

Reactive and regulative temperament and non-suicidal self-injury in Flemish adolescents: The intervening role of identity formation



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ABSTRACT

In the present study, we combined temperamental and identity models to investigate the influence of these two constructs on the vulnerability to non-suicidal self-injury (NSSI). We assessed NSSI, reactive [behavior inhibition system (BIS)/behavior activation system (BAS)] and regulatory temperament [effortful control (EC)], and identity synthesis and confusion using self-report questionnaires in 528 high school students (Mean age = 15 years, $SD = 1.84$, 50.4% female). The lifetime prevalence of NSSI was 14.2%. Our findings suggested that the association between BIS and NSSI was moderated by EC, such that higher levels of BIS and lower levels of EC predicted higher lifetime NSSI. Also, the association between BIS and NSSI was partially mediated by identity synthesis. The findings of the current study indicate that interventions that stabilize BIS reactivity, enhance EC, and promote identity synthesis may have important meaningful implications in the clinical management of NSSI.

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1. Introduction

Non-suicidal self-injury (NSSI) is defined as 'the intentional destruction of one's body tissue without suicidal intent' (Nock & Favazza, 2009, p. 9). A review of the international literature has indicated that the lifetime prevalence of NSSI in adolescence is estimated to be around 18% (Muehlenkamp, Claes, Havertape, & Plener, 2012) indicating that NSSI is an important health concern in this age group. Hence, investigating factors that lead to increased susceptibility to NSSI is essential. In the present study, we combined temperamental and identity models to investigate the influence of these two constructs on NSSI. Temperamental theories offer a framework that can integrate biologically-based individual differences with developmental processes, such as identity formation, to explain pathways leading to NSSI. However, an integrated perspective that combines both these constructs has not been tested so far.

2. Temperament, identity, and NSSI: conceptual and empirical associations

2.1. Temperament and NSSI

Temperament is defined as constitutionally-based individual differences in reactivity and regulation in the areas of affect, activity, and attention (Rothbart, Ahadi, & Evans, 2000). In the current study, we used Gray's (1991) Reinforcement Sensitivity theory (RST) to operationalize the reactive component of temperament. The original version of RST identifies three reactive systems: behavioral inhibition system (BIS), behavioral activation system (BAS), and Flight Fight/Flight System (FFS). BIS is responsive to cues of threat and non-reward. Activation of BIS triggers anxiety that may serve to inhibit approach behavior in response to negative consequences. BAS is responsive to cues of reward and non-punishment and its activation triggers approach behavior to rewarding stimuli (Gray, 1991). Finally, the FFS responds to unconditioned aversive stimuli by initiating defensive aggression or escape behavior. The FFS system will not be discussed further as it is not the focus of the current study.

The older version of RST was revised by Gray and McNaughton (2000). In the revised form of RST (rRST), BIS does not function as a punishment system but is conceptualized as a conflict detection and resolution system. BIS activity is experienced as worry, anxiety, or rumination. Further, unlike the original version of RST, the emotions of panic and

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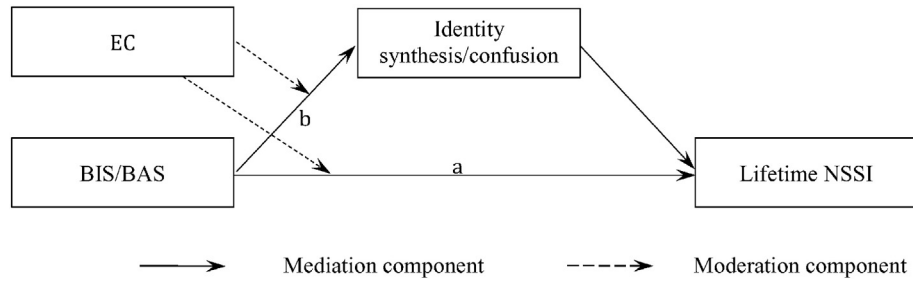


Fig. 1. The moderated mediation model hypothesizing the relationship between Rothbart’s temperament dimensions, identity formation, and lifetime NSSI.

fear were associated with the flight/freezing/fight system (FFFS) and not with BIS. The functioning of BAS was extended to mediate responses to all appetitive stimuli (unconditioned and conditioned). Given that the older version of RST has been more extensively tested using questionnaires than the revised version (Corr, 2016), the present study continues to use the older version.

