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Clinical Psychology

Implicit Abandonment Distress: Testing the Dynamic Link Between Schema Activation and Physiological Arousal

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Psychodynamic theory has been criticized as adhering to models of psychopathology that cannot lead to testable predictions and knowledge accumulation. To address this issue, we proposed an account of an implicit memory mechanism (a schema of abandonment) and measured the activation of this latent disposition in two meaningful contexts. Two hundred undergraduates were randomly assigned to either a social rejection or a comparison (non-reject) group, which was more ambiguous in nature. Explicit/implicit schema measures and psychophysiological data were used to test the relationship between schema activation and distress. As hypothesized, only the implicit schema measure was associated with physiological arousal; however, the nature of activation ran counter to our prediction. For participants with strong implicit abandonment schema content, significant arousal occurred in the comparison (non-reject) ambiguous group rather than the social rejection group. The findings demonstrate that: (1) implicit schema processes are indeed implicated in abandonment distress, and (2) situations in which the meaning of an event is more open to interpretation are likely more relevant to how schemas work. Altogether, findings suggest that psychodynamic processes are testable and may help account for distress dynamics, such as attempts to avoid real or imagined abandonment.

Introduction

Although the cognitive revolution has brought mental processes (including implicit processes) back into psychological science, psychodynamic theory continues to be criticized as adhering to models of psychopathology that cannot lead to testable predictions and knowledge accumulation (Hoffart & Johnson, 2017). According to these critics, in a dynamic perspective, measurable indicators of distress and the latent disposition that underlies these symptoms are defined in such a way that they cannot be disentangled from each other. Other scholars have pointed out inaccuracies in such conceptualizations of psychodynamic theory and have argued that unconscious processes can be examined using implicit measures that assess aspects of cognition outside of conscious awareness (Cohen et al., 2018). In line with this perspective (Grünbaum, 1984; Marraffa et al., 2016; McClelland et al., 1989), we conceptualized a latent disposition for abandonment as an implicit relational schema.

Broadly speaking, *schemas* are organized elements of past experiences and reactions that form a relatively cohesive and persistent body of knowledge capable of guiding subsequent perception, appraisal, and action (Segal, 1988). From a functionalist perspective (Armstrong, 1980), schemas can be further characterized as properties of persons to react in certain ways in certain contexts (Fridhandler, 1986; Hoffart, 2018). As noted above, a key challenge inherent in measuring these properties is the fact that some schema elements may operate outside of awareness. For instance, a traditional approach to measuring an "abandonment schema" is the Young Schema Questionnaire (YSQ), a self-report instrument with multiple subscales that asks individuals to determine the degree to which statements are true descriptions of them. Although individuals likely have some awareness of their behavior (e.g., "I tend to get 'clingy' when relationships end"), the YSQ must be tap-

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ping this kind of *explicit* self-knowledge rather than the *implicit* cognitive functions that also influence behavior. Many, therefore, argue that schemas should be measured through projective tests and physiological indicators of information processing rather than self-report (J. Muran et al., 1998; J. C. Muran, 1991; Segal & Shaw, 1986; Welburn et al., 2002).

In order to address these concerns, we proposed a functional decomposition of an abandonment schema involving two facets that could be examined experimentally (Thomas & Sharp, 2019). We conceptualized the first facet of an abandonment schema developed through an individual's history of care and attachment support as a *secure base script* (Waters & Waters, 2006). To assess individual differences in secure base script, Waters and colleagues developed the Attachment Script Assessment (ASA). The ASA uses word-prompt outlines in which participants tell stories with attachment-related themes from a set of words. Secure base script "knowledge" is then defined as the degree to which these narratives reflect an encounter with an attachment-related crisis, a clear communication of need for assistance, the provision of competent help (e.g., support and emotional soothing), and a return to normalcy with resolution of the problem (Steele et al., 2014; Waters & Waters, 2006). McLean, Bailey, and Lumley (2014) examined relationships between the ASA and the YSQ in a sample of undergraduates (N = 146) and found that secure base script scores were negatively associated with three of five Disconnection/Rejection Factor schemas (emotional deprivation, social isolation, and defectiveness) on the YSQ, but showed no association with two others (mistrust/abuse and abandonment). Their results are consistent with the frequent lack of association or equivocal relationship between explicit and implicit measures (e.g., Weinberger & Stoycheva, 2020) and underscore the potential differential validity of these measures as associated with abandonment schema response in meaningful social contexts.

We conceptualized the second facet of an abandonment schema developed through an individual's history of care and attachment support as an implicit memory of *abandonment distress*. This is the phenomenal experience of hopelessness, isolation, despair, and depression associated with past instances of abandonment (Watt & Panksepp, 2009). We assessed abandonment distress in terms of physiological arousal as measured by the skin conductance level (SCL) component of electrodermal activity (EDA). The logic for this operationalization follows from the fact that EDA tracks sympathetic arousal that is linked to autonomic emotional and cognitive processing, and can therefore capture implicit emotional responses that occur without conscious awareness (Braithwaite et al., 2013). More specifically, we used an SCL methodology consistent with other implicit emotion processing studies (see Crone et al., 2004; Hinrichs et al., 2017, 2019) to serve as a sensitive indicator of an implicit memory of abandonment distress that would likely be activated following exposure to a cue that is relevant to abandonment.

