According to their scores on the SBB-DES, participants were divided at the median into a depressed and a nondepressed group. The groups were significantly different in the predicted direction, such that the nondepressed group had significantly lower depression scores ($M = 0.28$, $SD = 0.32$) than the depressed group ($M = 1.01$, $SD = .53$; $t(82) = - 7.52$, $p \leq .001$). The groups did not differ on age ($p = 0.23$) or gender distribution ($p = .348$).

Information processing among depressed and nondepressed adolescents

The groups did not differ significantly at encoding stage of the information processing model (see Table 1 for descriptive statistics and results). However, depressed participants evinced lower proportion of positive to negative automatic thoughts than nondepressed participants, which supported the hypothesis that depressed participants would evince a more negative *mental representation* than nondepressed participants. Furthermore, they named fewer proportion of possible positive to negative responses than nondepressed participants (*response accessing*). Depressed participants were also more hopeless and evinced more withdrawal behaviors than nondepressed participants during the enactment stage.

Test of the Mood Induction

The mood induction component during the "self-referent encoding task" (SRET) resulted in feeling sadder following the dysphoric mood induction (baseline: $M = 11.92$, $SD = 24.06$; mood induction: $M = 61.98$, $SD = 44.84$; $t(91) = -13.20$, $p \leq .001$), feeling less happy (baseline: $M = 81.73$, $SD = 32.21$; mood induction: $M = 51.77$, $SD = 40.78$; $t(91) = 7.57$, $p \leq .001$), feeling more angry (baseline: $M = 8.64$, $SD = 17.55$; mood induction: $M = 24.73$, $SD = 32.64$; $t(91) = -5.12$, $p \leq .001$), and feeling more anxious (baseline: $M = 13.25$, $SD = 22.43$; mood induction: $M = 23.71$, $SD = 32.40$; $t(91) = 3.21$, $p = .006$) than before the mood induction.

Test of the Mediation Hypothesis

As described above, the test of the mediation hypothesis consisted of a series of regression analyses for 3 time points occurring at 2-month intervals (see Table 2 for mediation test results). The first regression analysis tested the potential mediation effect of mental representation at time 2 on the relationship between encoding at time 1 and response accessing at time 3. Because these analyses showed a nonsignificant relationship between encoding and response accessing, the first criterion for mediation was not fulfilled, and no further regression analyses were conducted on these variables.

The second regression analysis tested the hypothesis that response accessing at time 2 would mediate the relationship between mental representation at time 1 and response evaluation and selection at time 3. Analyses indicated that a more negative proportion of automatic thoughts during the mental representation stage was associated with a more negative proportion of possible responses at the response accessing stage. Furthermore, a more negative response accessing stage was associated with more hopelessness at response evaluation and selection stage; however, response representation did not have a significant effect on hopelessness at response evaluation and selection stage. Therefore, mediation analyses could not be conducted.

The third set of regression analyses tested the mediational effect of response evaluation and selection at time 2 on the relationship between response accessing at time 1 and enactment at time 3. Analyses indicated that a more negative proportion of possible responses at the response accessing stage was associated with more hopelessness at response evaluation and selection stage and more social withdrawal at the enactment stage (Figure 3a). The association between response accessing and enactment was reduced to nonsignificance when hopelessness at the response evaluation and selection stage was added to the model on the second step. Furthermore, the relationship between response accessing stage and enactment stage via response evaluation and selection stage was significant, $z = -3.10$; $p < .001$ (Figure 3b). These analyses indicated that hopelessness at the response evaluation and selection stage fully mediated the relationship between possible responses in long-term memory at the time 1 response accessing stage and withdrawal behavior at the time 3 enactment stage. Although a higher negative proportion of possible responses at response accessing were associated with more withdrawal behavior at the enactment stage, mediation analyses indicated that the response evaluation and selection stage is the mechanism by which response accessing predicts enactment.