The regulatory component of temperament was operationalized as effortful control (EC), which is defined as the capacity to modulate the reactivity of BIS and BAS to elicit more adaptive behavioral response (Derryberry & Rothbart, 1997).

Interaction of temperamental reactivity (i.e., BIS and BAS) and regulation (i.e., EC) is known to increase vulnerability to various clinical diagnoses including anxiety, conduct disorder, ADHD, etc. (Nigg, 2006). However, only a handful of studies have explored this interaction with respect to NSSI. For example, in a sample of eating disorder female patients who engaged in NSSI, Claes, Norré, Van Assche, and Bijttebier (2014) observed that besides the main effects of BIS and EC, the interaction between BIS and EC was significantly associated with NSSI. More specifically, higher levels of BIS combined with lower levels of EC was associated with the highest probability of NSSI engagement. Similar results were observed in male eating disorder patients who engaged in NSSI (Claes et al., 2012). These findings are similar to those of Baetens, Claes, Willem, Muehlenkamp, and Bijttebier (2011), who reported that higher levels of BIS combined with lower levels of EC were strongly associated with NSSI in a community sample of adolescents. These findings support the idea that individuals with increased BIS and reduced EC may be more vulnerable to increased distress and they may use NSSI as a means to regulate emotional distress (Claes, Luyckx and Bijttebier, 2014; Claes, Norré, et al., 2014).

2.2. Identity formation and NSSI

Erikson (1968) defines identity as a sense of self, resulting from the integration of past, present, and future experiences. The process of identity formation begins in adolescence. A stable identity or *identity synthesis* is a process of reworking childhood identifications into a larger and self-determined set of ideals, values, and goals (Schwartz, Zamboanga, Wang, & Olthuis, 2009). Identity synthesis can lead to positive self-

image and social relationships. However, the inability to develop a workable set of goals and commitments on which an adult identity can be constructed leads to *identity confusion* (Schwartz et al., 2009). Persistent identity confusion has been associated with both clinical syndromes and personality disorders (Demir, Dereboy, & Dereboy, 2009).

Disturbances in the process of identity formation have been implicated in the development of vulnerability to NSSI. Recent evidence suggests that NSSI may serve as a means to counteract a sense of loss of self (Breen, Lewis, & Sutherland, 2013). Associations between specific identity processes and statuses and NSSI have also been explored to some extent. In high school students, Claes, Luyckx, et al. (2014) found that NSSI was negatively associated with identity synthesis and positively associated with identity confusion. They also reported that identity confusion explained additional variance of NSSI above and beyond depression. Based on these findings, Claes and colleagues suggested that adolescents may engage in NSSI to cope with distress associated with identity confusion. Similar findings were reported by Luyckx, Gandhi, Bijttebier, and Claes (2015) in a sample of female high school students and female clinical population.

2.3. Temperament and identity formation

The influence of temperament on normal developmental processes like identity formation has not been studied as extensively as its role in clinical disorders. However, based on the influence of affective and behavioral outcomes of high BIS/BAS on identity formation some connections can be hypothesized. For example, it can be postulated that high BIS can have a disruptive influence on identity formation by triggering chronic anxiety. Adolescents with chronic anxiety may develop an “overcontrolling” personality which is characterized by resistance to taking decisions that would lead to changes in their lives. Ability to make and endure changes, however, is essential to the process of reworking old identities and forming new ones – i.e. identity synthesis (Crocetti, Klimstra, Keijsers, Hale, & Meeus, 2009). On the other hand, individuals with higher BAS may experience more positive feelings such as hope, elation, and happiness (Carver & White, 1994). Positive affect promotes exploration, enjoyment of new ideas and possibilities, and new ways of looking at things (Isen, 2008) – a process central to

Table 1
Pearson product-moment correlation coefficients of the main study variables.