Importantly, the salience and strength of abandonment schema activation are likely to change depending on the specific stimuli that are present within various social contexts (Cohen et al., 2018). This means that cross-sectional designs, which have shown theoretically consistent associations between items on the YSQ, personality trait measures, and attachment status (Bach et al., 2015; Bosmans et al., 2010; Mason et al., 2005), actually tell us very little about the *dynamic role* of an abandonment schema in the genesis of distress. Instead, rigorously testing conjectures about abandonment schema activation requires experimental paradigms that vary cues relevant to abandonment, thereby facilitating real-time assessment of responses (e.g., physiology, self-report) to abandonment cues.

In order to implement such a research design, we randomized 200 undergraduates to two groups of a social rejection paradigm used in a prior study on social rejection (Downey & Feldman, 1996). This manipulation was chosen after consulting meta-analyses and reviews of rejection studies (Gerber & Wheeler, 2009; Mishra & Allen, 2023) because it accurately mirrored daily experiences in which a person might feel abandoned and had already been validated as leading to a large effect size difference in self-reported feelings of rejection in the reject versus comparison (non-reject) group (see Materials and Methods section for modifications we made to the overall procedure). Indeed, variations of this manipulation have been used frequently in rejection experiments given its ecological validity and relevance to abandonment psychopathology (Ayduk et al., 2003, 2008; Garris et al., 2011). This research design enabled us to test a counterfactual dependency that followed from our two-facet conceptualization of an abandonment schema: *if* an individual exhibits a less consolidated secure base script, *then* they will be more likely to display pronounced physiological arousal when experiencing an event that is perceived as a social rejection. Our specific hypothesis was formulated from this conceptualization and the literature on explicit and implicit motivation. Since implicit responses are thought to represent a more primitive dispositional system derived from affective experience (versus explicit responses which represent cognitively elaborated constructs, see McClelland et al., 1989), we predicted that physiological arousal (as measured by SCL) would be associated with the implicit ASA secure base script measure, but not with the self-report YSQ abandonment schema items or the broader YSQ Disconnection/Rejection Factor.

Materials and Methods

Participants

The current study's manipulation was based on a prior study on social rejection (Downey & Feldman, 1996). This earlier study found a large interaction effect between the experimental group and rejection sensitivity on self-reported change in feelings of rejection. We used a more conservative estimate of a medium effect in our study, and a power analysis was conducted to determine the necessary sample size (Cohen's f = .25, α = .05, power = .80; total sample size = 128). A sample of 100 per group was chosen based on this analysis and feasibility. A total of 296 participants were subsequently recruited through the subject pool at a

large University; 200 completed both Part I and II of the study to form the final sample. Of the 96 that did not complete the study, 12 were canceled due to logistical problems with lab space and 84 failed to return to complete Part II. Inclusion criteria included agreement through written informed consent to participate in a two-part study and documentation that the participant was over the age of 18.

There were no explicit exclusion criteria for the study. We chose an undergraduate sample without exclusion criteria so that we could assess general abandonment reactions, rather than complicating the picture with a clinical sample. Of course, it is possible that a portion of the participants were struggling with clinical level problems and/or in therapy for these issues. We instituted an involved debriefing process in which safety was assessed, support given, and therapeutic resources provided to mitigate especially strong reactions to the manipulation.

Participants were told that the study aimed to investigate biological markers and social factors that influence the way people construct narratives, and that the researchers were particularly interested in how people form initial impressions of others. Participants were then randomly assigned to one of two groups: a social rejection group and a comparison group. The participants ranged from age 18-39 (mean = 19.00; median = 19.00; standard deviation = 1.81) and 69% identified as female (31% male). In terms of ethnicity, 51% identified as White, 26% Asian, 6% Black or African American, 5% Indian Subcontinent, 2% Pacific Islander, 1% Native American, 4% More than one ethnicity, and 5% Other. The participants' preferred romantic partner gender was assessed to assign a confederate that matched this preference, creating a higher likelihood that participants would develop positive expectations for a second interaction. This was a change to the original study design by Downey and Feldman (which assigned based on opposite sex) that we instituted to reduce the biased effect of heteronormative assumption. We also modified their procedure by having participants complete initial self-report measures (Part I) one week before the rejection manipulation and SCL measurement (Part II) (see Experimental Procedure below). This increased the likelihood that participants would not associate self-report questions in Part I with the manipulation in Part II. 30% identified their preferred romantic partner gender as female, 67% as male, and 3% as other (for these individuals we alternated assigning a female or male confederate). The study was approved by the University's Institutional Review Board and included a detailed description of how care would be taken to explain the nature of the deception (see below) at debriefing.

