General psychopathology and its social correlates in the daily lives of youth

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RA was responsible for writing the original draft of the manuscript and subsequent revisions following co-author reviews; RA was also responsible for conceptualizing and performing the data analyses. OJK, MS and IMG were involved in critical review and editing, and supervision of all parts of writing and analysis. All other co-authors (NH, KSFM, APH, AL, JD, CD, MDH, SG, NJ, CML, BPFR, ET, JvO, RvO, MW) were also involved in critical review and editing. JD, CD, MDH, NJ, CML, BPFR, ET, JvO, RvO, MW were involved in study conceptualization and data collection for Study 1 (TwinssCan). SG was involved in data curation, resources, and project administration for Study 1 (TwinssCan). NH, KSFM, APH, OJK and AL were involved in data collection for Study 2 (SIGMA). IMG conceptualized Study 2, with aid from RA, MS, KSFM, AL, and RvW. OJK coordinated Study 2 (SIGMA) data collection.

Abstract

Background: Adolescence is a period of both great social change, and of vulnerability for psychiatric distress. However, little is known about the associations between early psychopathology and social interactions at the fundamental level of daily life. To better understand the social correlates of subclinical psychopathology in adolescence, we assessed associations between general psychopathology and the quantity and quality of daily-life social interactions.

Method: During a six-day experience sampling period, adolescent and young adult participants in Study 1 ($n=663$) and Study 2 ($n=1027$) reported the quantity and quality of their everyday social interactions. General psychopathology was assessed using the Symptom Checklist-90 and Brief Symptom Inventory-53. The relationship between psychopathology and each outcome variable was tested in separate multilevel linear and logistic regression models.

Results: General psychopathology was associated with social interaction quality. Associations between psychopathology and the number of social interactions were less apparent: In Study 1, participants with more psychopathology were not more alone ($B(SE) = .10(.11)$, 95% CI: $[-.12; .31]$, $p=.38$), whereas Study 2 participants with higher levels of psychopathology were alone more ($B(SE)=.39(.06)$, 95% CI: $[.27; .52]$, $p<.001$).

Conclusions: Consistent associations between subclinical psychopathology and the quality of social interactions support the fundamentally social nature of early psychopathology. Moreover, negative experiences of social interactions may be more valuable markers of early psychopathology than a reduced quantity of social behaviours. Conceptualizations of daily-life social functioning, and prevention/intervention efforts would benefit from considering the quality of everyday social experiences.

Psychopathology is inherently social in nature. Ample epidemiological evidence suggests that different types of social risk factors are particularly strong predictors of the development and maintenance of a wide array of psychiatric disorders (e.g., Pickard et al., 2017; Sellers et al., 2019; Velthorst et al., 2017; Verboom et al., 2014). The role of social factors in psychopathology is especially relevant in adolescence – the age range between roughly 11 and 21 – as this is not only a critical period for social development (Blakemore & Mills, 2014) but also represents the age range where most psychiatric disorders have their first onset of symptoms (Kessler et al., 2007; Solmi et al., 2021). To aid early detection, and potentially prevent later mental disorders, it is imperative to understand the interpersonal factors that are associated with the development of psychological problems during adolescence.

Assessments of interpersonal factors involved in psychopathology (notably, social functioning) typically inquire about social behaviours and experiences at a single time point through retrospective self-report questionnaires or interview-based assessments (Birchwood et al., 1990; Cornblatt et al., 2007). Yet, such reflective measures do not account for several key aspects of real-life social interactions. Naturalistic social behaviour is subtle, dynamic, shaped by information from all senses, and takes place in different contexts and with different interaction partners (Zaki & Ochsner, 2009). This complexity makes it difficult to capture the relevant aspects of naturalistic social interactions – and limits the grounding of many social measures in ‘real life’ (Albert & de Ruiter, 2018; Reader & Holmes, 2016; Risko et al., 2016).

To better understand the social correlates of psychiatric disorders, it is imperative to assess social processes as they manifest *in day-to-day life* (Bernstein et al., 2018). The Experience Sampling Method (ESM) is particularly suited to this endeavour, as it prompts people in their natural environments to report on their thoughts, feelings, behaviour, and context multiple times a day via brief questionnaires (Csikszentmihalyi & Larson, 1987; Myin-

Germeys et al., 2018; Shiffman et al., 2008), thus allowing for more ecologically valid assessments of (alterations in) day-to-day social interactions.