The next analysis tested the mediating effect of enactment at time 2 on the relationship between response evaluation and selection at time 1 and depressive symptoms at time 3. Response evaluation and selection as well as enactment had a significant effect on depressive symptoms. There was, however, no significant effect of hopelessness at response evaluation and selection on withdrawal behavior at enactment stage. Thus, in spite of the reduction of the effect of the response evaluation and selection on depressive symptoms following the addition of enactment to the model, no mediational effect could be confirmed.

The next set of analyses tested the hypothesized mediation of mental representation at time 2 and response accessing at time 2 of the relationship between encoding at time 1 and response

evaluation and selection at time 3. Because there was no significant effect of encoding on response evaluation and selection the model did not meet required criteria for mediation and, consequently, was not tested further.

The sixth set of mediation analyses showed no effect of mental representation at time 1 on enactment at time 3 and thus, these variables were not tested further. The test of a mediation effect of response evaluation and selection as well as enactment at time 2 on the relationship between response accessing at time 1 and depressive symptoms at time 3 showed that a more negative proportion of possible responses at response accessing stage and more withdrawal behavior at enactment stage were associated with more depressive symptoms, but the nonsignificant effect of hopelessness at response evaluation and selection on depressive symptoms indicated there was no mediating effect of hopelessness on these relationships. When withdrawal behavior at enactment stage was added to the second step of the regression analysis of depressive symptoms on response accessing stage the relationship between the latter was reduced to nonsignificance but the association of enactment stage on depressive symptoms was remained significant. Furthermore, the relationship between response accessing stage and depressive symptoms via enactment stage was significant ($z = -2.42$; $p = .008$). Thus, the relationship of response accessing and depressive symptoms was fully mediated by enactment.

The test of the mediation of encoding at time 1 on enactment at time 3 by mental representation, response accessing, and response evaluation and selection at time 2 resulted in a nonsignificant relationship between encoding and enactment. Thus, no further tests could be conducted and mediation was not found for these variables. The test of mediation for response accessing at time 2 on the relationship between mental representation at time 1 and depressive symptoms at time 3 showed that a more negative proportion of automatic thoughts at the mental representation stage and a more negative proportion of possible responses at the response

accessing stage were associated with more depressive symptoms. The association between mental representation stage and depressive symptoms following the addition of response accessing into the model reduced the effect to nonsignificance, which indicated that response accessing fully mediated the relation between mental representation and depressive symptoms. Furthermore, the relationship between mental representation and depressive symptoms via response accessing was significant ($z = -3.10$; $p < .001$).

Finally, encoding at time 1 was not significantly associated with depressive symptoms at time 3, thus the model could not be fully supported within this sample.

Discussion

According to the social information processing model (Dodge, 1993), each stimulus is linearly and sequentially processed over 5 stages before behavioral action can be observed (Crick & Dodge, 1994; Dodge, 1993). In the current study, the social information processing model was conceptualized as a mediational model in which each stage of the model would mediate the relationship between the preceding and subsequent stages.

In order to test this hypothesis, a prospective study with three waves of assessment was conducted. All procedures in the current study had been established in previous studies and were used to investigate the social information processing model by Dodge (1993). It was hypothesized that the mediational model employed in this study would provide support for the social information processing model.

In a cross-sectional study from Quiggle et al. (1992), which employed the SIPI, a measure to assess the stages of social information processing, nondepressed and depressed adolescents differed on all stages of social information processing. The current study used a different method of data collection; however, with the exception of the encoding stage, it did not corroborate the previous proposals.

During a dysphoric mood induction during SRET (Kuiper & Derry, 1982), participants reported an increase in sadness, anxiety and anger and a reduction in pleasant emotions. These findings are similar to those previously found in tests with 14 year-old adolescents (Kelvin et al., 1999), possibly because children and adolescents may experience depression and negative arousal concurrently. In fact, Williams, Connolly and Segal (2001) found a strong positive relationship between self-reported anger and sadness among 16 to 20 year-olds. Taken together, these findings may indicate that adolescents experience negative emotions differently from adults. However, it is unclear whether adolescents have difficulty differentiating between anger and sadness or whether they truly experience both at the same time (Williams et al., 2001).