Experimental Procedure

In Part I of the study, participants came into the psychology building for a 20-minute session during which a research assistant (RA) led them through an informed consent form which described a two-part study on "how people form initial impressions of each other." If the participant consented to the study, the RA guided them through the completion of an online demographic form, Attachment Script Assessment (ASA), and the Young Schema Questionnaire (YSQ) which included the twenty-five items that tap the five Disconnection/Rejection schemas. Several additional instruments were administered but are not included in this paper; descriptions of all aspects of the study not included in this paper are presented in the Supplemental Materials (including results of video coding of rejection response and analysis of projective responses). Participants were then told that they would come to another location on campus within one week for Part II — the social interaction component of the study that would take another 60 minutes. In this session, they would engage in a 10-minute and then a 5-minute interaction. During the former, they would get to know another participant and during the latter they would continue the interaction while connected to an electrodermal activity (EDA) measurement device.

Upon arrival for Part II, the participant was brought by an RA to the assigned study room with a table and two chairs as well as audio/video recording equipment. The RA reminded the participant that since the study was about how people form impressions of each other, they would have two brief sessions during which they would "get to know another participant." The lab RA then told the participant that the other participant would be completing the same tasks but in a different room, prior to each interaction. Two electrodes were connected to the participant's fingers and a baseline EDA measurement was taken for five minutes. After this was completed, the electrodes were disconnected from the EDA device (but electrodes remained taped to the participant's fingers) and the RA had the participant complete an online State Positive and Negative Affect Scale (PANAS-S) questionnaire.

The RA then left the room to retrieve the confederate from the other room. The confederate's fingers were also taped with two electrodes and the confederate was told to act as another participant in the study by conversing in a friendly manner and letting the actual participant lead the conversation. Once the confederate was brought in and seated across from the participant, the RA told them that they would knock on the door once 10 minutes have elapsed. The RA entered the room after this period had elapsed, thanked them for completing the first interaction task, and stated that each of them would now complete a questionnaire on how well the interaction was going (interaction questionnaire). The RA then asked the confederate to follow them to complete the questionnaire in the room they were in originally.

When the RA returned to the participant room, the electrodes taped to the participant's fingers were connected again to the EDA device, and the recording was turned on. The RA then left the room to retrieve the confederate and returned in 2 minutes to state, "I'm sorry but [the confederate] does not want to continue with the second part of the experiment. I'm not sure what to do right now, so I'll need to check with my supervisor regarding what to do next. Please leave your hand still and the equipment connected, and I should be back in a few minutes." In the alternating comparison (non-reject) group, the RA stated, "I'm sorry but there's been a delay and there is not enough time for the second interaction," and then continued with the

same wording as above. In both groups, the RA pressed a key stroke on the computer to mark the moment they began delivering the manipulation. Completing the statement required approximately 20 seconds, after which the RA went to get the supervisor.

The supervisor of the experiment, the lead author of the study (blind to the group), entered the room 5 minutes later and told the participant that he was the study's supervisor and that the participant could still complete the final task. He then disconnected the EDA device and left the room. The RA then returned and administered again the PANAS-S. Once this task was completed, the supervisor returned to the room to conduct a funnel debriefing with the participant (see Supplementary Materials for details of the debriefing procedure). The debriefing form was then presented, describing the confederate's true identity and the nature of the experimental manipulation. The confederate was brought back in and reintroduced to the participant, as the supervisor assured the participant that the confederate had not known which manipulation the RA was going to tell the participant after the interaction. Any remaining concerns were addressed, and the participant was thanked and given subject pool credit for completing the study.

Measures

MANIPULATION CHECK MEASURES

Interaction Questionnaire – This questionnaire was administered after the interaction in Part II and before the experimental manipulation. It consisted of two questions designed to check that the interaction was viewed positively enough to reinforce expectations of a second meeting. The questions were: "Overall, how well do you feel the first interaction period went?" (5-point scale: 1 = Very poorly; 5 = Very well) and "Are you looking forward to meeting the other person again?" (Check box: Yes, No, Indifferent). These questions were identical to a previous study on social rejection that used the same rejection manipulation as the current research (Downey & Feldman, 1996).

Rejection Items – To assess the degree to which the manipulation in the experimental group led participants to feel rejected in contrast to the comparison group, five self-report rejection items (*unaccepted, rejected, hurt, disliked, discouraged*) were mixed into the state PANAS and administered to the participant before and after the manipulation. Items were rated on a 5-point scale (1 = Very slightly or not at all; 5 = Extremely). The rejection items were also identical to those used by Downey and Feldman, however, the delivery of the state PANAS occurred five minutes after the manipulation (rather than immediately after as in the Downey and Feldman study) which likely increased the likelihood that participants could detect and self-report what they were feeling.