Previous ESM studies assessing the social correlates of psychopathology in patient populations have focused on alterations in both the quantity of social behavior (e.g., the amount of time spent with others), and its experiential quality (e.g., how comfortable one is when with others). As such, fewer social interactions and more negatively experienced social interactions have been reported for people with depressive, anxiety, and psychotic disorders (Collip et al., 2011; Snippe et al., 2016; Walz et al., 2014). One key question that these studies with patient samples raise is whether a diminished quantity and quality of social interactions can already be observed at an earlier, pre-clinical stage. Studying the relationship between psychopathology and daily-life social processes in adolescents who have not yet developed clinically relevant psychiatric disorders is paramount for better understanding the early development of psychopathology and for identifying early intervention targets.

Some previous ESM studies have already explored the social correlates of psychopathology in the daily lives of young adults (i.e., students) in the general population. Findings generally indicate that those with higher psychopathology levels experience naturalistic social interactions more negatively. For example, more negatively experienced social interactions have been linked to higher levels of positive schizotypy (Barrantes-Vidal et al., 2013; Kwapil et al., 2012), anxiety (Brown et al., 2007), and depressive symptoms (Brown et al., 2011). The relationship between subclinical psychopathology and actual social behavior – amount of time spent with others – is less consistent. Depressive symptoms (Brown et al., 2011), social anhedonia (Brown et al., 2007), and schizotypy (Barrantes-Vidal et al., 2013)) have been linked to fewer social behaviors, while other studies have reported no similar significant association for anxiety (Brown et al., 2007), psychosis-proneness (Husky et al., 2004), or schizotypy (Kwapil et al., 2012).

Although psychopathology is generally linked to more negative expressions in daily-life social interactions, some daily-life studies in general population young adults have suggested that people with higher levels of psychopathology may actually experience mood enhancement when in the company of others. A number of ESM studies have observed a larger decrease in negative affect (and a larger increase in positive affect) for young people with higher levels of depression or schizotypy when they were in the company of (close) people – as compared to people with lower psychopathology levels (Brown et al., 2011; Kwapil et al., 2012;). Based on these findings, it is reasonable to hypothesize that adolescents with more psychopathology symptoms may also experience a ‘social sensitivity’ – or an increased affective benefit from being in the company of other people.

As these previous ESM studies on the relationships between psychopathology and daily-life social processes were largely in (young) adults, they leave open an important question: How are subclinical psychopathology symptoms related to the quantity and quality of daily-life social interactions – and to social sensitivity – for those in the crucial age period of adolescence? As mental disorder onset peaks around age 14 (Solmi et al., 2021), understanding the early social correlates of psychopathology is critical, both for better understanding the social development of mental health problems, and for informing early interventions.

Therefore, in this study, we aim to establish the relationship between self-reported psychopathology symptoms and the quantity (social behavior) and quality (social experiences) of daily-life social processes in two of the largest adolescent samples to study this question to date. Our first study (Study 1) was a post-registered analysis (i.e., a form of pre-registration for pre-existing data; Benning et al., 2019) from a large youth twin study (Pries et al., 2019). To gain insight into the consistency of results across samples, we subsequently decided to conduct a conceptual replication of Study 1, in another independent, large adolescent sample – the SIGMA study (Study 2; Kirtley et al., 2021).

For both studies, we hypothesize that higher levels of psychopathology are associated with both fewer social behaviors and more negatively experienced social interactions in daily life. To ascertain whether potential associations with psychopathology are specific to social situations, or instead, reflect a more general effect, we also investigate the link between psychopathology and the experience of moments when people are alone. Finally, we hypothesize that individuals with more psychopathology symptoms experience a social sensitivity or an increased affective benefit from being in the company of other people. Analyses in Study 2 are not pre- or post-registered but were performed as closely as possible to the post-registered Study 1 analyses.

Methods

Study 1

Participants

$N=778$ adolescent and adult twins aged 15-35 and their non-twin siblings were recruited as part of the TwinssCan study (for a full description, see Pries et al., 2019). The TwinssCan study included a battery of questionnaires and experimental tasks, in addition to ESM data collection. The study was approved by the local ethics committee (Ethics Committee Research UZ/KU Leuven, Nr. B32220107766). As the focus of this study is the adolescence period, participants over 21 years of age were excluded – in line with modern definitions of adolescence that extend its upper age limit to the early 20s (Sawyer et al., 2018). Participants who completed less than 30% of ESM questionnaires were also excluded (Delespaul, 1995; Trull & Ebner-Priemer, 2020). This resulted in a final Study 1 sample of $n=663$. Written informed consent was obtained from all participants, and from their parents, if subjects were younger than 18.

Demographic Information. No information on ethnicity or cultural or geographic background is available for Study 1 participants. Eighteen participants indicated speaking a

language other than Dutch at home, of whom six responded with a non-European language. These numbers imply that the Study 1 sample was relatively homogeneous in terms of cultural/geographic background.