		1	2	3	4	5	6	7	8
1	Lifetime NSSI	1							
2	Sex	0.18***	1						
3	Age	0.13**	-0.09*	1					
4	BIS	0.28***	0.41***	0.09*	1				
5	BAS	-0.06	-0.10*	0.10*	0.03	1			
6	EC	-0.20***	-0.01	-0.08	-0.24***	-0.19**	1		
7	Identity synthesis	-0.33***	-0.15**	-0.07	-0.31***	0.16***	0.35***	1	
8	Identity confusion	0.31***	0.12**	0.10*	0.42***	0.06	-0.41***	-0.59***	1

* p < .05.
** p < .01.
*** p < .001.

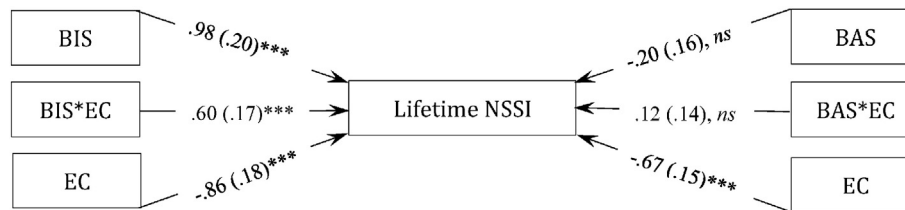


Fig. 2. Standardized coefficients for main effects BIS/BAS, and EC and the interaction between BIS/BAS and EC in the prediction of lifetime NSSI. Numbers between the parentheses are standard errors. (* $p < 0.05$. ** $p < 0.01$. *** $p < 0.001$).²

identity synthesis. Hence, high BAS may have positive influence on identity formation. Finally, high EC may help adolescents to navigate the period of identity crisis as it promotes higher attention to generate solutions, inhibit task-irrelevant thoughts, and persistence of a response in face of anxiety (due to high BIS; Rothbart & Ahadi, 1994). Hence, higher EC can promote identity synthesis and prevent identity confusion. However, as noted earlier, further research is needed to test these theoretical predictions.

2.4. The present study

The brief review of the literature presented above suggests that high temperamental reactivity (BIS, BAS) unregulated by regulatory temperament (EC) can lead to disturbances in identity formation and also increase vulnerability to NSSI. However, disturbances in identity formation have also been associated with NSSI engagement in adolescents. Hence, investigating a model that integrates the combined influence of temperamental factors and identity development on the vulnerability to NSSI seems warranted. Therefore, the present study had two goals. First, we investigated the correlations between BIS, BAS, EC, identity synthesis/confusion, and lifetime NSSI. Second, we integrated the temperament and identity development theories to test a moderated mediation model (Fig. 1). More specifically, we tested if the associations between BIS/BAS and NSSI were mediated by identity synthesis and confusion, and, if so, whether EC moderated the associations between BIS/BAS and lifetime NSSI (a path in Fig. 1) and between BIS/BAS and identity synthesis/confusion (b path in Fig. 1).

3. Method

3.1. Participants and procedure

The data for the current study were collected from high school students from a school located in the Dutch speaking part of Belgium.¹ Out of the total 1115 students in the school, 530 students participated. Two responses had to be excluded because of missing data on the study variables. Consequently, the final sample consisted of 528 students (50.4% female; response rate = 47.35%). The age of the sample ranged from 11 to 19 years (grade 7 to 12), with a mean of 15 years ($SD = 1.84$ years). The majority of the participants were Belgian nationals (95.5%).