State Positive and Negative Affect Scale (PANAS-S) – To disguise the assessment of rejection across experimental and comparison groups, a 31-item PANAS-S was administered before and after the manipulation. The PANAS-S asked participants to indicate to what extent they feel each emotion at this moment. The five rejection items (see manipulation check above) and six low arousal items (three positive: *happy, satisfied, tranquil*, and three negative: *frustrated, down, sad*) were added to the standard 20-item PANAS to create the final measure. Items were rated on a 5-point scale (1 = Very slightly or not at all; 5 = Extremely). The rejection items were analyzed to assess the effectiveness of the manipulation, but the other mood dimensions were not analyzed further in this study. Internal consistency for the rejection items in this study was sound (Cronbach's α = .91).

SCHEMA MEASURES

Young Schema Questionnaire (YSQ) – Five Disconnection/Rejection schemas were measured using an abbreviated (i.e., 25-item) Young Schema Questionnaire. Items are rated on a 6-point scale (1 = Completely untrue of me; 6 = Describes me perfectly). The YSQ is a reliable measure that has demonstrated good internal consistency, good test-retest reliability, and strong construct and discriminant validity (Hoffart et al., 2005; Rijkeboer et al., 2005; Schmidt et al., 1995; Van Vlierberghe et al., 2010). Internal consistencies for the Disconnection/Rejection schemas in this study were sound (Cronbach's α for Abandonment (AB) = .84, Mistrust/Abuse (MA) = .83, Emotional Deprivation (ED) = .71, Social Isolation (SI) = .85, and Defectiveness (DF) = .85; see Supplementary Materials for example questions corresponding to each schema).

Attachment Script Assessment (ASA) – To assess secure base script knowledge, the narrative-based ASA was administered using four word-prompt cards in which participants told stories with attachment-related themes from a set of words. The ASA has demonstrated strong reliability, validity in terms of consistent associations with attachment interview data, and cross-time stability (Vaughn et al., 2006). Narratives were transcribed and coded on a 7-point scale (1 = no secure base script with atypical script content; 7 = rich and detailed secure base script) by five trained coders to measure the degree of secure base knowledge. Inter-reliability for ASA coding was excellent, with an intra-class correlation coefficient (ICC; average measures, absolute agreement) of .93 (Fleiss et al., 1981) (see Supplementary Materials for further details).

DISTRESS MEASURE

Skin Conductance Level (SCL) – To assess changes in physiological arousal, two minutes of recording were taken just before the manipulation and another five minutes post-manipulation. SCL was recorded at a sampling rate of 250 Hz using a Biopac MP150 system with a constant voltage of 0.5 V (Biopac systems Inc., Goleta, CA, USA), two 11-mm inner diameter Ag/AgCl disposable snap pre-gelled electrodes, and additional BioPac GEL100 isotonic electrode gel. Electrodes were attached to the index and middle fingers of the left hand with medical tape, leaving the right hand free for performing tasks. SCL was recorded in a room at 20-21°C and below 50% humidity.

The SCL for each participant during the 5 minutes following the manipulation was normed by subtracting the av-

erage baseline SCL for that participant across the 30 seconds prior to when the research assistant began delivering the manipulation. This method has been used in other studies examining implicit emotion processing (Crone et al., 2004; Hinrichs et al., 2017, 2019). Pre-processing was performed using the Python BioRead package (https://github.com/uwmadison-chm/bioread), and the produced time series were compared to those created using the AcqKnowledge software to ensure similarity. Since regressions examined interactions between SCL and ASA scores, data was mean centered to remove collinearity between predictors and the interaction term (Iacobucci et al., 2016).

Analytic Approach

To assess whether the YSQ schema items or the ASA measure accounted for the change in SCL across the two groups, we first identified the time period when SCL was significantly impacted by the rejection manipulation using a cluster-based permutation-testing approach (Maris & Oostenveld, 2007). SCL was recorded for three hundred seconds (t = 300) and a two-sample t-test assuming equal variances was performed for each second (i.e., 1 Hz). Clusters were defined as uninterrupted time periods where, at each second, the t-test was significant ($p < .05$, two-tailed test). The "mass" of each cluster was defined as the sum of t-values across that time interval. The statistical significance of the "mass" of each cluster was evaluated via permutation-testing which involved pooling every participant's time series and then randomly assigning them to either condition (done 10,000 times). The statistical significance of the cluster identified in the non-permuted data was evaluated by assessing what percentage of permuted datasets yielded a cluster with a larger mass (e.g., 2% corresponds to $p = .02$). This was done while considering either the full [0 s, 300 s] time range or a more restricted time range that considers a more plausible period in which effects could arise: [0 s, 120 s]. This analytic approach accounts for multiple hypothesis testing and the fact that patterns could arise anywhere within the [0 s, 300 s] or [0 s, 120 s] ranges.

The reject/non-reject group effect yielded a significant cluster from [10 s, 52 s]. The mean SCL from this time period was used to evaluate whether an interaction effect of YSQ subscale or ASA score was significant. In total, 55 participants' SCL data were excluded either because they had short or very low voltage due to a technical recording error or because there was an error in marking when the manipulation was delivered. Three participants had no corresponding ASA data, and 1 had no YSQ data. A total of 27 subjects from the non-reject group and 28 subjects from the reject group had missing SCL data, and thus the two groups did not differ substantially in this regard. Note that missing participant data was unrelated to participant behavior in the task, and participants with missing data were excluded entirely from analyses if they had a missing variable.