Measures

Psychopathology

The Dutch version of the Symptom Checklist-90 (SCL-90; Derogatis, Rickels, & Rock, 1976) is a self-report questionnaire consisting of nine subscales and 90 items with Likert scales ranging from 0 ('not at all') to 4 ('extremely'). The SCL-90 was used to construct a global psychopathology score, the Global Severity Index (GSI), which represents the mean across all SCL-90 items (Derogatis, 1994). This GSI had high reliability, with *Cronbach's* $\alpha=0.97$.

Originally, we intended to use the depression, anxiety and psychoticism subscale of the SCL-90. Since the factor structure of the SCL-90 has been called into question by previous studies (e.g., Cyr et al., 1985; Ryttilä-Manninen et al., 2016), however, we first investigated the underlying factor structure of the SCL-90. Factor analysis subsequently indicated that the subscale factors were too highly correlated (between .91 and .95), and as such, insufficiently distinct (see additional factor analysis in Supplemental Material for more details). Therefore, only the GSI score was included as a predictor in all subsequent analyses.

Experience Sampling Method (ESM)

Participants answered ESM questionnaires on the PsyMate™, a custom-made Personal Digital Assistant (Myin-Germeys et al., 2011). In the six-day ESM period, participants received 10 prompts per day, between 7.30 AM and 10.30 PM, and each prompt contained a maximum of 57 items (subject to conditional branching). Participants had 15 minutes to respond to the questionnaire following each prompt. Participants were instructed to answer items by stating how they felt at the moment of the prompt.

Affect. The ESM questionnaire had a number of affect items, phrased as ‘I feel...’, rated on Likert-scales ranging from 1 (‘Not’) to 7 (‘Very’). Mean positive affect (PA) was calculated at each beep by averaging the scores on feeling cheerful, relaxed, satisfied, and generally well. Mean negative affect (NA) was computed at each beep by averaging scores of items on feeling insecure, lonely, anxious, and annoyed. As indicators of within- and between-person reliability, McDonald’s Omega coefficients were calculated: $\omega_{\text{within}}=.64$ for PA, and $\omega_{\text{within}}=.51$ for NA; between-person reliability was $\omega_{\text{between}}=.90$ for PA, and $\omega_{\text{between}}=.81$ for NA. The intraclass correlation coefficient (ICC) for PA was .36, and for NA .41.

Quantity of Social Interactions. Participants were asked at each prompt who they were with, and they could select one or multiple of different types of company. Based on this information, three dichotomous variables were computed: being alone; being with familiar people (partners, all relatives and friends); and being with less familiar people (colleagues, acquaintances, and strangers/others).

Quality of Social Interactions and Solitude. When participants were in company, they rated their preference for being alone (ICC=.22), feeling belonging to the current company (ICC=.29), finding company pleasant (ICC=.26), feeling safe in company (ICC=.29), and feeling judged in company (ICC=.38). When participants were alone, they were asked to rate the pleasantness of being alone (ICC=.38), feeling safe when alone (ICC=.41), and preferring to be in company (ICC=.40). All solitary and social experience items were also rated 1 (‘Not’) to 7 (‘Very’).

Study 2

Participants

$N=1913$ school-going participants aged 11-19 were tested as part of SIGMA, a longitudinal cohort study of adolescent mental health in the Flanders region of Belgium (Kirtley

et al., 2021). During class time, participants completed a battery of questionnaires on a tablet computer and the following day, participants' ESM period started. All participants and parents provided informed consent, and all procedures were approved by the local ethics committee (METC KU Leuven S61395). Excluding participants with fewer than 30% ESM compliance resulted in a final Study 2 sample of $n=1027$.

Demographic Information. As a proxy of national background, Study 2 participants were asked whether they felt any identification with any non-Belgian country or people, and $n = 186$ (26.1% of 713 completed responses) indicated explicitly that they felt like they belonged to at least one country other than Belgium.

Measures

Psychopathology

The abbreviated Dutch version of the SCL-90, the Brief Symptom Inventory-53 (BSI-53) (De Beurs, 2004), was administered, which was subsequently used for creating GSI scores for each participant (similar as for the SCL-90 in Study 1). Reliability for the GSI score was high (Cronbach's $\alpha=0.97$).

Experience Sampling Method (ESM)

Participants were provided with a smartphone by the researchers with the ESM application 'mobileQ' (Meers et al., 2020) pre-installed. The length of the ESM period and its prompt schedule was the same as in Study 1, although participants in Study 2 had only 90 seconds to start responding to a questionnaire at each prompt. The full ESM questionnaire consisted of a maximum of 47 items.