Results from the prospective study partially support the mediation hypothesis. Unfortunately, expected relationships between the encoding stage (SRET) and other stages of information processing and depressive symptoms could be not replicated. Moreover, the effects of the mental representation stage on depressive symptoms were not mediated by response evaluation and selection or enactment. Finally, response evaluation and selection had direct effects on depressive symptoms without being mediated by enactment (social withdrawal behavior).

This study employed the methods used by Dodge (1993) rather than those used by Quiggle et al. (1992) to measure depressive information processing. One important difference between the SIPI method used by Quiggle et al. (1992) and the method employed in this study is that the information processing in the former data collection was situation specific, which is an important part of the model developed by Dodge. Therefore, discrepancies between the findings and the hypotheses may have been due to a lack of situation specificity in the questionnaires used in the current study. Another limitation is that there is no information about the validity of the measures used to access the model stages. Furthermore, in the current study, the stimuli processing style at each stage was measured globally rather than focusing on single stimuli. Although this procedure

is tenable and should provide similar information regarding processing style as the single-stimuli method, discrepancies may exist.

Another explanation for our unexpected findings may be due to sample characteristics. Our study involved adolescents with no lifetime or current diagnosis of major depression. It could be possible that self-schema measured by SRET is different between adolescents with current or past diagnoses of major depression and normal adolescents, but not in adolescents without clinically relevant psychopathology. The literature provides mixed support for such an explanation. In one study, adolescents with high and low depression scores differed in their ability to recall positive or negative self-related adjectives (Zupan et al., 1987). Another study (Kelvin et al., 1999) excluded adolescents with a current or lifetime diagnosis of major depression. The remaining adolescents were divided into two groups according to their affect expression; however, both groups did not differ on encoding information. A further study (Prieto, Cole & Tageson, 1992) was unable to distinguish clinically depressed children and adolescents using SRET encoding from a group of nondepressed children and adolescents receiving treatment for other clinical problems. Future studies may help to determine whether the exclusion of adolescents who may fulfill criteria for a current or lifetime diagnosis of depression may limit the effect of depression on encoding information.

Previous cross-sectional findings have shown support for the social information processing model for depressed adolescents. The prospective design used in this study, however, provided only partial support for the mediation model. The lack of agreement between hypotheses and results in this study's nonclinical sample and the potential lack of validity of the selected measures may have prevented complete support for the hypotheses. Future studies are necessary to enhance the test of the mediation model, perhaps by using a randomly selected sample and a potentially more valid assessement technique (e.g., SIPI).

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Table 1

Descriptive statistics and results for differences between depressed and nondepressed adolescents

measure (stage of the information processing model)	Non-depressed adolescents Mean (SD)	Depressed adolescents Mean (SD)	t-value	df	p	g
SRET (encoding)	.60 (.38)	.56 (.31)	.41	91	.686	.05
ATQ-R (mental representation)	.67 (.10)	.57 (.12)	4.35	91	.001 ***	.91
SVF-KJ (response accessing)	.63 (.15)	.53 (.11)	3.60	91	.001 ***	.77
H-R Scale (response evaluation & selection)	54.85 (13.04)	62.74 (12.50)	- 2.84	91	.006 **	.62
YSR (enactment)	2.13 (1.96)	4.56 (2.46)	- 5.16	91	.001 ***	1.10

Footnote: SRET = self-referent encoding task; ATQ-R Automatic Thoughts Questionnaire-Revised; SVF-KJ = Stress Processing Questionnaire for Children and Adolescents; H-R Scale = revised Hopelessness-Scale; YSR = Youth Self-Report, social withdrawal; g = Hedge's g; * = $p \leq$