Given that a significant Shapiro-Wilk test ($W = 0.84$, $p < .001$) indicated non-normality of SCL residuals, we proceeded with a non-parametric permutation test of the beta weight for the interaction of ASA or Schema score by Group (see Table 2).[1] Specifically, the *lmPerm* R package (Wheeler & Torchiano, 2010) was used to fit the following linear model: *SCL ~ 1 + ASA × condition*. This package operates by repeatedly permuting the residuals, which continued until the standard errors of all estimated p-values were 100 times smaller than the p-values themselves (R-syntax: *result_np=lmp(SCR ~ MC_ASA * condition, data=df, maxIter=10000000, Ca=0.01*). Note that the permutation method generates a coefficient estimate and p-value which are reported in the results (it does not generate t or F values). As the analysis used 130 participants, and there were four predictors (including the intercept), there were 126 degrees of freedom. An alpha cutoff of .05 was used for interpretation of the results.

Results

Manipulation Check

Based on the funnel debriefing, 12 participants stated that they did not believe the manipulation, and thus were eliminated from all subsequent analyses. Of the remaining 188 participants, 150 participants showed no signs of detecting the fact that the person they interacted with was a confederate. Thirty-eight participants expressed uncertainty about whether deception was involved but were retained in all subsequent analyses, since there was little evidence that their reaction to the manipulation and responses to PANAS-S rejection items differed substantially from the rest of the sample. In addition, during the funnel debriefing, they did not appear skeptical of the stated purpose of the study and, generally, indicated that they thought the study was designed to measure what was described in the consent form.

Among the 188 participants whose data was used for the following analyses, ratings of how well they thought the interaction had gone ranged from *Neutral* to *Very well* (0% Very poorly, 0% Poorly, 2% Neutral, 44% Fairly well, & 54% Very well). No participant indicated that they were not looking forward to meeting the confederate again (73% indicated that they were looking forward to it and 27% indicated that they were indifferent). The responses to these items did not vary systematically as a function of the group to which a participant was randomly assigned (p-values ⩾ .25). A two-way repeated measures ANOVA indicated a significant Time x Group interaction effect for change

1 Cluster-based permutation-testing was done using parametric t-tests, as is typically done in cluster-based analysis due to computational efficacy. It should be noted that parametric and non-parametric tests will nonetheless yield nearly identical results (Knief & Forstmeier, 2021; Lumley et al., 2002).

Table 1. Participant Characteristics Across Groups

Characteristic & Variable	Reject	Non-Reject	χ^2	*t*	*p*
Gender			0.02		0.90
Female, freq (%)	68 (68.7)	61 (68.5)			
Male, freq (%)	30 (30.3)	28 (31.5)			
Ethnicity			19.37		0.06
White, freq (%)	58 (58.6)	44 (49.4)			
Asian, freq (%)	23 (23.2)	29 (32.6)			
Black or African American, freq (%)	8 (8.1)	5 (5.6)			
Indian Subcontinent, freq (%)	6 (6.1)	5 (5.6)			
Pacific Islander, freq (%)	3 (3.0)	2 (2.2)			
Native American, freq (%)	1 (1.0)	0 (0.0)			
More than one ethnicity, freq (%)	5 (5.1)	2 (2.2)			
Other, freq (%)	8 (8.1)	2 (2.2)			
Relationship status			4.02		0.57
Single, freq (%)	62 (62.6)	58 (65.2)			
Casually dating, freq (%)	19 (19.2)	14 (15.7)			
In a long-term relationship, freq (%)	17 (17.2)	19 (21.3)			
Married, freq (%)	1 (1.0)	0 (0.0)			
Age, mean (*SD*)	19.2 (2.2)	19.0 (1.2)		0.44	0.66
ASA, mean (*SD*)	3.4 (0.5)	3.5 (0.5)		-1.26	0.21
AB Schema, mean (*SD*)	2.5 (1.2)	2.3 (1.1)		0.94	0.35
MA Schema, mean (*SD*)	2.6 (1.2)	2.6 (1.1)		0.35	0.73
ED Schema, mean (*SD*)	1.6 (0.8)	1.5 (0.7)		0.97	0.33
SI Schema, mean (*SD*)	2.4 (1.1)	2.3 (1.1)		0.69	0.49
DF Schema, mean (*SD*)	1.8 (0.9)	1.6 (0.7)		1.49	0.14

Note. ASA = Adult Script Assessment, AB = YSQ Abandonment Schema, MA = YSQ Mistrust/Abuse Schema, ED = Emotional Deprivation Schema, SI = YSQ Social Isolation Schema, and DF = YSQ Defectiveness Schema.

in self-reported rejection (F (1,186) = 16.84, p < .01, η_p = .08, $\mu_{\Delta \text{ rejection}}$ = 2.43, $\mu_{\Delta \text{ non-rejection}}$ = -.07). This led us to conclude that the rejection manipulation was indeed successful and resulted in a medium effect. Table 1 below presents descriptive statistics for participant characteristics across groups (see Supplementary Materials for a correlation matrix of all primary study variables).