Affect. Mean PA and mean NA was measured and computed using the same items as for Study 1. Reliability coefficients are: $\omega_{\text{within}}=.73$ for PA, and $\omega_{\text{within}}=.62$ for NA; $\omega_{\text{between}}=.95$ for PA, and $\omega_{\text{between}}=.87$ for NA.

Quantity of Social Interactions. Similar to Study 1, Study 2 participants were asked whether they were in the company of others at each ESM prompt. Three similar dichotomous variables were constructed: being alone; being with familiar people (all relatives, friends); and being with less familiar people (other peers, teachers, and strangers/others).

Quality of Social Interactions and Solitude. When Study 2 participants were in company, they rated their preference for being alone ($ICC=.33$), feeling belonging to the current company ($ICC=.37$), feeling at ease in company ($ICC=.35$) and feeling appreciated by company ($ICC=.43$). When participants were alone, they were asked to rate the pleasantness of being alone ($ICC=.56$), a preference for being in the company of others ($ICC=.47$), and feeling excluded ($ICC=.30$). All items were similarly rated 1 ('Not at all') to 7 ('Very much').

Statistical Analyses

In each study, a series of multilevel regression analyses (with prompts nested in individuals, and for Study 1, also nested in twin pairs) was performed, with GSI as the (time-invariant) independent variable, and each (time-variant) social/solitary quantity/quality variable as the dependent variable. For the analyses involving the three (dichotomous) social quantity outcome variables, multilevel logistic regressions with varying intercepts were performed with the R-package 'lme4' (Bates et al., 2015). For the analyses with the eight (continuous) solitary/social experience as dependent variables, multilevel linear regressions with varying intercepts were performed using the R-package 'nlme' (Pinheiro et al., 2021). For every analysis, age and gender were included as covariates. No variables were centered before analyses.

For the social sensitivity analyses, two multilevel linear regressions with varying slopes were performed per study with moment-level social company, person-level psychopathology, and the interaction between company and GSI as independent variables, and PA and NA as dependent variables.

A Bonferroni correction was applied to each set of analyses (Bonferroni, 1950). For the initial psychopathology and social outcome analyses, $\alpha=05/11=.005$; for the social sensitivity analyses, $\alpha=05/2=.025$.

Open Science Practices

Analyses for Study 1 were registered online (<https://bit.ly/3uX53EQ>) following data collection, but prior to partial data access (in line with what has been termed 'post-registration'; Benning et al., 2019). All ESM social variables and demographic information had been accessed before analysis, but psychopathology information had not yet been accessed. Registration was also prior to the completion of data collection of Study 2 (and note that all analyses were identical in both studies). Deviations from the registration are described in the Supplemental Material. R code used for data manipulation and analysis, and full ESM questionnaires are available online on the OSF-page for this project (<https://bit.ly/3bAujcf>).

311 **Table 1: Descriptives of both studies.**

		Study 1 (n=663)			Study 2 (n=1027)		
	Variable	Mean (SD)	Median	Range	Mean (SD)	Median	Range
Demographics	Age	16.7 (1.5)	16.0	14.2 – 20.9	13.6 (1.8)	13.0	11.0 – 19.0
	Gender (%females)	58.2	-		65.1	-	
	Number of completed beeps (out of 60)	40.8 (10.1)	41.0	18.0 – 76.0	31.6 (9.2)	31.0	18 – 59
Psychopathology (SCL-90 in Study 1; BSI-53 in Study 2)	Depression	8.6 (8.8)	6.0	0.0 – 61.0	0.8 (0.9)	0.5	0.0 – 4.0
	Anxiety	4.4 (5.2)	3.0	0.0 – 40.0	0.9 (0.7)	0.7	0.0 – 4.0
	Psychosis	5.7 (7.1)	4.0	0.0 – 52.0	0.7 (0.7)	0.4	0.0 – 3.2
	GSI	0.5 (0.4)	0.4	0.0 – 3.3	0.9 (0.6)	0.7	0.0 – 3.4
Social behavior (ESM)	%time alone ^a	19.3 (16.4)	16.0	0.0 – 88.6	13.6 (13.9)	9.3	0.0 – 100.0
	%time familiar persons ^b	95.5 (9.3)	100.0	31.8 – 100.0	90.0 (14.8)	96.2	0.0 – 100.0
	%time less familiar persons ^b	23.4 (19.0)	20.0	0.0 – 100.0	47.6 (15.8)	46.9	0.0 – 100.0
Social experiences (ESM)	Belonging	5.9 (0.7)	6.0	3.1 – 7.0	6.0 (0.9)	6.3	1.3 – 7.0
	Prefer to be alone	1.9 (0.7)	1.7	1.0 – 5.0	2.1 (1.1)	1.9	1.0 – 7.0
	Pleasant	5.7 (0.7)	5.7	3.0 – 7.0	-	-	-
	Safe	5.8 (0.8)	5.9	2.6 – 7.0	-	-	-
	Judged	2.3 (1.0)	2.2	1.0 – 6.4	-	-	-
	At ease	-	-	-	5.9 (1.0)	6.1	1.2 – 7.0
	Appreciated	-	-	-	5.8 (1.1)	6.1	1.0 – 7.0
Solitary experiences (ESM)	Pleasant	4.5 (1.4)	4.6	1.0 – 7.0	4.8 (1.8)	5.0	1.0 – 7.0
	Prefer to be in company	3.8 (1.4)	3.8	1.0 – 7.0	3.7 (1.8)	3.6	1.0 – 7.0
	Safe	5.7 (1.0)	5.8	1.0 – 7.0	-	-	-
	Excluded	-	-	-	1.4 (0.9)	1.0	1.0 – 7.0
Social affect (ESM)	PA when alone	5.2 (1.0)	5.2	1.0 – 7.0	5.3 (1.0)	5.4	2.0 – 7.0
	NA when alone	1.6 (0.8)	1.6	1.0 – 7.0	1.8 (0.7)	1.6	1.0 – 5.4
Solitary affect (ESM)	PA when in company	4.8 (1.1)	5.0	1.0 – 7.0	5.1 (1.3)	5.3	1.0 – 7.0
	NA when in company	1.9 (0.9)	1.7	1.0 – 5.3	2.1 (1.0)	1.8	1.0 – 7.0