The high school students were provided with informed consent forms about 4 weeks prior to the day of data collection. Only students who obtained the signed consent form from their parents were allowed to participate. Data collection was completed during the school hours. Students were provided with an assent form and questionnaires in a sealed envelope. Researchers were present during the process of data collection to answer any questions. Students were asked to hand over the completed questionnaires in sealed envelopes. Contact details of the principal investigator and other mental health services were provided to the students if they wanted help after participating in the survey. All participants were compensated for participation with a movie ticket.

¹ The present data were also used in a manuscript by Gandhi et al. (2015) in which the association between maternal/peer attachment and NSSI was shown to be mediated by identity synthesis/confusion.

The ethics committee of KU Leuven (University of Leuven) approved the research protocol of the study.

3.2. Measures

We assessed NSSI by means of a single-item measure (i.e. “Have you ever injured yourself on purpose without an intent to die?”). Usage of single-item measures is common in NSSI research and often leads to a consistent estimation of prevalence of NSSI (Muehlenkamp et al., 2012).

The temperamental reactivity was assessed by means of the Behavior Inhibition System and Behavior Activation System Scales (BISBAS; Carver & White, 1994). The BISBAS scale consist of 20 items. Each item is scored on a 4-point Likert scale ranging from 1 (*Very true for me*) to 4 (*Very false for me*). The BIS subscale measures punishment sensitivity (sample item: “Criticism or scolding hurts me quite a bit”). The BAS subscale measures sensitivity to reward (sample item: “I go out of my way to get things I want”). In the present study, the Cronbach's alpha for BIS subscale and BAS subscale were 0.81 and 0.73 respectively. The BISBAS scale can also be used to measure BIS (conceptualized as anxiety and FFFS) and BAS as they are defined in the revised version of rRST (for further information, see Corr, 2016).

The Dutch version of Effortful Control Scale from the Adult Temperament Questionnaire (ATQ-SF-EC; Evans & Rothbart, 2007) was used to measure the individual differences in EC (regulative temperament). The ATQ-SF-EC has 19 items and items (sample item: “I am often late for appointments”) are measured on a Likert-type scale ranging from 1 (*not at all applicable*) to 7 (*completely applicable*). In the present study, the Cronbach's alpha for ATQ-SF-EC was 0.77.

Erikson Psychosocial Inventory was used to measure adolescent identity (EPSI; Rosenthal, Gurney, & Moore, 1981). EPSI is a 12 item self-administered scale used to measure identity synthesis (6 items; sample item: “I've got a clear idea of what I want to be”) and confusion (6 items; sample item: “I don't really know who I am”). The items are scored on a 5-point Likert scale ranging from 1 (*Totally disagree*) to 5 (*Totally agree*). In the present study, the Cronbach's alpha for identity synthesis and identity confusion were 0.75 and 0.67 respectively.

3.3. Analyses

All the analyses were performed using SPSS (v23). In order to facilitate comparisons between dependent variables that were measured on different scales, the study variables were standardized. First, associations between all the study variables were tested using Pearson product-moment correlation coefficients.

Next, moderated mediation was performed using a modified version of the piece-meal approach (Edward & Lambert, 2007). In this procedure, we tested the moderated mediation models only if specific parts of the hypothesized models (i.e. moderation and mediation pathways using bootstrap procedure) showed significant results. This procedure allows highlighting significant results from specific pathways even if the overall models do not fit the data.