The two groups did not differ significantly on any demographic or predictor variable. Although ethnicity was near the nominal cutoff for significance, the difference appears due to the small numbers of participants identifying ethnically as Black or African American, Indian Subcontinent, Pacific Islander, Native American, more than one ethnicity, or other.

Is secure base script associated with the intensity of physiological arousal more so than the AB self-report schema items and the broader Disconnection/Rejection Factor?

We predicted that the ASA would be associated with physiological distress, as measured by SCL, and that the AB self-report schema and the broader YSQ Disconnection/Rejection Factor would not. Figure 1A below depicts the average participant-normed SCL by group. Since the manipulation took approximately 20 seconds to verbally state, the x-axis begins at 0 seconds and the delivery of the manipulation is complete at t = 20 seconds (see dotted vertical line in Figure 1A).

The manipulation elicited significant effects on SCL. Cluster-based analyses showed a broad [10 s, 52 s] time range where the two conditions significantly differed (the total sum of t-values, the "mass," is 128.4). Permutation-testing, which corrected for multiple hypotheses with respect to the full [0 s, 300 s] range, showed that the cluster was significant (p = .02). This test, however, may be overly conservative, and permutation-testing with respect to a shorter [0 s, 120 s] range shows how notable the cluster actually is, as evidenced by a quite small p-value (p = .003).

Consistent with our hypothesis, examining just the mean of SCL across the identified [10 s, 52 s] range shows a significant Group x ASA interaction (b = -.73, p = .03, N = 130), and neither the AB self-report schema nor the broader Disconnection/Rejection Factor were significantly

associated with the difference in SCL across groups (see Table 2 below).[2] Although the non-significant finding for the Group x AB Schema does not prove a lack of association, the fact that the broader Disconnection/Rejection Factor was also not associated with SCL indicates that, even with greater power to detect effects (i.e., reducing variability in sub-scores by using all 25 items), no evidence of association was found. The Group x ASA interaction is depicted in Figure 1B and 1C. The direction of the interaction was opposite to our predictions (Figure 1C). That is, participants in the rejection group (red) showed a large increase in SCL if they had high levels of secure base script knowledge (high ASA), whereas those in the non-rejection comparison group (blue) showed a large increase in SCL if they had low levels of secure base script knowledge (low ASA).

Discussion

The main contribution of the present study was to shed light on the differential utility of *implicit* versus *explicit* schema measures in explaining an implicit measure of distress. An *implicit measure* (i.e., secure base script knowledge as measured using the ASA) was associated with participants' *abandonment distress response* (i.e., physiological arousal) but an explicit AB self-report schema measured using the YSQ and the broader Disconnection/Rejection Factor was not. Participants scoring *low* on secure base script appeared to have a "blunted" physiological response in the social rejection group and displayed a *greater change* in sympathetic response to the *comparison (non-reject) stimulus*.

How can we understand this difference in physiological reactivity? Since EDA is closely linked to autonomic emotional and cognitive processing, it can capture implicit emotional responses that occur without conscious awareness (Braithwaite et al., 2013). Moreover, the SCL component of EDA has been used in previous studies as a methodology to track physiological arousal associated with implicit emotion processing in the body (Crone et al., 2004) and trauma-response (Hinrichs et al., 2017, 2019). Although participants across the board (regardless of ASA score) self-reported feeling more rejected in the rejection group, it was only those with a high degree of secure base script knowledge that had a congruent autonomic-affective response. An intriguing possibility is that low-security ASA participants may have been more likely to expect rejection based on past experience and may have thus been less reactive to social rejection in the moment. This might also explain why they were *more reactive* to the comparison (non-reject) manipulation than those with high-security base script knowledge. In this group, the meaning of the statement "there is not enough time for the second interaction" could result in a wider range of possibilities for interpretation (including that the statement was meant to conceal that the participant was rejected by the confederate). In this sense, the stimulus in the non-rejection comparison group may be more accurately characterized as *ambiguous* as opposed to *non-rejecting*.

Understood within this context, low secure base script individuals may be poised for the possibility of rejection at any moment. The role of the attachment system in regulating arousal has indeed been shown in other studies which measure SCL in response to affectively charged stimuli. For instance, insecure and avoidant adults have been found to display larger skin conductance responses to negative pictures than secure adults (Silva et al., 2015). A significant correlation between avoidant attachment and higher skin conductance variability has been found in a number of studies (Bosmans et al., 2016), and avoidant attachment has also been associated with reduced skin conductance response to positive stimuli (Yee & Shiota, 2015). Physiological attachment reactivity has also been linked to brain activity—for example, the magnitude of bilateral amygdalae activation has been shown to correlate positively with skin conductance response during a stress prime condition (Lemche et al., 2006). Taken together, these findings suggest that different attachment styles are associated with different processes of attention bias, appraisal, and physiological reactivity to emotionally arousing stimuli.