312 *GSI: Global Severity Index of both the SCL-90 and BSI-53, represents the mean item endorsement on the full*
313 *SCL-90 and BSI-53.*

314 ^a Percentage was computed per person by dividing the number of reports of being alone for that person by the
315 total number of valid reports for that person x 100;

316 ^b Percentage was computed by dividing the number of reports of being in (less) familiar company by the total
317 number of valid reports for that person being in the company of any other person x 100. Note that participants
318 were able to indicate multiple types of company at each moment, and that these numbers therefore do not add up
319 to 100%.

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Results

In Table 1, descriptive statistics of all variables used in the current studies are presented. Notably, participants in Study 1 were older and had higher ESM compliance.

Psychopathology and Social Behaviors

Associations between mean psychopathology (GSI) and daily-life social behaviors are presented in Tables 2 and 3. In Study 1, mean psychopathology was not significantly associated with (the frequency of) being alone, nor with being with more familiar persons (Table 2). Higher psychopathology levels were associated with being more with relatively unfamiliar people. Conversely, in Study 2, higher psychopathology levels were associated with both being more alone, and with being less in the company of relatively familiar people – but not with the relative frequency of being with relatively unfamiliar people (Table 3).

Psychopathology and Social and Solitary Experiences

Higher levels of psychopathology were associated with every social experience that was assessed in both studies. In Study 1, when those with higher psychopathology levels were in the company of others, they preferred to be alone more, found their company less pleasant, felt less safe, more judged, and less belonging in their company (Table 2). For Study 2, more psychopathology was associated with a greater preference for being alone when with others, and with feeling less at ease, less appreciated and less belonging in their (current) company (Table 3).

For solitary experiences in Study 1, psychopathology was a significant predictor of feeling safe when alone, but not of the other solitary experiences (see Table 2). In Study 2, participants were not asked about feelings of safety when alone, but instead, were asked about feeling excluded when alone (see Table 3). These feelings of exclusion when alone were associated with mean psychopathology scores, while psychopathology scores were not significantly associated with the other solitary experiences.

Social Sensitivity

Results of the social sensitivity analyses are presented in Table 4. The interaction between psychopathology and being in company was not associated with an altered increase/decrease in positive or negative affect in either sample.

Table 2: Multilevel logistic and linear regressions in Study 1, predicting the quantity and quality of social encounters from psychopathology.