We first used Model 1 from the PROCESS macro (v2.15; Hayes, 2013) to test if the associations between BIS, BAS, and lifetime NSSI were moderated by EC. Next, we tested if the associations between BIS, BAS, and identity synthesis/confusion were moderated by EC. To correct

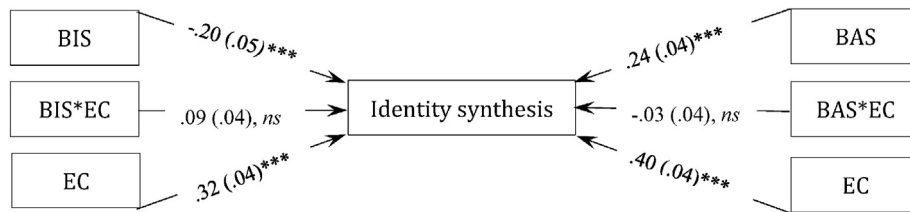


Fig. 3. Standardized coefficients for main effects BIS/BAS, and EC and the interaction between BIS/BAS and EC in the prediction of identity synthesis. Numbers between the parentheses are standard errors. (* $p < 0.05$. ** $p < 0.01$. *** $p < 0.001$).²

for multiple-testing, statistical significance was accepted only after Bonferroni correction. As we tested six separate moderation models, α was set at 0.008 (0.05/6).

In the next step, we used Model 4 from the PROCESS macro to test if associations between temperamental dimensions (BIS and BAS) and lifetime NSSI was mediated by identity synthesis/confusion. The α was set to 0.05 to generate 95% CIs for the indirect effects.

Finally, if the findings of moderation and mediation analyses point to significant results, we investigated a direct effect and first-stage moderation model (Edwards & Lambert, 2007). We used Model 8 from the PROCESS macro to test this hypothesis.

Appropriate probability distribution was used in the regression analyses (i.e., the normal distribution for continuous outcome variables and the binomial distribution for a binary outcome; Agresti, 2013). All the analyses (moderation, mediation, and moderated mediation models) were controlled for age and gender. The number of bias-corrected bootstraps for all the analyses were set to 5000.

4. Results

In our sample of adolescents, lifetime prevalence of NSSI was reported to be 14.2% (females = 10.4% and males = 3.8%; $\chi^2(1) = 18.28$, $p < 0.001$).

The Pearson's product-moment correlations (see Table 1) indicated that lifetime NSSI was positively associated with BIS and identity confusion and negatively associated with effortful control and identity synthesis. BIS was negatively associated with EC and identity synthesis, and positively associated with identity confusion. BAS was negatively associated with EC and positively associated with identity synthesis.

Figs. 2, 3, and 4 (the left panels) indicate the main effects and interactions of BIS and EC on lifetime NSSI, identity synthesis, and confusion. The main effects of BIS and EC, and the interaction between BIS and EC (BIS * EC) were significantly associated with NSSI. Post-hoc probing indicated that the probability of engagement in NSSI was highest for adolescents with high BIS and low EC. Further, although main effects of BIS and EC were significantly associated with identity synthesis and confusion, their interaction (BIS * EC) was not significantly associated with identity synthesis/confusion.

Figs. 2, 3, and 4 (the right panels) indicate that the association between the main effect of BAS and its interaction with EC (BAS * EC) were not significantly associated with NSSI. Further, although main effects of BAS and EC were significantly associated with identity synthesis, their interaction (BAS * EC) was not significantly associated with identity synthesis. Also, only EC was found to be significantly associated with identity confusion, whereas the main effect of BAS and the interaction between BAS and EC (BAS * EC) were not significantly associated with identity confusion. As the main effect of BAS was not significantly associated with NSSI and identity confusion, and the interaction between BAS and EC (BAS * EC) was not significantly associated with NSSI and identity synthesis/confusion, BAS was excluded from further analysis.

As shown in Fig. 5, whereas the indirect effect of BIS on lifetime NSSI via identity synthesis ($B = 0.164$, S.E. = 0.065, 95% CI = [0.060; 0.318]) was found to be significant, the indirect effect via identity confusion ($B = 0.151$, S.E. = 0.094, 95% CI = [-0.039; 0.341]) was not. Given that both the total and direct effects were significant, it can be

concluded that the pathway between BIS and lifetime NSSI was partially mediated by identity synthesis.