Within the present study, our results extend these findings by showing how expectations may lead to differing response patterns related to degree of attachment security. For instance, a therapeutic scenario illustrating this feature is a situation in which a clinician states that the session will need to come to a close because there is not enough time to talk about a new issue, and the client immediately brings up suicidal ideation from the week (presumably as an attempt to secure the care and attention of a therapist). It is the ambiguous nature of the situation that leads the individual to impose an interpretation that the therapist is abandoning them. This scenario is consistent with the SCL of the low ASA participants (left side on x-axis) in Figure 1. These individuals showed increased emotional arousal in response to an *ambiguous stimulus* (i.e., the non-reject stimulus) as opposed to an instance of *direct threat* (i.e., the rejection stimulus), which was much less ambiguous. This finding would be consistent with the psychodynamic formulation that schema-incongruent threats elicit extended processing to achieve accommodation (Horowitz et al., 1991). While direct applications to the clinical setting have to be viewed with caution given the nature of our sample, future studies might examine role of clinical-level

2 Note that SCL can vary between participants for reasons such as temperature and humidity (Boucsein et al., 2012). In part, this is accounted for by subtracting baseline SCL prior to the manipulation from the five minutes of post-manipulation data. We additionally performed the regression using within-subject z-scoring each participants' data (i.e., standardizing variability). Z-scoring was taken with respect to the distribution of SCL over the five-minute post-manipulation period. When this standardized SCL measure is used as the dependent variable, the pattern of significance is unchanged, and both the effect of Group on SCL remains significant ($b = .53$, $p < .01$) as does the group x ASA interaction ($b = .60$, $p = .03$).

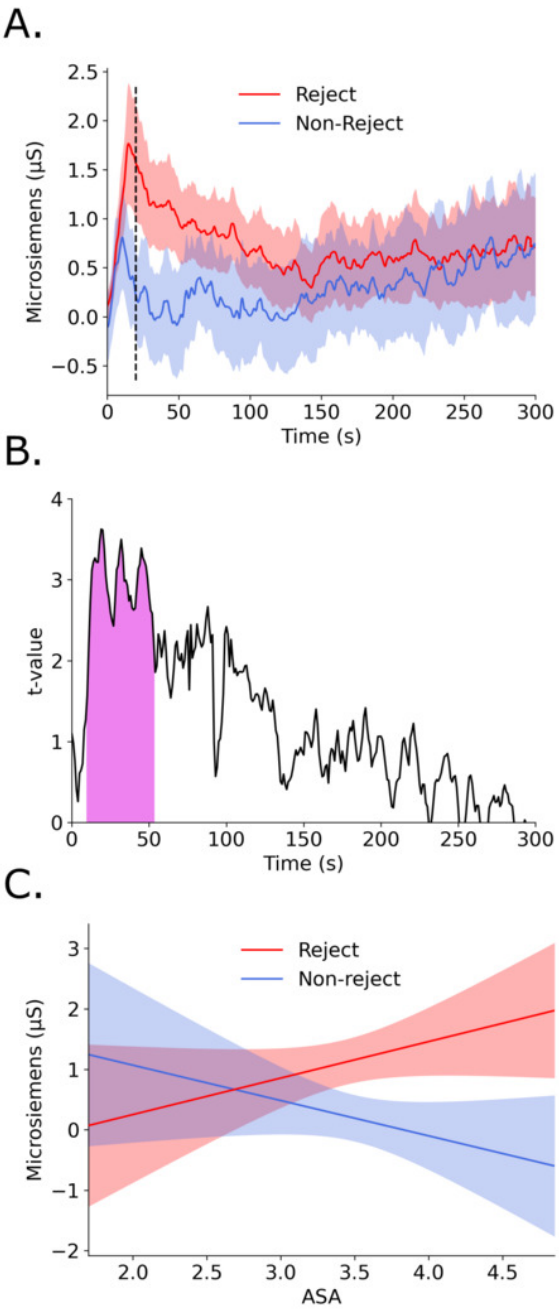

Figure 1. SCL results by Group and the Group x ASA Interaction

Figure 1. A. Change in average SCL for the five minutes following the manipulation by group (dashed line represents when the RA finished their statement). **B.** Visualization of the cluster-based analysis performed to assess the effect of Group on SCL. The t-values each represent a two-sample t-test done at each second comparing the Reject and Non-Reject groups (i.e., 300 tests). The shaded region shows the [10 s, 52 s] continuous interval wherein every second yielded a significant effect ($p < .05$, two-tailed test). **C.** Interaction effect depicting average SCL for the [10 s, 52 s] range with respect to Group and ASA. Shaded regions represent 95% confidence intervals.