		Psychopathology				Age				Gender (female)			
		<i>B (SE)</i>	95% <i>CI</i> <i>LL</i>	95% <i>CI</i> <i>UL</i>	<i>p</i>	<i>B (SE)</i>	95% <i>CI</i> <i>LL</i>	95% <i>CI</i> <i>UL</i>	<i>p</i>	<i>B (SE)</i>	95% <i>CI</i> <i>LL</i>	95% <i>CI</i> <i>UL</i>	<i>p</i>
Social Behavior	Being alone	.10 (.11)	-.12	.31	.38	.17 (.04)	.10	.24	<.001	-.30 (.10)	-.49	-.11	.002
	With familiar persons	-.45 (.18)	-.80	-.09	<i>.015</i>	-.43 (.06)	-.54	-.32	<.001	.30 (.17)	-.03	.63	.08
	With less familiar persons*	.34 (.11)	.13	.55	.002	.12 (.04)	.05	.20	.001	-.11 (.10)	-.31	.08	.26
Social Experience	Prefer to be alone	.43 (.06)	.31	.55	<.001	-.01 (.02)	-.05	.03	.53	-.17 (.05)	-.28	-.06	.002
	Finding company pleasant	-.39 (.06)	-.50	-.27	<.001	-.00 (.02)	-.04	.04	.82	.17 (.05)	.07	.28	.001
	Feel safe in this company	-.42 (.07)	-.54	-.29	<.001	-.00 (.02)	-.04	.04	.89	.25 (.06)	.14	.37	<.001
	Feel judged in this company	.52 (.09)	.35	.70	<.001	.04 (.03)	-.01	.10	.11	-.42 (.08)	-.57	-.26	<.001
	Feel like I belong in this company	-.43 (.06)	-.53	-.31	<.001	-.03 (.02)	-.07	.01	.14	.12 (.05)	.02	.22	.022
Solitary Experience	Pleasant being alone	.21 (.12)	-.02	.44	.09	-.08 (.04)	-.15	-.01	.027	.04 (.11)	-.18	.25	.74
	Feel safe	-.40 (.09)	-.58	-.22	<.001	-.01 (.03)	-.06	.05	.78	.00 (.08)	-.16	.16	.99
	Prefer company	.02 (.12)	-.22	.26	.87	.09 (.04)	.01	.16	.027	-.09 (.11)	-.31	.13	.40

P-values < .005 are below Bonferroni-corrected cut-off, and are displayed in bold; p-value <.05 are in italics.

**This specific regression model was not included in the registration for this study.*

Table 3: Multilevel logistic and linear regressions in Study 2, predicting the quantity and quality of social encounters from psychopathology.

		Psychopathology				Age				Gender (female)			
		95% CI		95% CI		95% CI		95% CI		95% CI		95% CI	
		B (SE)	LL	UL	p	B (SE)	LL	UL	p	B (SE)	LL	UL	p
Social Behavior	Being alone	.39 (.06)	.27	.52	<.001	.23 (.02)	.18	.27	<.001	.07 (.09)	-.10	.24	.40
	With familiar persons	-.45 (.10)	-.64	-.26	<.001	-.17 (.03)	-.23	-.10	<.001	.02 (.13)	-.24	.28	.89
	With less familiar persons	.03 (.03)	-.04	.09	.44	.01 (.01)	-.01	.03	.36	.05 (.04)	-.04	.14	.27
Social Experience	Prefer to be alone	.82 (.05)	.73	.91	<.001	.06 (.02)	.03	.10	<.001	-.14 (.06)	-.26	-.02	.025
	Feel at ease in company	-.69 (.04)	-.77	-.61	<.001	-.05 (.01)	-.08	-.02	<.001	.14 (.05)	.03	.25	.012
	Feel appreciated by company	-.67 (.05)	-.77	-.57	<.001	-.03 (.02)	-.06	.01	.13	.10 (.07)	-.03	.23	.14
	Feel like I belong in company	-.65 (.04)	-.73	-.57	<.001	-.07 (.01)	-.10	-.04	<.001	.07 (.05)	-.03	.18	.16
Solitary Experience	Pleasant being alone	.21 (.09)	.02	.40	.026	.04 (.03)	-.02	.04	.18	.29 (.13)	.03	.55	.026
	Excluded when alone	.28 (.04)	.20	.37	<.001	-.01 (.02)	-.04	.02	.48	.01 (.06)	-.11	.13	.88
	Prefer company	-.11 (.09)	-.30	.07	.24	.03 (.03)	-.04	.10	.37	-.13 (.13)	-.39	.12	.31

P-values < .005 are below Bonferroni-corrected cut-off, and are displayed in bold; p-value < .05 are in italics.