As some findings of the moderation analyses were inconsistent with our hypotheses [i.e., the interaction of BAS and EC (BAS * EC) were not significantly associated with NSSI or identity synthesis; and the interaction between BIS and EC (BIS * EC) were not significantly associated with identity synthesis/confusion], the first stage moderation mediation model is not presented.²

5. Discussion

The present study investigated the associations between reactive/regulative temperament, identity formation and vulnerability to NSSI, confirming and expanding the literature in several ways.

In line with previous research, BIS was found to be positively associated with NSSI, and EC was negatively associated with lifetime NSSI (Baetens et al., 2011; Claes, Luyckx, et al., 2014; Claes, Norré, et al., 2014). Further, identity synthesis and confusion were found to be significantly (positive and negative, respectively) related to NSSI (Claes, Luyckx, et al., 2014; Luyckx et al., 2015). Finally, lower scores of BIS and higher scores of BAS and EC were associated with a higher degree of identity synthesis. Also, higher BIS and lower EC scores were associated with a higher degree of identity confusion. These novel findings confirmed our hypotheses regarding the associations between temperamental dimensions and identity formation. The current findings also highlight the need for further exploration of these associations.

The moderation analysis showed that the interaction between BIS and EC was significantly associated with NSSI. More specifically, higher levels of BIS combined with lower levels of EC were associated with a higher probability to engage in NSSI. These findings are similar to the observations made by Claes et al. (2012), Claes, Luyckx, et al. (2014), Claes, Norré, et al. (2014) in eating disorder patients engaging in NSSI and by Baetens et al. (2011) in community adolescents engaging in NSSI.

Results of the mediation analyses indicated that associations between BIS and NSSI was mediated by identity synthesis and not by identity confusion. More specifically, higher levels of BIS may lead to a higher probability to engage in NSSI by partially suppressing identity synthesis. Greater identity synthesis, in turn, was associated with a lower probability to engage in NSSI. The current findings suggest that the lack of identity synthesis, rather than the presence of identity confusion may increase susceptibility to NSSI in adolescence. Although it is not clear why we encountered this discrepancy, these findings do reflect the views of Schwartz et al. (2009) who suggest that synthesis and

² We tested the direct effect and first stage moderated mediation model for BIS but, as expected, no moderated mediation was found for the indirect effects via identity synthesis/confusion. Additionally, we also tested the moderated mediation for the revised version of BIS (rBIS) using the procedure mentioned above. We calculated the FFFS ($\alpha = 0.64$) and anxiety ($\alpha = 0.74$) subscales of rBIS using the factor solution for BISBAS scale suggested by Heym, Ferguson, and Lawrence (2008). Our finding indicated that EC moderated the association between NSSI and FFFS/anxiety and also the association between identity synthesis and FFFS (but not anxiety). Next, we found that pathway between FFFS/anxiety and NSSI was mediated by identity synthesis. Finally, moderated mediation was encountered for the FFFS subscale (via identity synthesis) but not for anxiety. However, these results should be interpreted with caution as the BISBAS scale does not adequately parse the revised version of RST (Corr, 2016). Details of the results are available from the first author upon request.

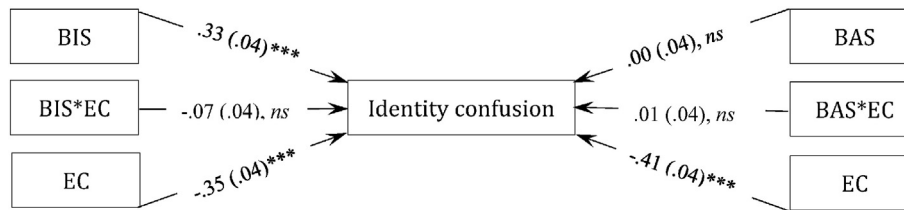


Fig. 4. Standardized coefficients for main effects BIS/BAS, EC and the interaction between BIS/BAS and EC in the prediction of identity confusion. Numbers between the parentheses are standard errors. (* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$).³

³ Moderation models were executed separately but are shown together here only for representational purpose.

confusion function more as independent constructs rather than as two ends of the same continuum, as suggested by Erikson (1968). Findings of this study support the idea that emotional distress secondary to increased BIS and reduced EC may lead to an increase in NSSI as it can help to regulate distress (Claes, Luyckx, et al., 2014; Claes, Norré, et al., 2014). In light of this finding, the lack of any relation between BAS and NSSI is unsurprising as BAS is exclusively represented by positive affect in the BIS/BAS scales (Carver and White, 1994).