Table 2

Hierarchical regressions testing the mediation hypothesis

Independent variable/dependent variable in each regression Analysis	B	SE B	β
Independent stage – mediational stage(s) – dependent stage			
encoding – mental representation – response accessing			
encoding at time 1/response accessing at time 3	.01	.05	.03
mental representation – response accessing – response evaluation & selection			
mental representation at time 1/response accessing at time 2	.38	.11	.36***
mental representation at time 1/response evaluation & selection at time 3	-21.23	11.66	-.20
response accessing at time 2/response evaluation & selection at time 3	-34.69	11.68	-.35**
mental representation at time 1/response evaluation & selection at time 3	-9.51	12.24	-.09

response accessing – response evaluation & selection – enactment			
response accessing at time 1/response evaluation & selection at time 2	-31.99	9.19	-.37***
response accessing at time 1/enactment at time 3	-5.40	2.18	-.27*
response evaluation & selection at time 2/enactment at time 3	.05	.03	.18
response accessing at time 1/enactment at time 3	-4.69	2.62	-.22
response evaluation & selection – enactment – depressive symptoms			
response evaluation & selection at time 1/enactment at time 2	.04	.02	.21
response evaluation & selection at time 1/depressive symptoms at time 3	.01	.01	.31**
enactment at time 2/depressive symptoms at time 3	.07	.03	.30**
response evaluation & selection at time 1/depressive symptoms at time 3	.01	.01	.22*

encoding – mental representation/response accessing – response evaluation & selection			
encoding at time 1/response evaluation & selection at time 3	-4.33	4.60	-.12
Mental representation – response accessing/response evaluation & selection – enactment			
mental representation at time 1/enactment at time 3	-2.58	2.43	-.12
response accessing – response evaluation & selection/enactment – depressive symptoms			
response accessing at time 1/depressive symptoms at time 3	-1.36	.46	-.32**
response evaluation & selection at time 2/depressive symptoms at time 3	.01	.01	.21
response accessing at time 1/depressive symptoms at time 3	-1.00	.55	-.22
response evaluation & selection at time 2/depressive symptoms at time 3	.01	.01	.18
enactment at time 2/depressive symptoms at time 3	.06	.03	.26*
response accessing at time 1/depressive symptoms at time 3	-.70	.55	-.15

table 1 continued

	B	SE B	β
encoding – mental representation/response accessing/response evaluation & selection – enactment			
encoding at time 1/enactment at time 3	-.06	.96	-.01
mental representation – response accessing/response evaluation & selection/enactment – depressive symptoms			
mental representation at time 1/depressive symptoms at time 3	-1.05	.51	-.23*
response accessing at time 2/depressive symptoms at time 3	-1.35	.52	-.31*
mental representation at time 1/depressive symptoms at time 3	-.48	.55	-.11
encoding – mental representation/response accessing/response evaluation & selection/enactment – depressive symptoms			
encoding at time 1/depressive symptoms at time 3	.02	.21	.01

table 1 continued

Footnote: B = unstandardized beta coefficient; SE B = standard error of the unstandardized coefficient; β = standardized beta coefficient;

* = $p \le .05$; ** = $p \le .01$; *** = $p \le .001$

Figure 1:

Illustration of the hypothesized linear and sequential order of social information processing

(Crick & Dodge, 1994; Dodge, 1993).

Figure 2a-b:

(a) Illustration of the mediation model test according to Baron and Kenny (1986), (b) Expansion

on the mediation model according to Gibb et al. (2001).

Figure 3a – b:

Test of the mediation model considering the first link in the model as an example; SVF-KJ as

independent variable, HR as mediator, and YSR as dependent variable.

time 1   time 2   time 3

Mediator Variable

a)

Independent Variable

Dependent Variable

time 1   time 2   time 3

Mediator Variable 1
Mediator Variable 2
Mediator Variable 3
Mediator Variable 4

b)

Independent Variable

Dependent Variable