411 **Table 4: Multilevel linear regressions in Study 1 and Study 2 with psychopathology, company and the**
412 **interaction between them as predictors, and Positive Affect (PA) and Negative Affect (NA) as the outcome**
413 **variable.**

	Positive Affect				Negative Affect			
	<i>B (SE)</i>	<i>95% CI LL</i>	<i>95% CI UL</i>	<i>p</i>	<i>B (SE)</i>	<i>95% CI LL</i>	<i>95% CI UL</i>	<i>p</i>
Study 1								
Total psychopathology	-.53 (.06)	-.65	-.40	<.001	.59 (.05)	.49	.70	<.001
Being in company	.21 (.03)	.16	.21	<.001	-.14 (.02)	-.18	-.09	<.001
Psychopathology * company	-.01 (.04)	-.09	.07	.87	-.03 (.03)	-.10	.03	.35
Study 2								
Total psychopathology	-.79 (.05)	-.89	-.69	<.001	.66 (.04)	.57	.74	<.001
Being in company	.08 (.05)	-.01	.17	.08	-.15 (.04)	-.23	-.08	<.001
Psychopathology * company	.03 (.04)	-.04	.11	.40	-.04 (.03)	-.10	.02	.21

Discussion

The results of this large-scale investigation into the daily-life social correlates of psychopathology indicated that higher levels of psychopathology in adolescence were associated with more negative experiences of social interactions. The relationship between psychopathology and social behaviors was less straightforward: While psychopathology was significantly associated with more time spent with (familiar) others in Study 2, this was not the case in the relatively older sample of Study 1. This combination of findings implies that early psychopathology is broadly characterized by an altered experience of social interactions and that its relationship with quantities of social behavior is less apparent and might differ across populations.

Psychopathology Involves Altered Social Experiences in Daily Life

A first and important set of findings is that altered daily-life social experiences are associated with higher levels of subclinical psychopathology. This is in line with previous, similar ESM studies investigating specific social experiences and specific types of psychopathology (Barrantes-Vidal et al., 2013; Brown et al., 2007, 2011; Kwapil et al., 2012). The current study adds knowledge about the relationship between subclinical psychopathology and altered social experiences in three important ways. First, these results demonstrate that this link is robust across two large and independent samples from different countries. Second, whereas previous similar studies have largely focused on young adults (Barrantes-Vidal et al., 2013; Brown et al., 2007, 2011; Kwapil et al., 2012), we also observe links between psychopathology and altered daily-life social experiences in adolescence. This suggests how, when adolescents experience everyday social interactions more negatively, this could already be indicative of underlying psychiatric distress. Third, whereas previous studies have largely focused on a limited number of daily-life social experiences (e.g., a preference for being alone when in company; Barrantes-Vidal et al., 2013), we see broad associations of psychopathology

with social experiences – not only with a preference for being alone, but also with finding company pleasant, feeling judged, appreciated, safe, at ease, and belonging. The consistent relationships between psychopathology symptoms and all aspects of social interaction quality may reflect the transdiagnostic relevance of social interaction quality. Future work could further identify at what stages of development, specific daily-life social experiences (e.g., feeling judged) become involved in the development of distinct types of psychopathology (e.g., social anxiety).

One could argue that those with more psychological symptoms experience everything more negatively, and that therefore, this negative social experience is not specific to social situations. However, this interpretation is inconsistent with the current results. Psychopathology was not significantly related to a number of more negative experiences when alone, such as preferring company when alone or finding company less pleasant (although it did relate to feeling less safe and more excluded when alone). In contrast, psychopathology was associated with every social experience, across both independent samples. Therefore, this study highlights the fundamental and specific relationship between psychopathology and social experiences.

Inconsistencies in the Relationship between Psychopathology and Daily-Life Social Behaviors

The association between general psychopathology and the amount of social behaviors is less clear-cut. In Study 1, psychopathology was not related to being more alone, while this same association was significant in Study 2. The variability in this relationship reflects the variability in previous studies. In some samples of young adults, higher levels of specific types of psychopathology have been associated with more time spent alone in daily life (Barrantes-Vidal et al., 2013; Brown et al., 2007, 2011; Kwapil et al., 2012), while for other samples, those with more psychopathology were not more alone (Brown et al., 2007; Heininga et al., 2017; Husky et al., 2004; Kwapil et al., 2012). Note how the type of psychopathology is not

necessarily predictive of being more alone vs. social – for example, positive schizotypy has been related to being both more (Barrantes-Vidal et al., 2013) and less alone (Kwapil et al., 2012).

These inconsistencies in the association between psychopathology and time spent with people are at odds with what might be expected from traditional views of social dysfunction. Most operationalizations of social functioning (e.g., Birchwood et al., 1990; Cornblatt et al., 2007) involve simply engaging in social activities. Yet, at the level of daily life, psychological distress is not necessarily related to being alone more. This implies that, in clinical assessments of social dysfunction, a high degree of engagement with others cannot be taken at face value as an indicator of adequate social functioning. Instead, the experience of social interactions needs to be considered as well.