Table 2. Full Summary of Non-Parametric Permutation Test for Group, YSQ Schema, ASA, and Group x Schema Interactions with SCL

Variable	*b*
Group	-0.45***
AB Schema	-0.04
Group x AB Schema	0.10
Group	-0.46***
MA Schema	-0.16
Group x MA Schema	-0.14
Group	-0.47***
ED Schema	-0.07
Group x ED Schema	0.18
Group	-0.46***
SI Schema	-0.13
Group x SI Schema	0.05
Group	-0.45***
DF Schema	-0.06
Group x DF Schema	0.10
Group	-0.49***
Dis./Rej. Factor	-0.04
Group x Dis./Rej. Factor	0.01
Group	-0.58***
ASA	-0.01
Group x ASA	-0.73*

Note. For each regression, the schema score variable was mean-centered. AB = YSQ Abandonment Schema, MA = YSQ Mistrust/Abuse Schema, ED = Emotional Deprivation Schema, SI = YSQ Social Isolation Schema, and DF = YSQ Defectiveness Schema. Dis./Rej. Factor = Disconnection/Rejection Factor (sum of the five schema scores). * $p < .05$. ** $p < .01$ *** $p < .001$.

pathologies or experience of psychotherapy on rejection response in line with this perspective.

Given the findings in this study, it appears that situations in which the meaning of a relational event is more open to interpretation may be highly relevant to how schemas work. It may be that these are the very situations in which "consistency" is maintained and memory supplies an interpretation of reality that differs significantly between those high and low on the schema. Furthermore, the fact that the ASA was associated with SCL, but the YSQ AB schema was not, suggests that implicit associations can become dissociated from explicit self-knowledge. Specifically, self-report measures and implicit motives have been shown to operate differently; the former are associated with immediate responses to structured situations based on social incentives and the latter are associated with primitive motivations derived from affective experience (McClelland et al., 1989). In the present context, the ASA (because it is not a self-report measure tapping explicit self-knowledge) may instead be capturing an aspect of past experience (secure base script) that corresponds more closely to the activation of emotional distress associated with past abandonment. This would explain why the ASA, but not the AB schema nor the broader Disconnection/Rejection factor, was found to be associated with SCL response. Alternatively, it may be that the self-report items from the YSQ are tapping socially desirable responses or content that is too general to track real-time physiological responses in an interpersonal context. Taken together, the findings in this study indicate that: (1) implicit and explicit schema measures have different associations with physiological response in inter-

personally salient contexts, and (2) situations in which the meaning of an event is more open to interpretation are likely relevant to how schemas work.

There were several strengths and limitations to the current study. The use of both *implicit* and *explicit* schema measures provided a robust means of assessing our hypothesis. Furthermore, since participants were randomized to the social rejection and comparison (non-reject) group, predictions could be tested regarding the nature of the response to each manipulation. Although we reached the goal for overall sample size based on an a priori power analysis, the number of participants with usable EDA data was smaller than expected. In addition, although we excluded participants who stated that they did not believe the manipulation, a possible confound is that they did detect false behavior subconsciously and reacted differently based on this assessment. Finally, although the use of a non-clinical undergraduate sample was a useful starting point for investigating abandonment schema activation, generalization to populations with significant psychopathology requires future work. Specifically, cultural and social context (including generational effects) play a substantial role in the processing of interpersonal phenomena such as rejection. It will be important to explore how social media, peer dynamics, and socialization norms may alter the way that feelings of abandonment are coped with and expressed among varying cohorts and cultural groups. Furthermore, the fact that we did not exclude participants based on history of psychopathology or prior experience of therapy may have led to an overly heterogenous sample and is a limitation. For instance, participants with significant trauma histories may have had stronger reactions to the manipulation compared to their peers. Generalization of the present findings should therefore be taken with caution and requires replication among more specific and diverse samples.

Conclusion

This study showcases a dynamic approach to studying schema activation by bridging psychophysiology with the cognitive and affective components of representational processes. The novelty of the present empirical approach rests on the elucidation of the dynamic effect of schema activation in meaningful social situations. Our findings indicate that schema activation may be more likely to occur in ambiguous relational contexts in which an individual must impose meaning to maintain intelligibility. Overall, these findings have relevance for understanding the etiology of certain forms of psychopathology (e.g., borderline features) and for therapeutic approaches that aim to address the underlying processes that maintain symptomatology.

Contributions

Contributed to conception and original study design: JGT, HB

Contributed to final study design and implementation of EDA data acquisition: FD, YK

Contributed to analysis, interpretation of EDA data, and writing of EDA methods section: PCB

Drafted all other sections of the article: JGT

Revised the article: HB, FD, PCB, YK

Approved the submitted version for publication: JGT, PCB, YK, FD, HB

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Competing Interests

The author(s) declared that there were no conflicts of interest with respect to the authorship or the publication of this article.

Data Accessibility Statement

The data that support the findings of this study are openly available in Open Science Framework at https://osf.io/fvg3x/.

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