Provided that our findings can be replicated longitudinally, our results have potential to inform clinical practice. The current study indicates that interventions that stabilize BIS reactivity, enhance EC, and promote identity synthesis may have important implications in the management of NSSI (Baetens et al., 2011; Claes, Luyckx, et al., 2014; Claes, Norré, et al., 2014). For example, Strauman's self-system therapy (Strauman et al., 2001) can decrease inhibition behaviors (governed by BIS) and hence can be helpful in the treatment of NSSI. Further, innovative techniques like videogames-based interventions (e.g., Braingame Brian; Prins et al., 2013) are likely to be successful in enhancing effortful control or self-regulation. Finally, adventure programs like Actionques (Kaly & Heesacker, 2003), a ship-based program that integrates water-sports and activities that promote ego-identity development, may particularly work well in adolescents in promoting identity synthesis and hence may reduce vulnerability to NSSI.

The present study has some limitations. First, given the cross-sectional design of our study, no claims regarding causal relations between temperament, identity formation, and NSSI can be made. Most significant associations observed in the mediation analysis are expected to be bi-directional. Prospective research is required to replicate our current findings. Second, as mentioned above, although the use of a single Yes/No question to assess lifetime engagement in NSSI leads to consistent estimations of NSSI prevalence (Muehlenkamp et al., 2012), researchers should also investigate if the participants' understanding of NSSI is similar to that of the researchers (Rodham & Hawton, 2009). Use of follow-up interviews or qualitative questions checking participants' understanding of NSSI can help researchers to address this issue. Third, in the present study, the alpha coefficient of the identity confusion sub-scale was marginally less than the conventionally

accepted value (0.70). Although, for scales with six or less than six items, alpha co-efficient values above 0.60 are considered as satisfactory (Peter, 2002), our findings should be still interpreted with caution. Finally, whereas the original RST is more commonly used in personality research, our preliminary analyses (see Footnote 2) indicated that two components of rBIS (fear and anxiety) may also play an important role in development of NSSI through complex developmental mechanisms. Hence, future researchers should consider exploring NSSI from the context of rRST.

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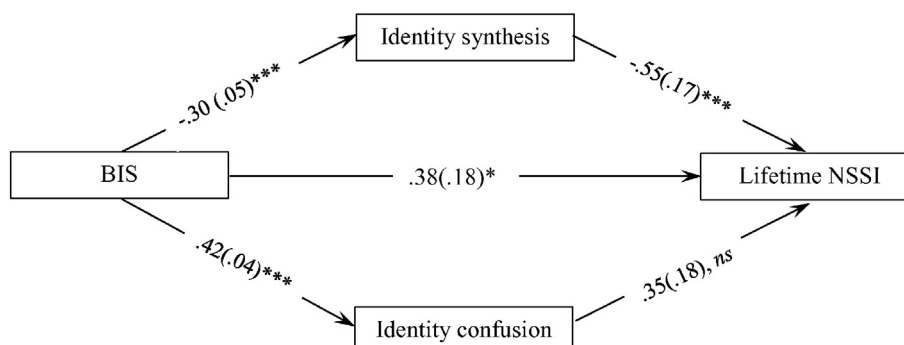


Fig. 5. Standardized coefficients for parallel mediation model between BIS and lifetime NSSI through identity synthesis/confusion. Associations with gender and age are not shown. Numbers between the parentheses are standard errors. (* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$).

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