Social Sensitivity

The current study did not show any evidence for a social sensitivity effect, as there was no altered affective response to being in company for those with higher psychopathology levels. One explanation for this finding is that social sensitivity is specific only to certain types of psychopathology, such as depression. The greater sensitivity to social situations that was described by Brown and colleagues (2011), for example, was interpreted as being caused by the depression-specific character trait of ‘sociopathy’, or social dependency (Coyne & Whiffen, 1995). It is possible that participants in the current study with mostly depressive symptom profiles did experience a greater sensitivity to social environments, but that this effect was obscured when we looked at the total psychopathology score only. Alternatively, social sensitivity may well involve a transdiagnostic process, but it is only apparent when adolescents are in company of people that they perceive as close (Brown et al., 2011; van Roekel et al., 2014). More research is needed to disentangle whether some people are more socially sensitive under certain circumstances.

Implications

Researchers have emphasized the inherently social nature of psychopathology for decades (Priebe et al., 2013; Schilbach, 2016; Sullivan, 1953; Vogeley & Vogeley, 2018). In this study, we aimed to pinpoint the social difficulties of adolescents at the most direct level of day-to-day social interactions. Across independent samples, adolescents with more psychological distress consistently felt less belonging, at ease, and appreciated in their day-to-day company. Moreover, the social nature of psychopathology was expressed more in adolescents' altered social experiences than in their decreased social behaviors.

These findings also may have notable implications for the conceptualization of social functioning. Traditional definitions and operationalizations of social functioning have strongly emphasized *quantities* of social behavior. For example, social functioning questionnaires tend to focus on having friends or engaging in social activities (Birchwood et al., 1990; Cornblatt et al., 2007). However, the current results demonstrate how – at the level of day-to-day life – the *quality* or the social experience might be a more relevant outcome to consider. Based on the current results, we argue that a transdiagnostic conceptualization of social functioning would benefit from a shift, from retrospective to daily-life assessments, and from social behavior to social experience.

Our findings indicate how early subclinical psychiatric symptoms may mostly manifest in altered social experiences. This implies that assessments of subclinical psychopathology and prevention efforts in youth would benefit from increased clinical attention toward altered social experiences in the daily lives of adolescents. Moreover, recent years have shown much promise for remotely delivered add-ons to psychological interventions that target problems in people's day-to-day lives, in the form of ecological momentary interventions (or EMIs; Heron & Smyth, 2010; Myin-Germeys et al., 2016). When such daily-life interventions are used to target social dysfunction (e.g., as in Hanssen et al., 2020), the current study shows that it is imperative to not

only assess and improve the quantity of social behaviors, but also the experiences of daily social interactions.

Strengths and Limitations

The current study has several strengths that contribute to a considerable level of confidence in the reliability of the reported results. This includes a substantially larger sample than those of most ESM studies, and the fact that we provide a direct in-paper conceptual replication in an even larger sample. Also, analyses for Study 1 were post-registered (Benning et al., 2019), a practice that is still relatively uncommon in psychiatry and clinical psychology research (Tackett et al., 2017), but allows for greater transparency, reproducibility, and replicability. This is particularly appropriate when analyzing large-scale and intensive longitudinal datasets involving many decision points, all of which represent potential researcher degrees of freedom (Kirtley et al., 2020; Simmons et al., 2011).

Some limitations also apply to this study. We initially intended to investigate the daily-life social manifestations of depression, anxiety, and psychoticism, but our measure of psychopathology inadequately captured distinct types of psychopathology. Consequently, we were unable to investigate the different social profiles of depressive, anxiety, and psychotic symptomatology. Study 2 was not designed as a replication of Study 1 and although we were able to conduct a conceptual replication, there are some methodological differences. Notably, Study 2 compliance was lower than Study 1 compliance. This is likely related to the response time: Study 1 participants had 15 minutes to respond to an ESM prompt, whereas Study 2 participants only had 90 seconds. We cannot exclude the possibility that such methodological factors also (partially) drive different results found across studies.

Conclusion

In the current study, we investigated the social manifestations of psychopathology in adolescents, when assessed at the crucial level of daily life. Psychopathology levels related

mostly to the social experience of the day-to-day social environment, rather than the quantity of social behaviors. The reported discrepancy in social/solitary preferences when in a social vs. nonsocial context indicates that psychopathology manifests mostly when young people actually engage in a social interaction, rather than when they are alone. This is consistent with the idea of psychopathology being inherently social (Priebe et al., 2013; Schilbach, 2016; Sullivan, 1953; Vogeley & Vogeley, 2018). This study sheds light on the potential value of considering altered social experiences in our conceptualization of social functioning, and in the identification of early intervention targets. We argue that to better understand the nature of psychopathology, interpersonal processes are key – and in order to capture social dysfunction that is relevant, it is crucial to use ecologically valid assessment methods. Doing so might bring us closer to developing interventions that actually target that space where people experience problems: In the arena of daily life.

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